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A MINERAL INVENTORY OF THE ESMERALDA-STATELINE RESOURCE AREA, LAS VEGAS DISTRICT, NEVADA

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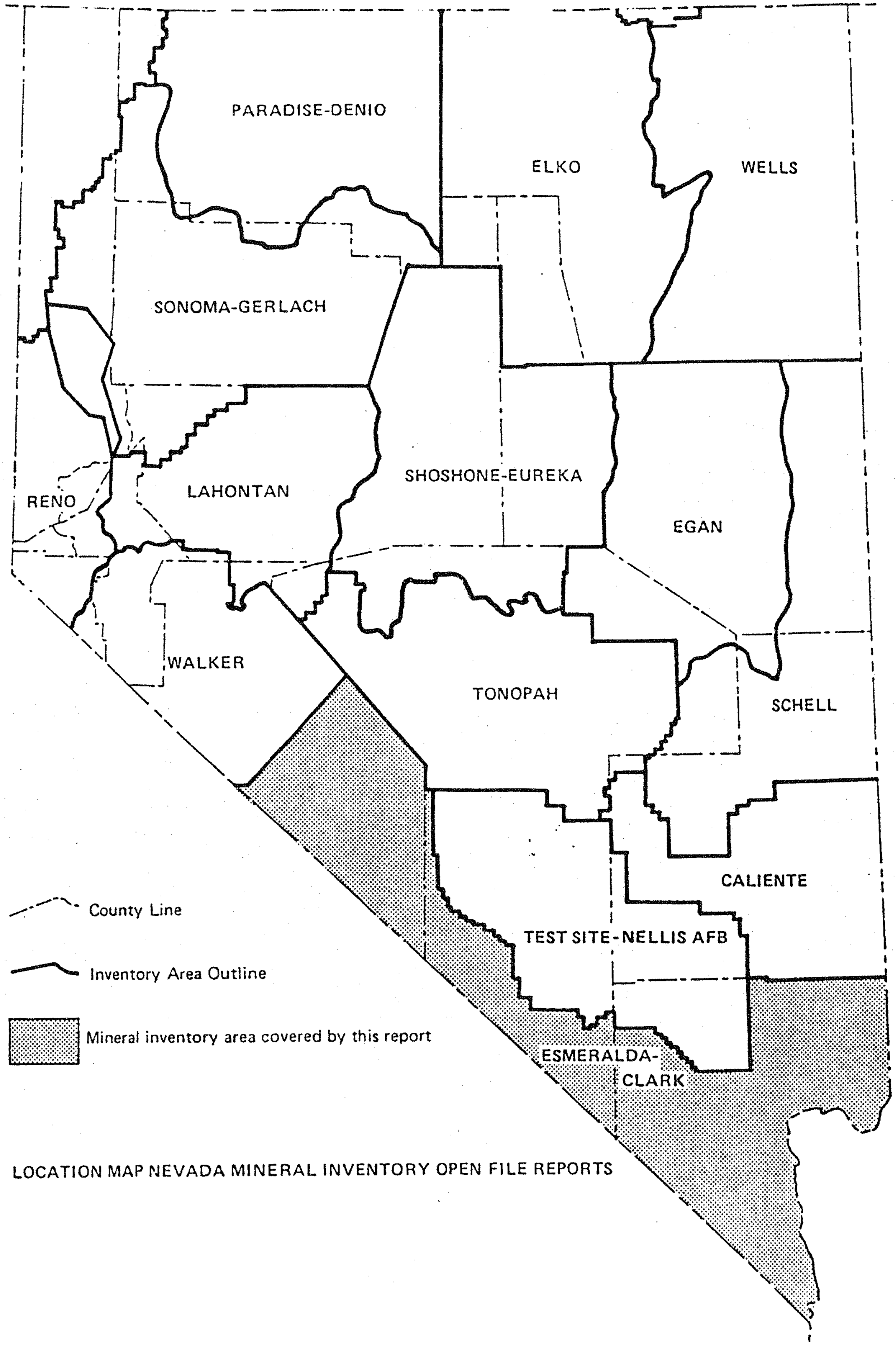
This information should be considered preliminary. It has not been edited or checked for completeness or accuracy.

See NBMG 83-12 for Geochemical Sampling.



LOCATION MAP NEVADA MINERAL INVENTORY OPEN FILE REPORTS

MINING DISTRICTS

ESMERALDA-STATELINE RESOURCE AREA

Alum
Alunite
Arden
Ash Meadows
Bare Mountain
Black Horse
Buena Vista
Bullfrog
Bunkerville
Charleston
Coaldale/Columbus Marsh
Crescent
Cuprite
Dike
Divide
Dyer
Eldorado
Fish Lake Valley
Gilbert
Gold Butte
Goldfield
Gold Point
Good Hope
Goodspring
Jean
Johnnie
Klondyke
Las Vegas/Virgin River
Lee
Lida
Lone Mountain (Weepah)
Moapa
Montezuma
Muddy Mountain
Newberry
Palmetto
Railroad Springs
Rock Hill
Crow Springs (Royston)
Searchlight
Silver Peak
Sloan
Stonewall Mountain
Sunset
Sylvania
Tokop
Tonopah
Tule Canyon
Windypah

Summary of Work Performed
Mineral Inventory Esmeralda-Stateline Resource Area
Contract YA-553-CTI-1058
Bureau of Land Management

Work was completed on the Esmeralda-Stateline Mineral Resource Inventory in two complementary stages. First, a search of the literature was made, and data on mineral occurrences within the project area compiled on short from Nevada CRIB forms. Courthouse records were then examined to obtain names and locations of active mining claims within the inventory area. All of the information was plotted on maps for field use. Folios were then prepared for each mining district, which included the CRIB forms, notes on mining claims, and pertinent references. This material provided the basis for planning the second stage of the inventory, the field examinations.

During the field stage of the project, every mining district within the Resource Area was visited and selected properties were examined. Important properties as well as outlying prospects were examined and described in order to provide more complete and accurate information on the occurrences beyond that provided in the literature. During the examination, emphasis was placed on collecting geologic information on the mineral occurrences and on noting current activity.

Studies in Clark County were not included in the original work proposal in this district but were later added with no increase in the total budget. Coverage in some areas of the district is, therefore, less complete than it could be due to constraints of both time and budget.

Photos were taken in each area to document activity, type of mine workings and geologic relationships. In addition, a total of 463 samples were collected showing typical mineralization from most of the visited properties. Most of the samples were high-graded and usually taken from dumps, ore piles, or outcrops.

A few samples of nearby intrusive rock or altered material were collected for comparison purposes.

The samples were then prepared for analysis by the Nevada Mining Analytical Laboratory, UNR, Reno and analyzed for elements (semi-quantitative spectrographic technique) by the Branch of Exploration Research, U.S. Geological Survey, Denver, Colorado. We would like to express our gratitude to these laboratories, for without their cooperation important information on element interrelationships within mining districts and between the various districts would not be provided. The laboratory, flooded with samples from wilderness programs from all over the west, has not been able to return all of our results in time to include with this report. We will continue to forward the sample information as soon as it is received in our office.

Information collected in the field was compiled on prospect forms, and new CRIB sheets were prepared for those properties examined in the field. For some properties it was only necessary to change or add to the existing form.

The information collected during the course of the Esmeralda-Stateline project has been compiled and is presented in this report in the following form:

1) Mining District folios:
   a) Prospect forms describing each property examined in the field. Sample descriptions accompany forms of sampled properties.
   b) Completed CRIB forms.
   c) CRIB forms which are incomplete due to lack of available information.
2) Photo Album, organized by mining district, containing slides of visited properties and documentation of new work.
3) Maps
   a) 30' series for project areas showing location of mining districts,

and sample locations.

b) USGS 7 1/2' and 15' topographic maps showing sample locations and prospect names.

4) Summary report, a brief report including location, history, comments based on field observations, and some comments on ongoing mining activity.

5) A copy of the lab report on the samples taken with pertinent comments.

6) Card file of prospects, E-Z Sort index cards with summary information for each mine/prospect/location within the area. This part of the data set is largely complete, but some cards remain to be typed (see attached list for completed/not completed file list).

In addition to this information, topographic field sheets and field notes are on file at the Nevada Bureau of Mines and Geology. Also, splits of all the samples taken as well as selected hand specimens have been retained at the Nevada Bureau of Mines and Geology. This material may be useful for additional studies in selected areas.

In reporting on this project, no attempt has been made to compile detailed geologic information on the districts. Since this project was a mineral inventory, our efforts were confined to acquiring new information on prospects, and no time was available to collect new regional geologic data. Local or regional geologic interpretations were derived from published geologic maps or other pertinent literature sources. Perhaps the best summary of the geology within much of the Esmeralda-Stateline Resource Area is found in the following publications:

a) Nevada Bureau of Mines and Geology Bulletin 77, entitled Geology and Mineral Deposits of Southern Nye County, Nevada by H.R. Cornwall (1972).

b) Nevada Bureau of Mines and Geology Bulletin 78, entitled Geology and Mineral Deposits of Esmeralda County, Nevada by J.P. Albers and J.H. Stewart, (1972).

c) Nevada Bureau of Mines and Geology Bulletin 62 entitled Geology and Mineral Deposits of Clark County, Nevada, by C.R. Longwell, E.H. Pampeyan, Ben Bower, and R.J. Roberts (1965).

ALUM DISTRICT

The Alum mining district is located approximately 7 miles due west of the Weepah district and 11 miles north of Silver Peak on a low divide between Clayton Valley and Big Smoky Valley in north-central Esmeralda County, Nevada. Access to the distirct is along fair dirt roads east and north from State Highway 47. Entry into the district from the north is not recommended. The road connecting the Alum district to the Weepah district is washed out.

The district was discovered about 1868 during the extensive exploration of Esmeralda County (Spurr, 1906). In 1921, the Western Chemical Co. erected an alum-sulfur treatment plant, and although the deposit was worked intermittently, no production was ever reported (Lincoln, 1923). Activity in the district was reported in 1939 and again in 1967, but again, neither attempt was successful. At the time of examination (Spring, 1983), no recent activity was noted at the property or in the general vicinity.

The Alum district has only one property, the Alum Pure/Sulfur Pure Patented Claims. The workings explore an elongated dike-like mass of hydrothermally altered rhyolite intruding gently folded, argillically altered sedimentary Tertiary rhyolite tuffs (Spurr, 1906). The older workings, which consist of several inclined shafts, were destroyed by open pitting during subsequent activity.

Native sulfur crystals, deposited by the sublimation of ascending sulfuric vapors, coat fractures and cracks and are disseminated throughout the altered rhyolite. Closely associated with the sulfur, in veins and streamers as much as several inches thick, is ordinary potassium alum kaolinite and minor gypsum seams. The veins pinch, split and widen throughout the deposit. Locally, the alum veins follow remnant sheeting in the rhyolite and iron oxides stain the deposit.

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Lincoln, F. C. (1923) Mining districts and mineral resources of Nevada: Nevada Publications Co., Reno.

Spurr, J. E. (1904) Alum deposits near Silver Peak quadrangle, Nevada: USGS Bulletin 225, p. 111.

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Stewart, J. H., and Carlson, J. E. (1976) Cenozoic rocks of Nevada: NBMG Map 52.

Young, G. J. (1914) Potash salts and other salines in the Great Basin Region: U.S. Department of Agriculture Bulletin 61.

ALUNITE DISTRICT

The Alunite (Railroad Pass) mining district is situated along Railroad Pass at the southeastern end of Las Vegas Valley in S2,T23S,R63E, and includes the workings in the northeast trending Black Hills. The district is located about 20 miles south of Las Vegas and 5 miles west of Boulder City in central Clark County, Nevada. Outlying areas are accessible by way of good dirt roads from U.S. Highway 95, while the main part of the district is within walking distance from the Railroad Pass Casino parking lot.

Lincoln (1923) reported that gold was first discovered in the Black Hills west of Railroad Pass prior to 1908, but R. T. Hill is credited with discovering gold and alunite in the district in 1908. The area's favorable similarity to the Goldfield mining district in the genesis and occurrence of alunite, along with similar country rock, alteration products, mineralization, and structural controls generated early hope that the Alunite district would be defined as a Goldfield-type gold deposit (Hill, 1908). The Alunite Mining Company soon formed, but was abandoned after a short and non-productive period of operation. In 1915, interest was revived in the district for alunite, valuable in itself for its potash content, but the venture was unsuccessful when the percent of potash proved too low to be mined economically (Lincoln, 1923). Interest was revived for a third time during WW I when the district was considered as a possible source for aluminum, but grade and distribution of the alunized rock was unfavorable for commercial exploitation (Longwell, et al., 1965). No production of alunite has ever been recorded. The Quo Vadis Mining Company began operations at the Quo Vadis Mine in 1915, but activity was sporadic and the mine closed in 1923 (lincoln, 1923). The only recorded production for the district came from the Quo Vadis Mine in 1935 and 1936 and amounted to less than $35,000 in gold with minor silver (Longwell, et al., 1965). The district has since been prospected intermittently up to the present. The recent field inspection noted no activity in the district except the surface exploration from the "1981 gold rush".

The Black Hills southwest of Railroad Pass is an eroded finger of the Miocene quartz monzonite Boulder City Pluton, overlain by propylitically altered andesite flows at the southern tip of the hills, and in fault contact on the western side with massive Tertiary andesite flow breccias and lavas. The rocks along the contact are argillically altered and locally silicified (Anderson, 1977). The pluton is uplifted relative to the volcanics along a north-trending, vertical shear zone. In the vicinity of Railroad Pass, the rocks are andesite and latite flows, breccias, and lavas, which are interstratified with sandy to conglomeratic sedimentary layers (Hill, 1908; Anderson, 1977). The volcanics are intruded by numerous dikes and irregular intrusive masses.

The Alunite district is located along intersecting zones of intense fracturing and faulting. The main fault trace extends northwest-southeast, with intersecting sets of strong north-south and east-west fractures and shears (Hill, 1908), (an extension of the Las Vegas Shear Zone?). Along Railroad Pass, the faults generally trend north-northwest and are downdropped to the southwest.

Hill (1908) suggests that the mineralization and alterations in the Railroad Pass area is probably the result of hot, acidic, solfataric, ascending volcanic vapors following brecciated zones in the volcanics. Alunite, along with silica, gypsum, and kaolin, replace Tertiary volcanic rocks in a belt along a complex zone of faulting. The alunite is widely disseminated throughout the altered volcanics, but occurs most conspicuously as small, massive, irregular, white to pinkish veins (Callaghan, 1936). Jarosite occurs as small crystals in vugs in the alunitized rock. Minor gold and silver also occur disseminated in the altered rock and in quartz veins (Longwell, et al., 1965).

The Quo Vadis Mine appears to be following the north-northeast trending fault zone which defines a graben and horst structure that is intersected by an east-west set of shears. The workings are long the east and west contacts of a down-dropped block of quartz monzonite between andesite breccia. The rocks along the contact are extensively and locally altered (argillic, propylitic, alunitized, and silicic). The fault breccia is coated with hydrothermal quartz and the fragments exhibit milling. Barite, calcite, and quartz veins cut across all rock types and structures. Mineralization at the property occurs as very fine sulfides (pyrite and chalcopyrite) along with free milling gold (Vandenberg, 1937) carried by quartz, barite, and manganese-stained calcite veins, which fill fault zone fissures. The veins and country rock are stained by malachite and iron oxides. The eastern fault contact appears to have carried a greater degree of mineralization than the western fault zone, however, the majority of workings follow the western fault zone.

The Blue Quartz Mine workings follow a 6-8 foot wide, vertical, northerly trending fault zone in propylitically altered andesite flows. Brecciated quartz and barite veins and stringers, carrying andesite fragments, pyrite and chalcopyrite, fill fault zone fissures. The sulfides are altered to malachite, and other copper and iron oxides. Barite crystals are intergrown with the quartz and malachite. Late stage silica flooding coats the veins, breccia, and country rock with fine galena grains and drusy quartz.

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ASH MEADOWS DISTRICT

The Ash Meadows district covers a sink and meadow area in the Amargosa Desert approximately 15 miles south of Lathrop Wells in extreme southern Nye County, Nevada. Access to the district is along good dirt roads east from Nevada State Highway 29.

The extraction of fuller's earth and montmorillonite clays from the district began about 1918 and continued into the 1930's (Kral, 1951). The district was relatively inactive until the late 1970's when the rapid rise in oil prices generated exploration in the oil industry and the district was reactivated. While no activity was directly observed at the time of inspection (Spring, 1982), freshly exposed faces of the deposit coupled with the amount of equipment left on site, indicated that the district had recently been producing. Ash Meadows is the largest producer of clays in Nevada with a past production exceeding an estimated $3 million. The CAT claim block, owned by Placer Amargosa Ventures, covers several square miles including the main part of the district. The older surface and underground workings have been destroyed by the current open pit operation. The main pit extends below the water table, which causes problems in extraction and requires that the clays be dried up to two months before processing (Kral, 1951). Five miles northeast of the main district are smaller montmorillonite deposits, similar to those found at Ash Meadows. Production from these deposits has been small, mainly from surface workings.

The Ash Meadows district is an area of horizontal to gently dipping Pleistocene playa deposits overlain by Recent alluvium. The deposits are generally lenticular to circular in shape and vary in thickness, thinning to the edges. The clays are probably the result of ground water alteration of the tuffaceous playa lake beds to calcium and manganese montmorillonite and fuller's earth deposits. Locally, the residual tuff textures are preserved. Minor iron oxides stain the deposits (Kral, 1951; Papke, 1970).

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BARE MOUNTAIN DISTRICT

The Bare Mountain (Fluorine) mining district is situated due east of Beatty and U.S. Highway 95 in an area which includes the northwest trending Bare Mountain and the northwestern end of Yucca Mountain, in southern Nye County, Nevada. The small, sub-district of Carrara is located on the east flank of Bare Mountain. All areas of the district are accessible by way of good to poor dirt roads east from U.S. Highway 95.

The Bare Mountain district was originally prospected during the 1904 Bullfrog boom. From 1905 to about 1918, the district was explored and small gold deposits were discovered on the west, north, and east flanks of Bare Mountain. Early attempts to develop ore bodies failed and most of the gold/silver production during this period was meager and went unreported. Mercury was originally discovered near the Telluride Mine around 1908. Later discoveries at the Tip Top and Thompson Mines resulted in the construction of a retort about 1912 and several hundred flasks of mercury were produced (Bailey and Phoenix, 1944). Other commodities produced in the district during this early period included gem-quality, cinnabar-bearing opal; ceramic silica from the Silicon Mine; volcanic cinder, kaolin, and perlite. Attempts were made to quarry marble from the Carrara quarry, but were largely unsuccessful (Ball, 1906; Lincoln, 1923; Cornwall, 1972). Early production figures for the district for the above commodities were included in the Bullfrog district, but estimates place them at less than $30,000 (Hewett, 1936).

Fluorspar has produced the largest value for the Bare Mountain district with the Daisy Mine as the main property. The original lode claims at the Daisy were located in 1918 by J. Irving Crowell. He sold the claims to Spar Products Corp. who leased the property back to the Crowell family (Continental Fluorspar Co.) on a 99 year lease. The property has been in continuous production since 1918, and is now being managed by the third generation of the Crowell family (Lincoln, 1923). Fluorspar production from the property through 1976 has been estimated at more than

200,000 tons and Cornwall (1972) reports reserves could last for years. The deposit is the largest in Nevada.

The Bare Mountain district is unique as being the only relatively active district in the Esmeralda-Stateline Resources Area Project. The Daisy Mine was producing, although cut back in manpower and productivity due to the recession; the Stirling-Panama Mine area, along with adjacent properties along the eastern flank of Bare Mountain, was mining disseminated gold and exploring reported silver bearing zones. A caretaker was in residence on the Silver Peak claims. The Oasis Mountain Project (Spicer Claim) north of Beatty near Springdale, had been producing telluride gold for over a year, and the district had been extensively explored during 1981-1982.

Bare Mountain is a northwest, elongated triangular mass of complexly faulted and folded Late Precambrian to Late Paleozoic clastic and carbonaceous sedimentary rocks, which are locally intruded by Tertiary-Quaternary dikes of pegmatite, aplite, and granitic porphyry. Intruding the sedimentary mass throughout the area are low grade, ore bearing stringers and massive veins of quartz. The sedimentary beds form a northwest dipping, northeast striking monocline. Locally, the sediments are metamorphosed to hornfels, tactite, marble, and phyllite/schist by tectonic activity and intrusives. To the north of the area underlain by bedded sediments are outcrops of Tertiary rhyolitic welded and non-welded ash-flow tuffs and flows. East and southeast of Bare Mountain are Tertiary-Quaternary cinder cones.

Deformation of the Paleozoic block occurred in at least three stages: the initial, intense deformation of the beds during the Sonoma Orogeny at the end of the Paleozoic; intense thrust and right-lateral strike-slip faulting in the Mesozoic (Laramide Orogeny?); and normal faulting during the Tertiary Basin-Range tectonic period. Locally, thrust faults favor the weak, shaly units of the Wood Canyon and Carrara Formations. The main deformation of Bare Mountain is probably related to the right-lateral shearing of the Walker Lane Mobile Belt (Longwell, 1960). The mountain is bounded on the east and west flanks by Tertiary-Quaternary Basin-Range normal faults.

The northern end of Yucca Mountain is composed of Miocene to Recent rhyolitic welded and nonwelded tuffs, and rhyolite to rhyo-dacite porphyry dikes, stocks, and lavas which include volcanic glass, pumice fragments and stones. The tuffs are bleached, argillically altered, and are irregularly silicified and opalized from ascending hydrothermal solutions. Alaskite dikes and fine-grained granitic dikes intrude the altered volcanics and follow bedding planes in the Paleozoic sediments on the north side of Bare Mountain. The volcanics are thought to be derived from the Timber Mountain Caldera, Oasis Mountain Caldera, and other volcanic centers located north and northeast of Bare Mountain. Erosional remnants of later basalt flows overly the earlier extrusives. The tuffs and flows are generally horizontal or have shallow dips and strike in all directions. Faulting in the volcanics generally trend northeast and are later intersected by north-northeast trending fault traces (associated with the Walker Mobile Belt?). Tectonic activity in the Tertiary moderately deformed and tilted the volcanics. The volcanics lie either in direct contact with the Paleozoic sediments or along a shallow, north dipping thrust fault.

Mineralization within the district occurs in several general modes. Hydrothermal quartz veins and breccia zones are found throughout the Paleozoic sediments. The quartz veins are thin and irregular, and are locally mineralized with microcrystalline gold, auriferous chalcopyrite and pyrite, argentiferous galena and sphalerite. The metallics are carried and deposited by the quartz veins along bedding shears and disseminated in the country rock, the most favorable being the dolomitic member of the Precambrian-Cambrian Stirling Quartzite. Alteration minerals associated with the sulfides include malachite, azurite, hematite and limonite. The country rocks adjacent to the veins are locally silicified and argillized. Irregular breccia pipes or zones on the eastern flank of Bare Mountain in the dolomitic Nopah Formation consists of fragments of felsic volcanics, dolomite, and siltstone. The breccias are argillically altered and carry minor gold and fluorite. Fluorite fills the open spaces and replaces the breccia fragments, which are rounded and surrounded by rock flour. Stibiconite was observed with the fluorite. The Tertiary rhyolite tuffs are hydrothermally altered to masses of chalcedony, opal, and alunite which carries fine stringers and grains of cinnabar (Knopf, 1915). Sparse cinnabar is also in lenses of cryptocrystalline silica along with coarsely crystalline barite and calcite along fissures in dolomite.

The principal fluorite deposits at the Daisy Mine in the northern end of Bare Mountain occur as irregular, hydrothermal replacement bodies along fault zones in dolomite (Nopah Formation). The orebodies' formation was structurally controlled by thrust and normal faults. The extent of the deposit is unknown. Surrounding the ore bodies are clay-like rinds of gouge which are reported to carry small amounts of gold. In the vicinity of the mine, crystalline fluorspar fills solution cavities in the dolomite. Mr. Jack Crowell, the current mine manager, was kind enough to give us a tour of the Daisy Mine. Activity at the mine extends from the 8th to the 13th levels. Samples were taken from the present ore body. For a complete description of the Daisy Mine, refer to the list of references cited.

The Oasis Mountain Project (Spicer Claims) has been mining telluride gold for over a year near Oasis Mountain. The claim block extends over 5 square miles and includes the Transvaal Camp area. According to the project geologist, gold tellurides occur in the rhyolite breccia. The ore bodies are in vein, epithermal and intrusive systems associated with the Timber Mountain Caldera. He also suggested that a molybdenum porphyry system might be located at depth in the

Transvaal Camp area, which is located along the rim-fault system of the Timber Mountain Caldera.

Along the eastern flank of ~~Bean~~ Bare Mountain, the Panama Mine-Stirling Mine area is currently open-pitting for disseminated gold in breccia zones along a shallow thrust fault. The ore, which occurs in the upper plate, ranges from 0.5 to 4.0 oz/ton with values in arsenic, antimony, and mercury. Below the ore zone the rocks are silicified from ascending mineralized solutions. The area is extensively brecciated and intruded by porphyry dikes. Minerals observed in the area include clays, alunite, limonite, jarosite, fluorite, stibnite, and cerrusite. Throughout the workings, thin calcite/fluorite and quartz veins are prevalent. Stibiconite was observed associated with fluorite, which partially cements and replaces the breccia fragments.

Kaolin has been mined from montmorillonite deposits outcropping east of Beatty on the western flank of Beatty Mountain. The kaolin resulted from the alteration of Miocene-Pliocene tuffs along faults. The deposits grade laterally into the country rock.

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BLACK HORSE DISTRICT

The Black Horse mining district is located on the southeast flank of Miller Mountain in the extreme western part of Esmeralda County, Nevada, in T2S, R34E. It is bounded on the south by U.S. Highway 6, on the north and west by the Mineral-Esmeralda County Line, and on the east by the Columbus salt marshes. It is accessible from the south by way of dirt roads north from U.S. Highway 6, and from the northeast and northwest by way of poorly maintained dirt roads. Due to the 1982-83 wet winter, many of the roads have been washed out and are impassible or very dangerous.

Little is known about the early history of the Black Horse mining district, although it possibly could have ties to the Candelaria (Columbus) and Coaldale mining districts, which were active as early at the 1860's. Earliest production figures known were from minor shipments of low grade tungsten in the 1940's from the Black Horse Mine. Production from the 1940's to the 1970's has been minor and infrequent. Recently the older workings have been drilled and trenched in the skarn zone. The Black Horse district was the county's leading producer of tungsten in 1955. (Albers, Stewart, 1972).

The Black Horse district is underlain by the Precambrian Campito Formation and the lower Cambrian Poleta and Harkless Formations. The rocks consist of quartzitic silstone, limestone, and sandy limestone which have been metamorphosed to hornsfels, marble, and garnet-epidote rich tactite (Albers, Stewart,1972). The metasediments are intruded by a Tertiary granodiorite pluton which is in turn intruded by massive quartz veins, massive feldspar-mica rich pegmatite dikes, and very fine grained aplite dikes. Barite veins were noted in the skarn zones near the Maxwell Mine. It has not been determined whether the metamorphism of the sediments results from the Tertiary instrusions, a yet unexposed intrusion, at depth, or from previous tectonic activity. Overlying the metasediments in the north-northeast part of the district are Tertiary rhyolite welded ash flows and Quaternary basalt flows. Late Tertiary cinder conesare found in the area of the basalt flows. At one site, a solution cavity was noted to have formed in the rhyolite ash flows and was weathering in situ. The cavity (or cavities) is filled with masses of red, yellow, and brown banded, and milky green (prase) varieties of jasper.

The principal mineralization of the district occurs in the metamorphosed Cambrian Harkless Formation where scheelite, powellite, and crystalline molybdenite are disseminated throughout the banded tactites. (Note: The district is an excellent collection site for jasper (gem quality?), idocrase (vesuvianite), and epidote crystals. Crushed quartz veins carrying fresh and oxidized sulfides (pyrite, chalcopyrite, bornite) were observed in the Cambrian Campito Formation. Sericite and jarosite were noted coating fracture and fault surfaces in skarn zone. Abundant secondary copper minerals coated the veins and country rock. At the Molly claim (the old Black Horse Mine) the limestones are locally silicified and marbleized.

Lying astride the Esmeralda-Mineral country line, immediately southwest of the district, are Miocene-Pliocene diatomaceous earth deposits. These deposits have been mined by GREFCO (Great Lakes Carbon Corporation) and have been in production since 1944. According to the chief engineer of the corporation, the deposits are an isolated embayment of a Tertiary fresh water lake bed. The sediments which formed the shallow basin include argillic and calcareous diatomite, clays and volcanic ash. These deposits are underlain and overlain by basaltic flows.

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BUENA VISTA DISTRICT

The Buena Vista district, also known as the Queens, Oneata, Mount Montgomery, or Basalt district, is usually described under Mineral County. The principal mining area in the district, however, is located at the head of Queen Canyon in Esmeralda County. Queen Canyon lies just north of Boundary Peak in the northern White Mountains east of the Nevada-California state line. All of the portion of the district in Esmeralda county is within the boundary of the Inyo National Forest, and a small part of the district at the head of Queen Canyon, including the Indian Queen mine site, is within the Sugarloaf Roadless area.

According to Lincoln (1923) the first mining activity in the area dates to 1862. Little came of the early prospecting, and it was not until 1870 that the Indian Queen (Queen) Mine was located. Production began in 1873, and extended for a number of years. Couch and Carpenter (1943) credit the district with $367,435 through 1881. Lincoln (1923) mentions a revival in 1905-07, but no record of production for this time exists. The Tip Top gold mine and the Red Rose and Wild Rose mercury mines are sometimes included within the Buena Vista district, but they are more logically placed in the Fish Lake Valley district which lies to the east. The Buena Vista district, as described in this report, includes only the historic mining area in and around Queen Canyon, southeast of the Esmeralda County line.

As shown on U.S.G.S. map GQ-1013, the rocks exposed on the southwest side of Queen Canyon are hornblende diorite, ademellite, and granite of the Inyo batholith. On the northeast side of Queen Canyon, metasedimentary rocks of the Cambrian Harkless Formation and the Ordovician Palmetto Formation are exposed. These rocks have been intruded by the Inyo batholith complex, and hornfels, skarn, and marble have formed locally within the contact zone. Tertiary volcanic rocks form the upper reaches of the northeast side of Queen Canyon either covering or cross-cutting the older sedimentary rocks. Most of the mineral properties in Queen Canyon are located within the north west trending band of Harkless Formation exposed on the steep slope of the canyons' north wall. The Indian Queen or Queen mine is high on Garnet Ridge at the southeast head of the canyon, the Morgan, Spohr, and Albert mines are located along the trend of the Harkless outcrop to the northwest. Just above the old camp area in Queen Canyon, the canyon forks on each side of Garnet Ridge. The lower point of Garnet Ridge is underlain by Ordovician Palmetto Formation, mapped in thrust contact with the underlying Harkless. No mineral deposits were seen in the Ordovician rocks, and the thrust itself has no evidence of mineralization. The thrust contact is mapped (U.S.G.S. GQ-1013) as following the canyon floor to a point just west of the old camp where it climbs up and across the toe of the canyon wall west of the Albert mine. There are small prospects here, but they are in the Harkless Formation, just east of the mapped thrust contact. The small outcrop of basalt just above the Spohr mine is in flow contact with the underlying metasediments, and a red baked zone can be seen below the basalt in the metasediments. Although not shown of the geologic quadrangle map, it seems that there is a major structure between the Cambrian rocks and the Tertiary rocks high on the canyon rim to the northeast. The Cambrian rocks east of the Albert mine appear to be large, chaotic blocks, in a way similar to blocks on the margins of large caldera structures. The highest points on the east canyon rim, Mustang Point, Horseshoe Rock, and Kennedy Point, appear to be rhyolitic plugs or domes within the Tertiary section. The structural boundary between Mustang Mountain to the east and Queen Canyon to the west also forms the general boundary between the Buena Vista district and the adjacent Fish Lake Valley district.

The Harkless formation in the area of the mines in Queen Canyon is composed of argillites,phyllites, and spotted schists. The rocks are tan, pale green, and maroon, and they show abundant iron staining around the old mine workings. At the Indian Queen mine, some of the workings follow a N50°E shear zone which is heavy with iron and manganese oxide staining. Other workings on the ridge above the mine expose N40°W trending shear structures. The underground workings of the Indian Queen mine were not accessible to examine at the time of our visit. The portal (Poorman Tunnel) had been recently rehabilitated and was locked. However, members of a U.S. Bureau of Mines team conducting work on the roadless area evaluation project were able to gain access and examine the underground workings. The old drifts and stopes are reported to follow prominent northwest-southeast shear zones. Mining was done on what are described as breccia zones laced with quartz veins containing sulfide minerals (Brad Lyles, personal communication). An interesting observation made by Lyles is that the old workings extend for a long distance to the southeast, and that the extreme southeast end of the accessible workings pass from altered sediments into highly altered volcanic rocks. The contact is not sharp, and is complicated due to the alteration. Lyles did not think that the vein-type mineralization was present within the volcanics. It would be interesting to study this area in detail. If the vein mineralization of the Indian Queen does extend into volcanics, the mineralization is therefore very young, and not related to the Inyo Batholith to the south. If, as is more logical, the vein mineralization does not cross the contact, the alteration in the volcanics may signify young mineralization related to the volcanics similar to what can be seen in the mercury-gold properties in the Fish Lake Valley district to the southeast. Whatever is the case, if volcanic rocks were actually intersected by the deep workings of the Indian Queen, the contact between Cambrian sediments and Tertiary volcanics must here be a structural contact.

At the Albert and Spohr mines, N20°-30°E shear structures were followed by some of the old workings, and northwest trending shears with thin quartz veins along them were seen at the upper Albert workings. Most of the old workings at both the Indian Queen and Albert mine areas appear to follow N40°W structures.

Dump rock at the Indian Queen contains visible amounts of galena, chalcopyrite, pyrite, and copper oxide minerals. Some galena with quartz was seen at the upper Albert workings. Other dumps in the area were, except for minor iron staining, essentially barren.

At the time of our examination, no mining was in progress in the canyon. Signs on the road leading into to the district and various notices within the canyon gave evidence of recent work by Candelaria Metals Corporation. The Queen mine(Poorman Tunnel) had been recently retimbered at the portal, and remains of new work buildings were seen. All equipment had apparently very recently been removed and what had been a fairly ambitious project had been terminated. Other old portals in the area had been retimbered, but only one or two sets at each portal had been replaced, as if the work were for external appearances only. Sample trenches had been cut across the Queen dump, and a large area below the old camp had been scraped clean, as if to prepare a leach pad foundation. No ore piles were in evidence, and as of August, 1982 the project seems not to have progressed beyond the sampling stage.

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BULLFROG DISTRICT

The Bullfrog district and the included Pioneer district to the north are located in the Bullfrog Hills just west of Beatty in southern Nye county. The Bullfrog Hills extend in an east-west direction between the Amargosa range on the west and Bare Mountain-Pahute Mesa on the east forming a divide between Sarcobatus Flat to the north and the Amargosa Desert to the south. The western portion of the district is included within the boundary of Death Valley National Monument.

Gold was discovered at the original Bullfrog mine at the south end of Bullfrog Mountain, 7 miles west of Beatty, in the summer of 1904. The initial finds were high-grade surface ore, assaying at $700 per ton, and a rush to the area developed. By November of that year five separate towns, Amargosa, Beatty, Bullfrog, Bonanza, and Rhyolite, were laid out and were competing to become the trade center of the district (Latschar, 1981). The Montgomery-Shoshone mine, the most important in the southern part of the district, began production in 1907. To the north, in the Pioneer area, the Mayflower mine began operations in 1911, and the Pioneer mine opened in 1913. The Montgomery-Shoshone closed in 1910, the Pioneer closed in 1917 (Lincoln, 1923). Minor activity continued in the district up to about 1921, and small leasing operations continue in the area to the present. Lincoln, 1923, gives a total production figure of $2,792,930 for the period 1905-1921 and credits most of the production to the Montgomery-Shoshone mine.

The gold deposits in the Bullfrog district are in fissures and veins in rhyolitic welded tuffs and are for the most part related to steep normal faults. Ramsome and others (1907) in U.S.G.S. Bulletin 407, described the old mines and deposits in detail, and that work should be consulted for individual mine descriptions. The mineralogy of the gold-silver veins is simple and consists of quartz, calcite, and finely disseminated gold-silver in scattered pyrite grains.

Small amounts of chalcocite and green chrysocolla and malachite were present in the original discovery ore from the district, giving the ore a green color which led to the name Bullfrog for the mine and, eventually, for the district. Lincoln (1923) mentions that alunite is present, probably as an alteration mineral associated with the epithermal gold deposits.

At the time of our examination in 1982, claims in the area of the Connection shaft at Pioneer were held by Cordex Exploration. In this area, gold mineralization is present in large blocks of Cambrian limestone which are included within a Tertiary ash-flow tuff unit. Mineralization is related to a steep fault which cuts both rock types. The limestones are silicified and the tuffs are opalized and display weak argillization, but gold values were reported to be mainly confined to the limestone block. This area is on the western margin of the large Oasis caldera, and the Cambrian limestone blocks may be slide blocks originating from the nearby west caldera wall.

Other properties within the district may have potential for the development of bulk-minable deposits of gold. One of the most interesting, just from its 1907 description in Ransome, is the Gold Bar area, now within Death Valley National Monument. At the Gold Bar, Ransome describes a zone of irregularly fissured and brecciated rhyolite fully 100 feet wide with no definite boundary between vein material and rhyolite.

At the time of our examination, small leach operations were reported to be active at the Montogomery-Shoshone and Mayflower mines. Small amounts of gold ore were being mined from the east side of Bonanza Ridge, west of Rhyolite. This ore was being hauled to a mill north of Beatty for processing.

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BUNKERVILLE DISTRICT

The Bunkerville (Key West, Copper King) mining district is located about 10 miles south of Mesquite in the northern Virgin Mountains in northeastern Clark County, Nevada, in T15S, R70, 71E. The district is bounded by the approximate latitudes 36°35' and 36°45', and longitudes 114°00' and 114°15'. The western portion of the district is easily accessible by way of the Gold Butte Road south from Interstate 15 along good to fair dirt roads; however, the eastern side of the district is accessible only from the north by a fairly long and steep hike along a washed out jeep trail.

The first reported activity in the district resulted from copper-nickel ore being discovered in the eastern part of the district in the 1890's. From 1900 to 1903 the Nevada Copper and Nickel Co. explored the district, primarily for additional copper-nickel deposits and it was during this investigation that platinum's association with the copper-nickel ore was discovered. Minor ore was produced in 1908 and 1916 from the Key West Mine, after which the mine shut down. Attempts to mine in 1929 resulted in 2,000 tons of copper-nickel ore being mined and milled, but poor mill recovery prompted another shutdown. Attempts were made again to mine the copper-nickel deposits in 1936, 1952 and 1953, but all were unsuccessful. Since then other companies and individuals have explored the area, but with little or no results. The tungsten-beryl-mica deposits are located in the rough terrain of the eastern part of the district, east of the Key west area. Development work was done in the early 1950's and between 1953 and 1956 the Tri-State Metals, Inc. produced approximately 150 units of tungsten ore. There were shorts periods of activity in 1971 and 1980. Scrap mica was reported to have been mined in the 1890's and sheet mica was mined in 1920 by Daniel Bonnelli, who was one of the earlier settlers and explorers of the region.

Beryl was noted in the district in the 1930's (Holmes, 1964) and several attempts were made to mine the deposits prior to 1960. Transportation costs have proven to be prohibitive, thus preventing economical production of the tungsten-beryl-mica deposits. The total production for the district has been less than $30,000 in gold, silver, platinum, palladium, copper, lead, nickel, tungsten, and cobalt. Both areas of the district have been subject to U.S. Bureau of Mines investigations (Heedham, et al, 1950; Holmes, 1964).

The northern Virgin Mountains are a northeast trending, structually complex range consisting primarily of Precambrian metamorphic rocks flanked by Paleozoic and Cenozoic formations. The Precambrian rocks are highly deformed and locally range from moderately to highly metamorphosed from both contact and regional metamorphism. Middle Precambrian granitic, pegmatitic, and mafic dikes and plutons invade the older metamorphic rocks. Paleozoic carbonate and clastic sedimentary rocks, ranging in age from Cambrian to Permian, flank the Precambrian core. A narrow, irregular belt of Mesozoic rocks border the Paleozoic rocks on the northern edge of the district. Longwell (1928) and Beal (1965) suggest that structurally, the Virgin Mountains are a broad, northeasterly trending, asymetrical anticline with the north flank complicated by extensive faulting. The northern Paleozoic and Mesozoic formations appear to be tilted, massive fault blocks in thrust fault contact with lower thrust plates of Precambrian rocks. Throughout their history, the Virgin Mountains have experienced several episodes of thrust faulting, chiefly during the Late Cretaceous and early Cenozoic. This thrust faulting is possibly related to the Mesozoic Overthrust belt, which at the present time is considered a prime collection site for oil reserves. These thrust faults are complicated by local normal, reverse, and strike-slip faulting. The Bunkerville district is divided into 5 general structural blocks, bound by reverse and thrust faults (Beal, 1965).

The Precambrian rocks generally consist of garnet-sillimanite-biotite schist, granite and granodiorite gneisses, and pegmatite dikes, with the schistosity of the rocks trending northeast and almost vertical. Most of the narrow pegmatites dikes are simple or barren; however the complex variety (those which have been enriched by hydrothermal solutions) are abundant throughout the district. These pegmatites follow the northeast trend of the district and show substantial amounts of beryl and chrysoberyl along with minute quantities of cesium and lithium (Holmes, 1964). Massive and tabular pegmatites, up to 75 feet wide also cut the Precambrian metamorphics and carry minor beryllium. The Precambrian pegmatites have been dated by K-Ar method at $1.37 \pm 0.14 \times 10^9$ years (Anderson, 1951). Dark grey mafic dikes and sills cut the Precambrian rocks in the southwest block and smaller hornblendite dikes occur throughout the district.

All mineral deposits are related to or occur in the Precambrian rocks with the mineralized zones divided into two main groups: The tungsten-beryllium-mica belt in the eastern part of the district which extends from the Arizona border southwest for approximately 1.5 miles; and the northeasterly trending copper-nickel-platinum deposits in the western part of the district. The tungsten-beryl-mica workings are along and adjacent to prominent reverse faults in garnet-mica schist with concordant hornblendite sills and dikes, pegmatites, and scheelite-bearing quartz veins. These intrusives follow the general northeast structural and foliation trend. Chrysoberyl and beryl occurs as disseminated grains and local concentrations in the pegmatites. Scrap mica is a constitute of the garnet-mica schist and sheet mica occurs sporadically in zones throughout the pegmatites (Holmes, 1964).

The copper-nickel deposits are generally fissure type veins with partial replacement and disseminations. Beal (1965) suggests that the deposits resulted from hydrothermal activity along north-northeasterly trending faults. The two main deposits (the Key West Mine and the Great Eastern Nickel deposit) are located in Precambrian granodiorite gneiss which grades laterally into granite gneiss and later was intruded by hornblendite and pegmatite dikes. Most of the nickel-bearing sulfides (pyrite, pyrrhotite, and chalcopyrite) are confined to the hornblendite dikes, where they mainly occur in tiny veinlets and discrete grains. Chrome has also been noted in the hornblendite dikes along with traces of platinum (Lindgren, Davy, 1924).

At the Key West mine the hornblendite body occurs as a domelike structure approximately 150 feet wide and 200 feet long with mineralization, metamorphism, and alterations occurring in varying degrees. The mineralization appears to be confined to the areas where pre- and post-mineralization faulting is most prominent. The ore minerals are not confined to any one given rock type, but the main ore body occurs in the large hornblendite lenticular mass. The ore consists of oxidized and sulfide minerals containing copper, nickel, and platinum, along with minor amounts of gold. Magnetite is uniformly distributed throughout gangue and ore. (Needham, Davy, 1924). The sulfides at depth also include sphalerite and molybdenite and are concentrated in the hornblendite dike and other hosts, including quartz veins. Outcrops at the mine are intensely weathered and hydrothermally altered to spectacular colors.

At the time the district near visited no activity was observed at either the tungsten-beryl-mica area in the east or the nickel-copper deposits in the west. However, surface exploration had been conducted in the area surrounding the Key West Mine within the last 5 years.

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CHARLESTON DISTRICT

The Charleston mining district is located on the eastern flank of the northwest trending Spring Mountains, approximately 35 miles northeast of Las Vegas, Clark County, Nevada. Access to the district is along well marked and used roads west from U.S. Highway 95. The district lies within the boundaries of the Toiyabe National Forest. Limitation of time and field money did not allow us to do on-site examination of this district.

The district's early history is unknown. Hewett (1936) reports that oxidized lead-zinc ore valued at less than $5,000 was mined and shipped from the district between 1926 and 1929. In 1953 and 1954, the Ada and Edith claims produced 11 ounces of silver and 18,300 lbs of lead valued at approximately $2,500. Other properties in the district also produced minor lead and zinc (Longwell, et al, 1965). During the period that field work was conducted in Clark County, the Charleston district was under an estimated 12 feet of snow, therefore, the district was not examined. There is no known activity enquiry in the district.

The Spring Mountains are a block of Precambrian metamorphic basement rocks overlain by Paleozoic carbonaceous and clastic sediments ranging from Early Cambrian through the Middle Permian. Mesozoic rocks outcrop only on the eastern flanks of the range. The district is centered on the Post-Jurassic Keystone Thrust Plate and Lee Canyon Thrust Plate, where the structurally higher Lee Canyon thrust overrides the Keystone thrust from the west placing Cambrian carbonates over Penn-Permian carbonates. The Lee Canyon Thrust Place is the middle plate of three major NNW dipping, NNE trending, easterly directed thrust plates exposed in the Spring Mountains (Laramide Orogeny ?). The major thrust plates are further complicated by local folds, high-angle normal faults, and smaller imbricated thrust faults within the plates. (Burchfiel, 1974).

The few workings in the district are located along thrust and normal faults in the Keystone plate near Lee and Kyle Canyons. The ore occurs as small, oxidized, lead-zinc-silver replacement bodies in the dolomitized carbonates along thrust and offsetting normal faults. The deposits near Lee Canyon are in the Late Cambrian Nopah Formation (dolomites) and the deposits near Kyle Canyon are within the Penn-Permian Bird Springs Formation (Longwell, et. al, 1965).

Mineralization in the district appears to be extremely minor and of no economic importance (Bohannan, 1980) with the primary mineralization of the Spring Mountains confined to the Goodsprings district in the south. Evidence suggests that the ascending ore-bearing solutions associated with the late Mesozoic Tertiary igneous activity that produced the Goodsprings deposits did not migrate northward along the Keystone Thrust to the Charleston district (Bohannan, 1980).

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COALDALE AND COLUMBUS MARSH DISTRICTS

The Coaldale mining district is located to the south and southwest of Coaldale Junction (the junction of U.S. Highways 6 and 95). It includes mines and prospects to the north and northwest of Emigrant Peak at the northern end of the Silver Peak Mountains. The Columbus Marsh district encompasses the Columbus Marsh playa northwest of Coaldale Junction.

The workings in these districts are relatively minor, consisting of about a dozen shallow vertical and inclined shafts for coal and numerous bulldozer cuts and trenches.

Borate minerals were discovered on Columbus Marsh in 1871, and several small mills were built on or near the playa in the following few years. Salt was supplied to nearby mills from the playa as early as 1864 (Papke, 1976, p. 22). By 1882 the borax production from this area had ceased. Coal was discovered at the northern end of the Silver Peak Mountains in 1893. Attempts to mine and market the coal locally were made at various times in the 1890's and early 1900's, but because of the poor quality, none were very successful (Albers and Stewart, 1972, p. 62). Uranium mineralization was discovered in the Coaldale district in the early and mid-1950's; exploration activity for uranium also is reported for the late 1960's and late 1970's. No commercial uranium deposits were located.

The borate mineral ulexite occurs as cottonball-like thin layers 2-15 cm below the surface of Columbus Marsh locally in irregular areas around the margin of the playa (Papke, 1976, p. 22). The halite mined in the 1860's was probably from playa surface encrustations.

Four coal beds have been recognized in the Miocene or Pliocene Esmeralda Formation exposed about 6-7 km southeast of Coaldale Junction. They range in thickness from approximately 1 to 7 m and are distributed over a stratigraphic interval of about 90 m (Hance, 1913; Albers and Stewart, 1972, p. 61). The coal is quite variable in quality and shaly partings are common. The ash content of even the best grade coal is high, and folding and faulting in the Tertiary sedimentary rocks would further complicate economic extraction (Garside and others, 1980). Toenges and others (1946) include a map which shows the coal beds and workings.

A number of uranium prospects are known in the Coaldale district; most of these consist of slightly anomalous radioactivity or sparse uranium minerals in Tertiary sedimentary or volcanic rocks (Garside, 1972, p. 47-48). Two radioactive occurrences are associated with springs. Only minor prospecting has been done at most of these prospects, and there has been no uranium production from the district.

The most promising uranium prospect in the district has been called the Coaldale prospect. At this property, yellow, six-valent uranium minerals occur in dark gray chalcedonic veinlets, as fracture coatings, and as partial fillings in cavities once occupied by feldspars. The wallrock is rhyolitic welded tuff. Many of the veinlets are silica-cemented hydrothermal breccia zones. A number of similar veins cut rhyolitic welded tuff on the Hombre claims, located about 3 km west of the Coaldale uranium propsect. These were explored for uranium by shallow drilling in 1981? by Sierra Del Rio Nuclear. In addition to chalcedony, the veins and silicified zones contain barite, pyrite, and iron- and manganese-oxide minerals. Anomalous molybdenum is also rumored to occur in the veins.

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CRESCENT DISTRICT

The Crescent (Crescent Peak) mining district is located in the northern end of the New York Mountains and the southern end of the McCullough Range, straddling Nevada Highway 68, approximately 12 miles west of Searchlight, Nevada, in T28S, R61E. The district is accessible from Nevada Highway 68 by way of fair to poor dirt roads. It is bound by the approximately latitudes 35°25' and 35°35', and longitudes 115°05' and 115°15'.

An Indian known as Prospector Johnnie was thought to have made the first recorded turquoise discovery southeast of Crescent Peak in 1894, although the area had been mined for turquoise around 1200 A.D. by native Americans (Lincoln, 1923; Morrissey, 1968). Other turquoise properties were soon discovered and considerable turquoise was mined between 1894 and 1906. Ransome (1907) states that the district was first exploited for precious metals about 1895 and again in 1905. The district has had small and intermittent activity throughout its history with peak periods in 1905-1907, 1911, 1930, and 1934-1941 (Longwell, et al. 1965). The district has been explored sporadically since 1954, mostly drilling and claims staking by various companies, coinciding with the rise and fall of mineral prices. There is currently ongoing small scale activity in the district, mostly by private individuals. Many of the older workings have been obliterated by recent surface exploration. Recorded production for the district from gold, silver, copper (turquoise), and lead, with minor molybdenum and vanadium is approximately $63,000 (Longwell, et al. 1965), however, turquoise production has been estimated as high as $1,000,000 (Morrissey, 1968).

The workings in the Crescent district are centered around Crescent Peak which is underlain by Precambrian, medium to fine-grained, quartzo-feldspathic augen gneisses which grade from granite to granodiorite and locally include small masses of schist and quartz (Bingler, Bonham, 1972). The Precambrian rocks are intruded by a highly fractured and altered quartz monzonite pluton which is pervasively silicified and sericitized (Bingler, Bonham, 1972). The pluton has been dated Tertiary-Cretaceous by Bingler and Bonham (1972), but a lead-alpha age from a granite sample indicates it to be Precambrian age or about 927 $\pm$ 90 m.y. (Schilling, 1965). The pluton is intruded by pegmatite dikes, up to several yards wide and containing radial aggregates of muscovite-biotite several feet wide; massive white quartz veins up to a foot wide; and pre-alteration diorite(?) dikes, mostly on the east side of the pluton (Archbold, Santos, 1962).

There are four distinct alteration zones within the quartz monzonite pluton; an argillic and coarse-grained sericite zone within the central core, surrounded by fine-grained quartz and sericite zone, and an overlapping quartz flood alteration zone (Archbold, Santos, 1962). Shattered masses of quartzite, which are cemented with silver and gold bearing quartz, outcrop in the vicinity of the Crescent townsite. Ransome (1907) suggests that these are remnants of an eroded syncline which overlaid the Precambrian gneisses.

There are two prominent fault zones in the district, one striking northwesterly, and the other easterly to northeasterly. Many of the faults are difficult to trace due to the extensive alteration on the surface. Hydrothermal quartz cements the fault zones and carries crystalline and disseminated auriferous pyrite, chalcopyrite, argentiferous galena and tetrahedrite. Locally, the sulfides are found disseminated in the granitic and gneissic rocks in the vicinity of the quartz veins (Longwell, et al. 1965). Supergene copper minerals stain the country rock throughout the district.

Turquoise is associated with quartz veinlets in the argillic and coarse sericite alteration zones while gold is associated with quartz veins, disseminated pyrite, or fault zones. The pluton contains disseminated copper minerals and has been suggested as a site for a copper porphyry deposit (Archbold, Santos, 1962).

In the extreme western portion of the district, south of the highway to Nipton and near the California state line, Hydro-Met Corporation of Victorville, California has recently operated the Lily claim area. A large open pit has been started on a wide shear zone reported to contain low-grade values in gold. The property has been idle for about one year, but may resume mining and heap leaching if metal prices remain at a reasonable level. To the north of this area, on the west pediment of the McCullough range, a large claim block had recently been staked by Houston International Minerals, probably a gold exploration play.

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CROW SPRING (ROYSTON) DISTRICT

The Crow Spring (Royston) mining district is located on either side of the Esmeralda-Nye County line in the Royston Hills in the northwest quarter of T5N, R40E. It is about 25 miles northwest of Tonopah, Nevada, and is accessible north from U.S. Highway 95 along well used dirt roads.

The first recorded activity in the Crow Spring district was in 1902 when two prospectors, Workman and Davis, began mining turquoise at the Royal Blue Mine. From 1902 until 1915, the Royal Blue Mine produced an estimated $ 5 million in gem quality turquoise. After 1915 the district reported intermittant activity in 1927, the 1930's, and 1940's (Morrissey, 1968). Production in the district has been coincident with the rise of gem prices. The district and its surrounding area was heavily staked and prospected in the early 1970's by companies interested in copper-molybdenum systems. Up to the present, the district had produced primarily gem quality turquoise, variscite, and minor amounts of diatomaceous earth, silver, lead, copper, and gold (Albers, Stewart, 1972). The original workings, which were scattered along an east-west trending canyon, have been obliterated by recent open pit operations (Morrissey, 1968). The main workings in the district are owned by the Royal Blue Mining Company and are currently idle. The caretaker at the Royal Blue mine would not permit us to inspect the workings, thereby restricting our examination of the main part of the district.

The Royston Hills are a north to northeast trending series of low hills made up of the Permian-Triassic Excelsior Formation, which is intruded by a quartz monzonite mass and overlain unconformably by Tertiary welded ash flows. The Excelsior consists of volcanic breccia, flows, tuffs, and brecciated greenstone with thin, tuffaceous sandstone interbeds and limestone lenses (Ross, 1961). The formation is intensely silicified throughout the district. Kleinhampl (in prep.) assigns the mineralized zone to the Middle Permian Pablo Formation; however no data is offered in support.

The turquoise occurs principally in veinlets and seams with minor lenses and nodules, ranging from a fraction of an inch to more than an inch in thickness, in fracture zonesin altered trachyte, rhyolite and quartz porphyry, and along the contact between the intrusive and the volcanic sediments. The rocks were locally silicified after the turquoise was emplaced (Murphy, 1964; Morrissey,1968). In fault breccias the turquoise cements the matrix and occurs as lenses and nodules. The color of the turquoise ranges from pale to dark sky blue (Morrissey, 1968).

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CUPRITE DISTRICT

The Cuprite district is located near U.S. Highway 95 about 19 km south of Goldfield. The district probably should be considered to include a few properties on the eastern part of Mount Jackson Ridge and in the southern part of the Goldfield Hills. The underground workings are shallow, usually less than 100 m in depth, and lateral workings are not usually extensive. Numerous shallow shafts are present in Cambrian rocks in several parts of the district.

The district was discovered in 1905. Production from the district is very small, probably a few small shipments totaling less than $10,000 (Ball, 1906; Hewitt, 1936). Most of the underground exploration for copper and silver was probably done in the early 1900's; very minor sulfur production is also reported during that time. Silica was produced from the Cuprite district in the period from 1914-18 (Fulton and Smith, 1932). Also, in 1960 an attempt was made to mine and process silica from the district (Olson, 1964, p. 245). There has been little activity in the district since that time although recent claim staking suggests that the hydrothermally altered areas in Tertiary rocks are being evaluated for their precious metal potential.

The Cuprite mining district contains mineralization of two different types and ages. The younger, which has affected rocks as young as 7 m.y. (Ashley and Abrams, 1980) is characterized by acid-sulfate alteration that has converted Cambrian siltstones and Tertiary tuffs, flows, and volcanic sedimentary rocks to silicified, opalized, and argillized rocks. Mineral production associated with this alteration includes only minor amounts of sulfur, silica, and clay. Potential for substantial discoveries of commercial sulfur and clay is low, for silica the potential is high, and for gold and mercury it is low to moderate. Alunitic rock exists, but its tonnage is too small and its mineralogy too unfavorable for exploitation by presently contemplated commercial processes (Ashley, 1978). The silicification is concentrated in the central part of the 10 Km^2 altered area. Most of the remaining altered rocks are opalized, but argillized rocks appear locally near the margins of the altered area. Several sulfur prospects and silica quarries are located along the contact between silicified and opalized rocks, and possible gold prospects are located within the silicified zone. Alunite is abundant locally in the opalite. The alteration and the associated precious-metal mineralization probably are localized along northerly trending faults that are prominent in surrounding unaltered rocks (Ashley, 1977).

The older mineralization at Cuprite consists of base-metal veins (mainly copper-lead) with minor precious metal values (mainly silver) in unaltered to locally hornfelsic Cambrian siltstones. This mineralization is probably Mesozoic in age, associated with a buried pluton (Ashley, 1978). This mineralization occurs at scattered mines and prospects over 15 km apart. The veins contain chalcopyrite with lesser amounts or pyrite and galena. The gangue is chalcedonic and vitreous quartz, and calcite. The sulfide minerals occur as seams and lens-shaped masses along faults. The upper portions of the veins are oxidized to a gossan containing oxide copper minerals (Ball, 1906, 1907). Picked ore from one mine was reported to contain 7 oz/ton gold, 230 oz/ton silver and 19% copper (Ball, 1906).

In addition to the above described properties, manganese and barite properties in the southern Goldfield Hills was included in the Cuprite district. The Gaillac manganese property appears to be a vein-like deposit. The Congress barite occurrence consists of a 0.9 m vein of white barite in limestone of probable Cambrian age. The vein trends northerly and has a high angle (K. Papke, written communication, 1983).

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DIKE DISTRICT

The Dike mining district is located approximately 12 miles northeast of Las Vegas in S6, T19S, R63E in Clark County, Nevada. Access to the district is by way of a single dirt road in good condition north from U.S. Highway 93.

Very little is known of the history of the Dike district. It was originally located in 1916 and consists of a single working, the Lead King Mine, which was reported to have shipped only 2 carloads of ore of 50% lead sometime between the 1920's and 1930's (Longwell, et al, 1965). The property has been inspected at various times but no further activity has been noted. At the time of inspection, there was extensive surface scrapings and some trenching in the hills. The access road is well maintained, probably due to the microwave station immediately north of the district. The district is presently inactive.

The only property in the Dike district, the Lead King Mine, is located in the low hills at the southern end of the north-trending Arrow Canyon Range. The workings are in the limestone beds of the Mississippian-Pennsylvanian Birdsprings Formation. The beds range from 1 to 4 feet wide, strike N75W and dip about 20°NE, and are cut by bedding plane faults. These fault zones served as conduits for mineralized calcite to ascend. The crystalline calcite veins range from 2 to 6 feet wide and carry pods and stringers of argentiferous (?) galena. Adjacent to the veins, the limestone is dolomitized, with very fine galena crystals disseminated throughout the host rocks. At depth, the galena has altered to cerussite (Longwell, et al, 1965).

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DIVIDE DISTRICT

The Divide (Gold Mountain) mining district is centered on Gold Mountain, 9 km south of Tonopah. The workings in the district are quite extensive; many of them are shafts with lateral workings. The production part of this district is located on the north side of Gold Mountain, but shallow shafts were sunk in both mineralized and unmineralized areas for several km around Gold Mountain. The deepest workings (420 m) are at the Tonopah Divide Mine.

The geology and mining history of the district is summarized in Bonham and Garside (1979). Much of the following is taken from that report. Gold was discovered in the district in 1902 and small gold-bearing veins on Gold Mountain were mined intermittently until 1917 when the discovery of silver ore triggered one of the last major Nevada silver rushes. By 1919 an area of over 130 km^2 surrounding Gold Mountain has been staked, and over 100 mining companies had been formed in the district. The boom soon subsided as only a few of the properties were found to contain ore in minable quantities.

Most of the ore mined in the district was produced during the period between 1920 and 1929 and most of the production came from the Tonopah Divide Mine. The district has a total production of approximately $3.5 million from 3,275,079 ounces of silver and 32,474 ounces of gold. There has been no recorded production since 1950, however, considerable exploration work has been done since 1976 in the district. Bulldozer trenching and sampling along the main mineralized lode was done in the late 1970's, and Falcon Explorations Co. mined a considerable amount of material from the vicinity of the Tonopah Divide Mine in 1982 and hauled it to a heap-leach facility about 8 km south of the mine. In addition, Cordex Exploration Co. has located (by diamond-drilling methods) an estimated 5 million tons of ore containing 0.06 oz/ton gold and 1.5 oz/ton silver (Bonham, 1982). This deposit is located on Hasbrouck Mountain at the west edge of the district.

Two main types of precious-metal deposits have been mined in the Divide district. Prior to the discovery of the high-grade silver ore body at the Tonopah Divide Mine, mining was confined to narrow veins, valuable chiefly for their gold content, occurring in Miocene Oddie Rhyolite or silicified rocks of the Siebert Formation adjacent to the Oddie Rhyolite. These veins are relatively narrow, seldom exceeding 1 m in width, and are simple mineralogically. They contain, where unoxidized, fine-grained quartz, silicified angular fragments of wall rock, pyrite, free gold, and minor silver sulfides.

The disseminated deposit of Cordex Exploration Co. at Hasbrouck Mountain is related to the high-gold type of mineralization. This deposit is located in strongly silicified volcaniclastic and tuffaceous sedimentary rocks of the Miocene Siebert Formation. The area of silicification is surrounded by argillic alteration. Features such as silicified hydrothermal breccia zones and the presence of siliceous spring sinter in the Siebert indicate the shallow nature of the mineralizing hydrothermal system.

The second type of precious metal mineralization in the district is the silver-bearing lodes, from which most of the production of the district has come. The principal host rock for these lodes is the Tonopah Summit Member of the Fraction Tuff, although mineralization of this type also occurs in the Oddie Rhyolite and in the Siebert Formation. These lodes typically occur in fracture and fault zones in the Fraction Tuff and vary in width from a few centimeters to about 30 m. Their surface outcrops are marked by weakly to moderately silicified, iron-stained zones traversed by numerous fractures. The walls of the lodes are usually well defined and commonly slickensided. The Fraction Tuff where these lodes occur, is altered to an aggregate of quartz, sericite, and adularia. Numerous small quartz veinlets occur within the lodes but bold quartz veins do not occur.

The oxidized ores contained cerargyrite as the chief silver mineral and variable amounts of free gold. Ferrimolybdenite and powellite occurred in oxidized ore at the Tonopah Divide Mine, and highly anomalous amounts of molybdenum (up to several thousand ppm) are present in many of the other mineralized zones in the district. Barite is present in many of the mineralized lodes, particularly in the southern part of the district. Based on samples from dumps and underground, the primary ore contains pyrite, sphalerite, argentiferous galena, chalcopyrite, molybdenite and tetrahedrite(?). Supergene acanthite was an important ore mineral in the district.

Approximately 40 km^2 of hydrothermally altered rocks are present in the Divide district, of which only a few square kilometers have been productive. The alteration is zoned around fractures and fault systems which are the sites of the productive and unproductive lodes within the district. The lodes consist of quartz, sericite, adularia, and pyrite and are enclosed by an envelope of propylitized rock which grades outward into zeolitized tuff.

There does not seem to be a dominant or systematic pattern to the mineralized lodes in the Divide district. The main lode at the Tonopah Divide strikes northwest and is nearly vertical; however, the strike of other veins and lodes ranges from east-west to north-south. The considerable thickness of the Fraction Tuff in the Divide district suggests that the district may be located within a caldera that was the source of this tuff. If this caldera exists, the Divide district would be located on its southern margin.

The age of mineralization at the Divide district has been determined quite accurately based on K-Ar determinations of vein and host rock minerals. This age of mineralization is believed to be about 16 m.y. (Bonham and Garside, 1979, p. 125).

Bonham and Garside (1979) suggest that the silver lodes of the Divide district represent fracture-controlled leakage haloes from a major hydrothermal system genetically related to a subjacent composite stock underlying the district. The occurrence of anomalous amounts of base metals, particularly molybdenum, in these fracture systems suggests the possibility of a buried, porphyry-type, molybdenum-copper deposit beneath the Divide district.

Geochemical anomalies in Pb, Zn, Ag, Au, Hg, As, W, Sb, Bi and Mo occur in the Divide district centered on Gold Mountain (Bonham and Garside, 1982).

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DYER DISTRICT

The Dyer district covers a very small area on the western edge of the Silver Peak mountains, directly east of Dyer Ranch.

Old mines and small prospects in the main part of the district are clustered within an area of about one quarter of a Section along a single northwest trending dry wash. Prospecting has been confined to a north-west trending band of Cambrian Harkless Formation which has been intruded by a body of quartz monzonite immediately to the northeast. To the southwest, just upslope from most of the mineral occurrences, the Harkless forms the lower plate of a thrust sheet, and has been overriden by the Poleta Formation.

Spurr (1906) mention that there was activity in this district in 1863-64, more in the period 1884-87, but was quiet during his visit in 1903. Lincoln (1923) mentions production from the district in 1912, and Couch and Carpenter (1943) show a small production in 1925. Total production for the district through 1972 is given at only a little under $13,000 (Albers and Stewart, 1972), so the total of all of the years of activity resulted in very little actual dollar value.

The best description of the old workings is by Spurr in 1906. Black copper-silver sulfides, in placed oxidized to carbonates and oxides, occur in quartz veins in crushed, folded shales and silicified limestones. The structures along which the veins formed strike N60°-80°W, and display manganese-iron oxide rich gossan zones along them. Areas of jasperoid laced with silica veinlets were seen in zones along a structure near sample site 1253.

Fairly new claim posts (notices dated 1980) were seen in the area of the main shafts low in the wash, and recent flagging gave evidence of a sampling project covering the old mine area. No work was in progress at the time the area was visited in August, 1982.

About one and one half miles due south of the central cluster of prospects, the old workings of the Bluff mercury mine are located along the north side of a dry wash. Cuts and pits, and an old shaft expose a lense of jasperoid and gossan along a N70°W structure. The zone is exposed across about 50' of width along the side of a knob of silicified limestone. The zone is highly stained by manganese and iron oxides and Baker (1964) reports that cinnabar is present as films and disseminations in the shear structure. The area has been explored by trenching in the last 10-15 years, but no recent activity was evident.

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ELDORADO DISTRICT

The Eldorado (El Dorado, Colorado, Nelson) mining district is located in and around the town of Nelson in Eldorado Canyon, west of the Lake Mead Recreation Area, Clark County, Nevada. The Eldorado Canyon trends east-west through the southern end of the Eldorado Mountain. Nelson is approximately 25 miles south of Boulder City, Nevada, by way of U.S. Highway 95 and Nevada Highway 60. All areas of the district are accessible along good to poor dirt roads from Highway 60. Prior to the building of Hoover Dam, the district extended to the Colorado River.

The Eldorado district, one of the oldest in Nevada, began operations about 1857 when gold ore was discovered on what is now the patented Eldorado Rand property. Nelson was founded and the Colorado mining district organized in 1861. The early miners found the remains of workings which dated prior to 1860, indicating that the district probably had been worked by the Spanish or Mexicans several hundred years ago (Vandenberg, 1937). The Southwestern Mining Company acquired most of the producing mines and controlled mining activity from 1862 to 1897 (Longwell, et al. 1965). Ore produced during this time, which consisted of free gold and hornsilver, was shipped down the Colorado River to towns in California or on to the Gulf of California. In the early 1900's, the Techatticup and Eldorado Rand mines were the main producers, with most of the other properties idle or producing intermittently. During this time, interest declined in the district as other districts throughout Nevada came into production making the remoteness of Eldorado Canyon less attractive. Activity up to the present has been relatively consistent with the rise and fall of metal prices. Ransome (1907) estimates production in the district prior to 1906 to be between 2 and 5 million dollars. Longwell (1965) reports production from 1907 to 1961 to be an estimated $4.5 million in gold, silver, copper, lead, and zinc. The district was extensively explored, both surface and subsurface, during the "1981 gold rush". At the time of inspection, activity was noted west of Nelson in the vicinity of Wall Street and

Black Hawk mines where heavy equipment was observed moving surface dirt, or possibly removing the old dumps for residual values. However, no large scale active mining or ore production was observed, and generally, activity in the district is confined to independent owners and lessees conducting yearly assessment work. Year round residents live at Nelson and scattered throughout the district.

The Eldorado district is underlain by a Precambrian granitic metamorphic basement complex and overlain by Tertiary volcanics, which in turn, are intruded by Middle Mesozoic to Late Tertiary felsic and mafic plutons, masses, dikes, and ore bearing quartz veins.

The Precambrian rocks are composed of rapakivi granite, granite gneisses, porphyries and schists overlain with erosional remnants of Tertiary megabreccias and volcanic flows and lavas. The extrusives represent at least three episodes of volcanic activity in the Tertiary. The Lower Tertiary Patsy Mine volcanics consist of andesite lavas and flow breccias, and rhyolite breccias. The Mount Davis and Golden Door volcanics overlie the Patsy Mine volcanics conformably and consist of rhyolite ash-flow tuffs overlain by an eastward thickening wedge of andesitic rhyo-dacite lavas interbedded with clastic debris (Anderson, 1971). The volcanics strike north and generally dip to the east with the northernmost volcanics dipping west. The volcanics exhibit a broad anticlinal structure, probably an expression of the underlying Precambrian rocks. Structurally controlled and in fault contact with the basement and volcanic rocks are middle Mesozoic to Tertiary granodiorite, quartz monzonite and microgranite plutons and masses. North trending irregular dike swarms of pegmatites, aplites, andesite porphyries, and fine-grained rhyolite cut the metamorphics. A few later rhyolite dikes intrude the volcanic rocks (Ransome, 1907; Volborth, 1973; Anderson, 1971). Erosion has removed much of the Tertiary volcanics from the basement rocks. Everywhere in the district, the Precambrian basement rocks are separated from the volcanics by a layer of well-sorted, poorly-bedded, angular detritus composed of conglomerate, limestone, and sandstone cemented with calcite (Anderson, 1971). Rocks exposed on the dumps suggests that the district is underlain by extensive plutonic rocks at shallow depth. East of Nelson, along Eldorado Canyon, and in the extreme southern part of the district, megabreccias of Precambrian gneisses and Tertiary intrusive and extrusives were thrust over basement rocks during the Lower to Middle Tertiary (end of the Laramide Orogeny?).

Volborth (1973) suggests that the present structure of the Eldorado Mountains is the result of Cenozoic Basin and Range type faulting and is a southern extension of the province. The district is cut by parallel, normal, north and northwest trending faults, possibly related to the Las Vegas Shear. With local exceptions, the downthrown side of the fault block is to the west. The east-west trending Nelson fault (Nelson Wash) divides the district into two distinct fault blocks, with the northern Nelson block downthrown and shifted westerly relative to the southern Precambrian granitic complex. North of the Nelson fault, Tertiary volcanics are downthrown between Precambrian metamorphics in an elongated, north-northwest graben and horst structure. Along the two parallel fault zones are granitic, granodioritic, and volcanic megabreccias.

The ore zones in the Eldorado district occur in epithermal quartz and calcite fissure veins in the Precambrian metamorphics and in the shattered quartz monzonite-granodiorite plutons which are filled and cemented with quartz and calcite (Hansen, 1962; Longwell, et al. 1965). The ore bearing veins also follow the brecciated contacts between the plutons and propylitically altered andesite dikes. The quartz/calcite veins strike east-west, dip vertical to horizontal, and range from minute stringers to several feet in thickness (Ransome, 1907). Some veins exhibit post-emplacement crushing. Early mining removed free gold and hornsilver from the oxidized ore on the surface leaving gold-bearing sulfide minerals in the quartz/calcite veins below the oxidization level. Chalcopyrite, pyrite, galena, sphalerite, and chrysocolla are the principle ore minerals. The quartz veins were observed to carry specularite and bladed boxworks, suggesting stibnite. The alteration of the primary sulfides produced surface coatings of copper oxides on the veins and country rock. Sericitic and chloritic alteration is common along the contacts between quartz veins and country rock which is locally silicified. Late stage flooding of hydrothermal silica coats open spaces and fissures in quartz veins and host rocks, and cements breccia in the fault zones. Jarosite was noted coating fracture surfaces at the Nevada Gold Co. claims and at the Tonne claims. Bailey (1944) reported the occurrence of mercury at the Patsy Mine. The workings follow the contact between highly altered and fractured Tertiary rhyolite and andesite flows. No mercury was observed at the mine or on the dump.

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FISH LAKE VALLEY DISTRICT

The Fish Lake Valley district covers the eastern slope of the northern White Mountains in Esmeralda County. The district extends from near Sugarloaf Peak on the Esmeralda-Mineral County line south to the vicinity of Chiatovich Creek. Mining properties are grouped in two separate areas within the district, one near Sugarloaf Peak and the other to the south around the B & B mercury mine. Two other mines, the Mollini mine on the state line south of Indian Creek and the Lake Mercury mine on the east side of Fish Lake Valley are also included in this district although they are quite distant from the main district activity. Most of the mines and prospects in the western or White Mountains part of the district are within the Inyo National Forest and a large area west of the B & B property is within the Sugarloaf Roadless area.

The earliest activity in the district was at the Tip Top, or Gold Hitt gold mine south of Sugarloaf Peak. Paher (1970) describes activity at Gold Hitt in 1905, but he has the area confused with Queen Canyon to the west. The Tip Top was known to be active by 1915, however, and a production of $130,000 is credited to the mine by 1918. The Mount Montgomery or Wild Rose mercury mine produced during World War I. The mercury deposits around the B & B were discovered in 1927 (Bailey and Phoenix, 1944), and were active in the 1930's and 1940's. Currently, interest in the district is high and gold exploration programs are underway near most of the old mercury and gold properties. In the summer of 1982, no properties were beyond the exploration stage, however.

The geology of the northern White Mountain is dominated by the large Inyo batholith complex which forms the spine of the range. Narrow bands of Cambrian and Ordovician rock which have been intruded by the batholitic rocks outcrop in a northwest-southeast line along the east side of the range, east of Boundary Peak and west of a line through Mustang Mountain and the drainage of Dry Creek.

Generally, this line marks the western boundary of the Fish Lake Valley district. East of the line, rocks cropping out are andesites and rhyolites associated with a large Tertiary volcanic center (Stewart and Carlson, 1976). Younger Quarternary basalts cap some of these Tertiary rocks along the range flanks to the east. Most of the mineral occurrances in the northern part of the Fish Lake Valley district are associated with andesite and rhyolite domes and plugs within the Tertiary volcanic outcrop area. To the south, along Dry Creek, the Red Rock and Container mercury mines occur in brecciated Cambrian rocks near a mapped thrust contact.

At the Wild Rose mercury mine on Sugarloaf peak, cinnabar and yellow mercury chlorides occur in brecciated, silicified rhyolite along the margin of what appears to be an intrusive plug. The best mineralization was seen in two circular areas of hydrothermal breccia exposed in the pit above the old retort site. The breccia zones have a N30°E trend and, it is interesting to note, are on the projection of northeast trending structures seen in the adjacent Buena Vista district. The Tip Top gold mine, south of the Wild Rose deposit, occurs along a strong north-south vein south of its intersection with a N30°E structure. The vein is 10' to 15' wide and is composed of banded, lamellar quartz containing fine-grained black sulfides. The wall rock near the vein is silicified and laced with small quartz veinlets. To the southwest of the Wild Rose-Tip Top area, several old prospects follow a wide N30°E shear zone which contains local areas of brecciation and quartz veining. Dumps contain silicified rock with considerable jarosite present in vugs. The Tip Top mine and vicinity (at the time of the examination) was controlled by Cordex Exploration Co., and considerable exploration drilling has been done in the general area within the past year.

At the Buckskin mercury property, located on a fork of Pinchot Creek east of Sugarloaf peak, cinnabar occurs in a pipe-like body of hydrothermal breccia at the intersection of a strong N30°E structure with a N75°E shear zone. The rock in the breccia has been silicified, brecciated, then cemented with chalcedonic quartz. Cinnabar is apparently a late stage mineral as it coats open fractures which cut the breccia. A large area of discoloration in the volcanic host rock surrounds the mine area. Fresh claim posts were seen in the area, but there was no evidence of recent work. At the F & L mercury mine to the south cinnabar and mercury chloride minerals occur in breccia zones and open conduits localized on and around a bleached, silicified area which caps a hill south of Mustang Canyon. The top of the hill is composed of opaline hot springs deposits, and the dome shape of the hill may indicate that it is underlain by a shallow volcanic plug. Mineralized breccias exposed in the F & L pit follow a N30°E shear zone that crosses through the mine area. The zone has an exposed width of about 400 feet. The breccia centers occur within the shear zone, where N70°-80°W structures intersect it. The F & L is credited with only a few flasks of mercury production in the 1930-40's. The entire area around the deposit is now under the control of U.S. Steel Corporation, and, in the summer of 1982, they were actively exploring the area for gold. The B & B mercury deposit, about one mile southwest of the F & L, is in a similiar geologic setting, it is within a large area of brecciated, opaline material associated with a hydrothermal center. Cinnabar and mercury chloride minerals are found as fracture coatings within the brecciated zone. Here, as at the mercury deposits to the north, the important structural direction seems to be N30°E breccia zones occur at points along this trend where it is intersected by cross-cutting structures.

The B & B mine has the largest recorded production of mercury of all the mines in the Fish Lake Valley district. Between its discovery and 1943, it recorded a production of 2659 flasks, but the mine produced again in the 1960's.

In the southern part of the district, south of Dry Creek, the Red Rock and Container mines and the Picture Rock and Montana prospects are all mercury occurrences in Cambrian sediments in the upper plate of a thrust sheet. The host rock is mapped as a brecciated, marble but, in outcrop, it more closely resembles a quartzite. The rock is highly silicified, however, and could originally have been a marble. At the Red Rock, cinnabar was seen to coat quartz crystals and fill breccias along strong N30°-40°E and N80°W structures. The setting at the Container mine is similiar, there breccia fillings of cinnabar were seen, and some vugs were coated with yellowish barite crystals. Coating of a yellow mineral, possibly antimony oxides or mercury chloride were also noted. No evidence of recent activity was noted around these properties.

The McNutt and Crimson Crown mercury prospects, just east of the Red Rock area, are both volcanic hosted deposits. The McNutt explores a small opalite zone exposed in a wash, but directly north of it an eliptical outcrop of silicified rhyolite is exposed which is laced with stockworks type quartz veinlets. Some of the larger (½") veinlets have fine-grained pyrite within them and along their walls. Evidence of recent exploration was seen at this deposit.

Across Fish Lake Valley to the east, at the south end of the Volcanic Hills the Lake, or Riek mercury prospect occurs in shear zone rubble in a recent hot spring sinter blanket. The spring area is weakly active and is now seeping water. A large diameter drill hole, probably a geothermal test well, has recently been drilled at the spring site. The well is capped, and valves to test flow are in place.

The Mollini Mine, within National Forest lands near the California state line in the extreme southern part of the district, explores a narrow quartz vein which cuts rocks of the Precambrian Wyman formation within the contact aureole of the Inyo batholith. Numerous lenses of epidote skarn are exposed on the ridge near the quartz vein outcrop, but the skarn does not appear to be mineralized. The quartz vein itself shows only weak copper staining.

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GILBERT DISTRICT

The Gilbert (Desert) mining district is located in the eastern part of the arcuate Monte Cristo Range in the northern part of Esmeralda County, Nevada, in T3,4N;R38E. The district forms a north-northeast trending, elongate area approximately 7 miles long and 1.5 to 3 miles wide, which is bounded on the south by the south flank of the Monte Cristo Range, on the east by the Big Smoky Valley, on the north by the line between Townships 3 and 4 North, and on the west by the latitude 118°45'. Access to the district is easiest from the east along dirt roads from U.S. Highway 95.

Little is known about the early history of the district, but it was prospected in the late 1800's and the Carrie Mine had been developed by 1880. The district's only recorded boom occurred in 1924 when the Gilbert brothers discovered high grade gold ore on the Last Hope Claims. The district was then extensively prospected but with little recorded results. The Castle Rock Mine produced one flask of mercury in 1928. Drilling in the area was reported in 1943 (Bailey, 1944). Additional drilling was done in the early 1970's, and more exploration work was done during 1981-1982. The total recorded production for the district is approximately $100,000 (Ferguson, 1927; Albers and Stewart, 1972), principally from gold. While currently non-producing, most of the main part of the district has been staked and it is being explored and evaluated by Anaconda Mining Co., a subsidiary of Atlantic Richfield Oil Company. Also, independent persons were observed exploring the district during the examination. The district is currently being mapped by J. H. Stewart of the USGS as part of the Tonopah CUS mapping project.

The Gilbert district is almost entirely underlain by Tertiary sediments and mafic and felsic lavas along with minor exposures of cherts, quartzites, slates, and limestones of the Ordovician Palmetto Formation. The sediments are intruded by Late Jurassic or Early Cretaceous alaskite, granitic, and aplitic dikes. The Miocene Esmeralda Formation outcrops throughout the district, its upper member is a very fine-grained sandstone interbedded with limestone and its lower member is a bedded rhyolite and rhyolite breccia. There are extensive flows of the Gilbert Andesite (Pliocene?) and later Pleistocene basalt flows throughout the district (Ferguson, 1927; Albers and Stewart, 1972).

Structurally, the Monte Cristo Range, along with the Cedar Mountains form an arc which is concave northward and concentric with the Silver Peak-Palmetto-Montezuma oroflex. However, since the Monte Cristo Range is primarily made up of Tertiary extrusives, a relationship to the oroflex is questionable (Albers and Stewart, 1977). The district lies along or near the northwest trending structural disruption known as the Walker Lane (Locke, 1940).

Two periods of mineralization have been recognized in the Gilbert district (Ferguson, 1927). The earlier is a deep seated quartz vein and skarn system. The bedded sediments of the Palmetto Formation were intruded by Mesozoic granitic masses and dikes which silicified the limestone beds and developed considerable sericite and epidote in the skarn along the intrusive contact. Later ascending mineralized solutions filled the fissures and minute cracks in the skarn with sulfide-bearing, coarser crystalline quartz and disseminated the sulfides, in the adjacent jasperoid rocks. Minerals deposited in the skarns and quartz veins include pyrite, chalcopyrite, argentiferous galena, sphalerite, molybdenite, and tetrahedrite. The degree of silicification of the carbonates decreased with the distance from the intrusives. Silica later flooded the system coating the rocks with drusy quartz and cutting the jasperoids. The only representation of this system are the silver-antimony deposits found at the Carrie Mine.

A later system of shallow, very fine to massive quartz and calcite veins is found in the brecciated Tertiary lavas and Ordivician Palmetto Formation. These quartz/calcite veins are generally found near an intrusive rhyolite mass and have a tendency to follow the varying attitudes of the older sediment beds. The deposits consist of small veins of hydrothermal quartz intergrown with calcite crystals and locally, coated with barite crystals. Crystalline quartz also cements the breccia with the fragments acting as nucleating points. The fragments in the breccias appear milled. Free gold is the principal ore mineral along with minor amounts of silver chlorides and sulfides (Ferguson, 1927).

In the southern part of the district, a small cinnabar deposit (Castle Rock Mine) occurs in the bleached and altered Gilbert Andesite along a steeply dipping, northeast trending fault breccia zone. The breccia is locally silicified and cemented with chalcedonic silica, with fine grains of cinnabar and pyrite along with cockscomb quartz coating the open spaces. Cinnabar is also reported along fractures and open spaces in the silicified andesite. Minor stibnite has been reported associated with the cinnabar (Lawrence, 1963).

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GOLD BUTTE DISTRICT

The Gold Butte mining district is located in the southern part of the Virgin Range in the northeastern part of Clark County, Nevada. It is bounded on the west and south by Lake Mead, on the east by the Arizona-Nevada state boundary, and on the north by an arbitrary east-west line throughout St. Thomas Gap. Access to the district is south from Interstate Highway 15 along the north-south Gold Butte Road and fair to extremely rough dirt roads, or by boat from Lake Mead.

The district was first mined in 1873 when Daniel Bonelli discovered and began mining vermiculite deposits that occur northeast of Gold Butte Lode gold mining began about 1905 and the town of Gold Butte was laid out in 1908. Shipments of argentiferous copper and zinc were reported from 1912 to 1918, but from 1918 through 1941, gold was the principal, albeit, minor commonodity produced. Intermittent small-scale placer operations contributed to gold production after 1926 (Hill, 1916; Lincoln, 1923; Vanderburg, 1936,1937). Currently the southern part of the district is being explored by individual prospectors. No activity was observed in the northern part of the district. Mr. Eddie Bozell, owner of the Treasure Hawk Mine (formerly the Radio Crystal Mine), was kind enough to provide a tour of his operation, however, he did not permit the taking of samples, photos, or notes, thereby severly restricting the inspection. The Treasure Hawk Mine is a completely self-sustaining placer operation and is currently producing enough gold to support at least 5 persons. Assessment work is the only activity observed on the other active properties in the district. A full-time caretaker was in residence at the Vermiculite Mine at the time it was visited.

Mineral production from the district includes gold, silver, copper, lead, zinc, vermiculite sheet mica, and magnesite. Scheelite and powellite have been noted in the joints and fractures and disseminated in the granitic dikes, however, no tungsten production has been reported.

The district is divided into two distinctly different geological areas by the northeast trending Gold Butte Fault, a left-lateral fault with no apparent vertical displacement, and an approximate 11.25 km horizontal displacement. North of the fault, a series of north-trending ridges and valleys formed by steeply easterly dipping beds of Paleozoic quartzite, limestone and chert, interbedded with limy shale are faulted against Precambrian gneisses and overlain by Tertiary sediments. Mineralization in this area appears to be confined to Trampand Azure Ridges, where small, irregular replacement bodies of oxidized copper, lead and zinc ore occurs along fractures in Mississippian and Cambrian carbonates (Longwell, et al, 1965). Uranium has been reported along joints, in the Tertiary Horse Springs Formation (Garside, 1973).

Rocks south of the dividing fault are chiefly Precambrian gneisses and schists which have been intruded by Precambrian, medium to coarse grained, porphyritic, locally perthitic rapakivi-like granite. The granites underlie the metamorphic rocks wherever exposed and represent a roof portion of a granite batholith, with numerous cupolas, dikes, inclusions, and intrusion breccias. Rb-Sr age-dating have determined the age of the batholith to be 1.06×10^8 to 1.09×10^8 years (Volboth, 1962). The Precambrian complex is flanked on the west by the same north-trending carbonate ridges described to the north and displaced to the west by the Gold Butte Fault. Cutting both gneisse and granites are small, irregular, vuggy, quartz veins and stringers, massive pegmatite bearing radioactive minerals (Garside, 1973), and aplite dikes. The quartz veins are virtually vertical and strike generally north-northeast. The veins have a strong tendency to branch, then unite at a distance. The country rock adjacent to the veins is lightly altered to sericite and chlorite. Minor free gold occurs in the more heavily mineralized veins (Hill, 1916). Gangue minerals include quartz and fluorite. It has been noted that the granites in the Gold Butte region have a high rare earth content (Weyler, 1965).

Leighton (1967) suggests that the origin of the vermiculite deposits in the district is the result of hydrothermal alteration of mafic minerals, particularly biotite, as a result of the intrusion of pegmatite dikes in the area. The vermiculite is most abundant, of higher quality, and possesses zonal relationships near the pegmatite dikes. Leighton also suggests that meteoric waters continued the process of vermiculitization after the hydrothermal activity had ceased.

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GOLDFIELD DISTRICT

The Goldfield district is centered on the town of Goldfield in eastern Esmeralda County about 40 km south of Tonopah. Diamondfield, to the northeast of the town of Goldfield, is also included in the district. The workings in the district consist of hundreds of shafts with thousands of meters of underground workings. Although most of the ore was mined within a few kilometers of the town, minor properties are located up to 18 km east of Goldfield.

The Goldfield district has produced more than 4.2 million ounces of gold, 1.5 million ounces of silver, and 7.7 million pounds of copper since its discovery in 1902. Ransome(1909) gives a concise account of the discovery of the district and of mining in the early years. Some later developments are described by Locke (1912) and Searls (1948), but no comprehensive account of later mining developments is available. Following the original discovery, development in the main productive part of the district immediately northeast of the townsite was very rapid, and 539,000 ounces of gold were produced in 1910. After that time, as the mining progressed to deeper levels, production declined. During the 1930's, production included much gold reprocessed from mill tailings (Ashley and Keith, 1976), a procedure that has been reactivated recently in the main mill tailings areas north of Goldfield. Noranda Exploration, Inc. did a considerable amount of exploration in the main part of the district in 1981-82, and there are unconfirmed reports that they did block out some ore-grade material (possibly 0.5 million tons of 0.07 oz./ton gold).

The geology of the Goldfield district is described in Ashley (1974) and Ashley and Keith (1976). Albers and Stewart (1972, p. 67-69)give a summary of the geology and ore deposits of the district, much of the following is adapted from that summary.

The principal rocks in the Goldfield district are Miocene volcanic rocks that overlie a basement of Ordovician shale and chert (Palmetto Formation) and Mesozoic granitic rock. The principal host rocks in which ore shoots occur are the Milltown Andesite and an overlying rhyodacite. These units give isotopic ages of about 22 m.y. They are highly bleached and altered generally in a large eastward elongated elliptical belt that includes the principal productive part of the district. Elsewhere they have undergone only fairly weak propylitic alteration. The bleached rocks are argillized, alunitized, and silicified. Typically the most silicified and alunitized rock forms more or less linear ledges enclosed in soft argillized rock. The individual ledges range from a few feet to hundreds and locally to thousands of feet in length and from a few feet to many tens of feet wide. They occur mainly within and parallel to the margins of an eastward elongate elliptical area which measures about 8 to 11 km. long east-west and 5 to 6.5 km. north-south. It can be demonstrated that the major faulting in the district occurred prior to alteration and mineralization, and it is apparent that the ledges, which dip mostly at angles steeper than 40°, reflect an elliptical fracture system probably the rim fracture zone of a caldera.

The principal mineralized belt is a quartz-alunite ledge system that trends generally about north and dips 30° to 40°E, but which in detail has many irregularities. The dip generally flattens with increasing depth. Individual ore bodies contained in the ledge system were typically rather small, extremely irregular in shape, and often very high in grade. According to Locke (1912), p. 845) the ore bodies were much like plums in a pudding and only 6 percent of the aggregate lode areas revealed in all the levels of the Goldfield Consolidated was occupied by ore. However, in certain areas there was more or less an alinement of ore bodies downdip so that their distribution was not completely haphazard. Nevertheless, prediction of the location and (or) grade of ore bodies was virtually impossible. Very little ore was found as deep as 1,000 feet.

The high-grade sulfide-sulfosalt-native gold ores usually thought of in connection with Goldfield came entirely from the main part of the district. They formed open cavity fillings in fractured and brecciated parts of the unoxidized ore bodies. Many ore bodies had an approximately medial seam of high-grade ore termed a 'stope streak'. Spectacular high-grade ore consisted of breccia fragments coated with several layers containing quartz, pyrite, famatinite, tetrahedrite-tennantite, bismuthinite, goldfieldite, and native gold in various combinations and proportions. Sphalerite or tellurides also occurred in the crusts of some high-grade ores. Native gold was often clearly visible in one or more of the layers. In more typical ore, pyrite was the most abundant sulfur-bearing mineral, and famatinite was second in abundance. The famatinite often enclosed subordinate tetrahedrite-tennantite, sometimes minor bismuthinite, and at most only a very few tiny specks of native gold (Ashley, 1974). The gold/silver ratio was about 3:1. The depth of oxidation throughout the altered area is at least 10 m and oxidation extends to at least 300 m along fractures.

There are two other productive areas in addition to the main area: the Sandstorm area about 1.6 km to the north, and Diamondfield about 5 km to the northeast. The mineralized ledges in the Sandstorm area are in Oligocene rhyolitic rocks that are older than the Milltown Andesite. The mineralization at Diamondfield occurs in the Milltown Andesite; ore bodies in the eastern part of the Diamondfield area are considerably higher in silver than other Goldfield ores (Albers and Stewart, 1972).

Direct dating of hydrothermal minerals (alunite and sericite), dating of pre- and post-mineralization units, and fission-track dating of rocks with thermally annealed apatite yield an age range of 21-20 m.y. for the hydrothermal alteration (Ashley and Silverman, 1976). Ore deposition occurred late in this hydrothermal episode (Ashley, 1979).

The trace element geochemistry of the Goldfield district is described by Ashley and Keith (1976) and Ashley and Albers (1969, 1973a-f). Gold, silver, lead, bismuth and arsenic all show similar distribution patterns in silicified rocks (Ashley and Keith, 1976). Gold, silver, and lead are potentially useful guides to ore for geochemical prospecting (Ashley and Albers, 1975).

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GOLD POINT DISTRICT

The Gold Point (Hornsilver, Lime Point) mining district is located along Slate Ridge in T7S; R41, 41 ½, 42E, in the southern part of Esmeralda County, Nevada. It is bounded on the north by the town of Gold Point, on the east by a north-south line through Mt. Dunfee, on the south by the Tokop mining district and Oriental Wash, and on the west by the western edge of R41E. All portions of the district are easily accessible by way of good dirt roads from Nevada highway 71 from the north and from the south through the Tokop mining district.

The Gold Point district was discovered about 1886 by Thomas Shaw. It was originally called the Lime Point district and included the Tokop district until about 1900. Ore was producted from the district in the 1880's and shipped to the railroad at Lida, but the milling plants were poor, labor and supply costs were high and the distance required to transport ore discouraged further silver mining (Turner, 1922). Little activity was reported in the district until the Goldfield boom in 1902 caused the camp to be deserted. When the boom died down, people returned and an increase in exploration resulted in high grade hornsilver being discovered. The discovery rejuvenated the camp and prompted it to change its name to Hornsilver in 1908. At that time the population was about 225. The district producted gold, silver, copper, lead, and zinc from 1907 to 1921 (Turner, 1922; Lincoln, 1923). In the 1920's many of the mines were non-producing due to litigation (Turner, 1922). The town again changed its name from Hornsilver to Gold Point in 1930 when more gold than silver was produced. The district has intermittently produced ore up to the present time. During the recent field inspection, exploration was active around the townsite. e.g., people were entering and inspecting the older mines, heavy equipment had been brought in and earth was being moved. What appears to be a leach pond was being constructed immediately west of town. The total production for the district has been estimated between 3/4 and 1 million dollars (Albers and Stewart, 1972).

The main part of the Gold Point district is situated in the middle of the arcuate Slate Ridge in the Precambrian Wyman Formation and Reed Dolomite. Here, the Wyman Formation consists of silt and claystone interbedded with limestone, which are metamorphosed in varying degrees to shales, phyllites, calc-silicates, and marble. Overlying the Wyman is the Reed Dolomite, a grey, coarsely crystalline dolomite (Albers, Stewart, 1972). Intruding the Precambrian metasediments is a northeast trending finger of the Jurassic Sylvania Pluton. Turner (1922) suggests that the north dip of the beds is the result of tilting from the emplacement of the pluton. Both the metasediments and the pluton are faulted and sheared along N50-70W trending, high angle, parallel fault zones which are possibly related to the Silver Peak-Palmetto-Montezuma Oroflex structure. Paralleling the shear zone are fine grained diorite dikes and ore bearing quartz veins. The quartz veins are crushed and cemented with hematite and chalcedonic silica (Turner, 1922). The crushing of the veins due to post-emplacement movement rendered the original sulfides susceptible to oxidizing solutions (Ransome, 1909). The Gold Point ore consists of silver in the form of cerargyrite with minor bromyrite as crusts coating the oxidized, crushed quartz fragments and gossan. Native gold, galena, and cerrusite in minor quantities also occur with the ore.

Arthur Baker (1966) made the following comments pertaining to ore potential: "I can see little hope for anything in the region, unless one of the three possibilities -- a porphyry copper to the northwest, something in the area of strong mineralization near the plug (S26, T7S, R42E), or something in the vicinity of the strong garnetite (S9, T8S, R42E). The veins that characterize the district in general are of no interest."

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GOOD HOPE DISTRICT

The Good Hope (White Wolf) mining district is located on the southwest flank of the Silver Peak Mountains, about 7 miles south of Piper Peak in the southwestern part of Esmeralda County, Nevada. The district is bounded on the west by the southern end of Fish Lake Valley. Most of the district is accessible by way of fair to poor dirt roads east from Nevada Highway 3A; however, some of the roads were washed out in the excessively wet winter of 1982-1983.

Little is known of the history of the Good Hope district, however, it is probably intimately tied to the histories of the nearby Silver Peak and Palmetto mining districts, reflecting their periods of exploration, production and inactivity. Lincoln (1923) reports ore, probably from the Good Hope (Lookout Mine?) was produced for processing at Furnace Creek, California, before 1906. At the Lookout Mine are remains of a modern mill and leach ponds, indicating activity at the mine within the last 20 years. During the recent examination (Fall, 1982), most of the properties were inactive. However, one property did have permanent residents and the watch dogs' less than friendly attitude discouraged examination of the property. The property's assessment work did appear to be current. Most of the drainages in the district were staked for placer claims, but did not appear to be active. Production figures for the district were less than $2000, primarily from silver (Albers, Stewart, 1972).

The Good Hope district is underlain by the Lower Cambrian Poleto Formation (limestone and quartzite/siltstone) which is overlain stratigraphically and in thrust contact by the Cambrian Harkless Formation (siltstone and quartzitic siltstone). The sediments are intruded by successive Jurassic to Cretaceous plutonic masses, belonging to the Palmetto Pluton (Albers, Stewart, 1965). The plutonic masses range from coarse-grained hornblende-biotite quartz monzonite to fine-grained, leucocratic granite. Intruding the plutons and sediments are northwest-trending, vertical, fine-grained aplitic and aphanitic to medium-grained dioritic dike swarms. The dikes are structurally controlled by northwest trending fault zones. Randomly distributed throughout the district are small klippes of Harkless Formation and erosional remnants of non-welded and welded ash flow and air fall tuffs.

Mineralization within the district appears to be limited to sulfide bearing quartz and calcite veins which fill fault fissures in the sediments and intrusives. The veins also follow bedding planes in the sedimentary rocks. The thin quartz/calcite veins carry grains of pyrite, chalcopyrite, and argentiferous galena which have altered to copper and iron oxides. Many of the workings explore the rocks near the mafic dikes, however, no mineralization was noted near these sites.

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GOODSPRINGS DISTRICT

The Goodsprings mining district is perhaps one of the better described mining areas within the Esmeralda-Stateline project boundary. The properties, ore controls, and mineralization characteristics are well described in numerous publications. We have, therefore, confined our work at Goodsprings to compiling data from the literature and restricted our field reconnaissance to the collection of samples, mainly for comparison purposes.

Currently the Goodsprings (Yellow Pine, Potosi) mining district is centrally located around the town of Goodsprings, in the southern end of the Spring Mountain Range in T23, 24, 25, 26S; R57, 58E, in the western part of Clark County, Nevada. It is bounded on the west by the Pahrump and Mesquite Valleys, on the south by the California-Nevada state line, on the east by Goodsprings Valley, and on the north by Potosi Mountain. Access to the district from the east is by way of Interstate Highway 15, and then Nevada Highway 53; and from the west by way of U.S. Highway 95, then Nevada Highway 16. Access within the district is generally along excellent to fair paved and dirt roads, however, many of the workings are at higher elevations, requiring some hiking over rough terrain.

The ore deposits at Potosi Mountain were originally known to the Paiute Indians and Franciscan monks prior to 1855 (Lincoln, 1923). The earliest recorded mention of the district was in 1856 when Nathanial V. Jones was sent by the Mormon church to investigate lead occurrences at Potosi Mountain reported by the Indians and by Mormon pioneers returning from California in 1855. He was later returned by the church to develope the deposits and zinc ore was first smelted in 1857. The years following these initial developments produced no real activity other than claims staking. Between 1893 and 1905, interest shifted from the Potosi Mine area to the present center of activity and minor gold was produced at the Keystone, Boss and Clementia mines. Completion of the railroad in 1905 and the recognition of oxidized ores in 1906 greatly aided the development of the district and it became a major producer of lead and zinc for Nevada. In 1914, platinum and palladium were recognized in the ore at the Boss Mine which has been originally mined for copper and gold had been discovered 30 years earlier (Knopf, 1915). Barite was found in 1915 and vanadium was found and mined in 1917. Lead and zinc production peaked during WWI, after which the district was largely dormant except for a minor flurry of activity in the 1920's. The district again began to produce during WWII, but activity subsided after the war ended. Up to the present activity in the district has been minor and flunctuated widely in response to metal prices. By 1962, the district had produced in excess of $31,000,000, in zinc, lead, copper, gold, silver, cobalt, vanadium, platinum palladium, along with minor amounts of mercury, antimony, nickel, molybdenum, manganese, iridium, and uranium (Longwell, et al, 1965). The recent field inspection indicated that the rise in gold and silver values had produced an interest in the gold mines, the Red Cloud, Columbia, Chiquita, and Keystone; however, no evidence of recent production was observed. Many of these and other mine tailing piles appear to have been removed for milling of the residual minerals. A large staking operation west of the town of Goodspring was in effect in April,1983.

The rocks in the Goodsprings district are predominently Paleozoic and early Mesozoic carbonates and clastics that have been intruded and overlain by Tertiary igneous rocks and Cenozoic alluvium. No rocks of Cretaceous age have been noted. Hewett (1931) suggests that sometime between the Late Jurassic and the Middle Tertiary, the beds were folded and faulted in varying degrees, with the massive limestones of the Devonian and Mississippian developing open folds, and the Pennsylvanian beds forming closed folds. The stratified beds homoclinally dip westward at moderate angles and are complexly broken into thrust faults that parallel the bedding planes, and locally dip more steeply than the beds. The district is also cut by numerous, younger, high angles faults. Towards the end of the Mesozoic thrust faulting began with additional normal and low angle thrust faulting occurring. The area has undergone localized tilting after deposition of the Tertiary volcanics. South of the town of Goodsprings, remnant flows of Tertiary volcanics cap Table Mountain and randomly outcrop throughout the district. In and around Goodsprings, and southeast of Potosi Peak, the Paleozoic carbonates are thrust faulted over the Jurassic Aztec Sandstone (Longwell, et al, 1965). Devils Peak is an exposed Tertiary granite porphyry plug. Minor intrusive dikes are exposed west of Goodsprings, following northtrending thrust and high angle faults. Hewett (1931) suggests that these thrust faults provided structural controls for distribution of the intrusives. Small dikes, considered to be lamprophyres, have been encountered at depth in several mines.

After the stratified rocks were folded and faulted, the area was subjected to considerable erosion, and volcanic activity was renewed, probably coincident with the Middle Tertiary volcanism occuring elsewhere in Nevada.

Varying degrees of alteration have changed the county rocks, the most extensive being dolomitization. Locally, silicification occurs adjacent and related to the fault zones.

The Pb-Zn ore deposits are mainly confined to the Mississippian Monte Cristo Formation, with the uppermost member, the Yellowpine Limestone accounting for approximately 85% of the lead-zinc production and the Anchor Limestone member accounting for an additional 10% (Albritton, et al, 1954). These two members, being more massive than the other members, were considerably fractured during the period of faulting, and were dolomitized and silicified along the resulting shear and fractures. Mineralized solutions appear to have followed the same conduits resulting in the ore deposits.

Locally, breccia along the feeding fissures is mineralized; more commonly, the ore formed in the permeable ground that was marginal to the fissure (Albritton, 1954). The impermeable zones of mudstone and altered porphyry, along with films of clayey gouge along thrust planes, contributed to retarding the progress of fluids. The ore bodies are controlled by the dip of the beds. Ore bodies are generally lenticular and parallel to horizontal bedding, are flattish pipes, parallel to bedding or crosscutting it at low anges in the inclined beds. A few ore zones follow steep faults (Albritton, et al, 1954). The primary minerals were sphalerite and galena, which have been oxidized to hydrozincite, calamine, smithsonie, cerrusite, and less commonly, to anglesite (Longwell, 1965). Most of the workings exhibit an abundance of secondary copper minerals coating fractures and breccia surfaces, and disseminated in the altered carbonates. Much of the original sulfide ore has been oxidized to below the level of previous mining. Gangue minerals in the district include barite, calcite, and quartz.

Free gold was mined at the Keystone and Chiquita mines in the central part of the district. Here, gold occurs in altered granite porphyry plugs and dikes, or replaced in adjacent carbonates along fractures.

Copper mineralization occurs as primary and altered sulfides near but not in granite porphyry intrusives and as secondary alteration minerals, e.g., carbonates, silicates, and sulfates, in Devonian or older carbonate beds (Hewett, 1931). Oxidized cobalt minerals occur with the copper deposits, and have resulted in minor shipments of cobalt.

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JOHNNIE DISTRICT

The Johnnie (Montgomery) mining district is located on the west flank of the northeast end of the Spring Mountain range in the southeast end of Nye County in T17S, R52, and 53E. The district straddles Nevada Highway 16, approximately 3 miles north of the townsite of Johnnie and 9 miles south of U.S. Highway 95. Most of the properties are easily accessible from Nevada Highway 16 along excellent dirt roads. While the townsite of Johnnie is uninhabited, year round residents live near the Johnnie Mine and the community of Pahrump is less than 15 miles to the south.

The earliest recorded discovery in the district is thought to have been made around 1890 by the Montgomery party from Indian Springs, and additional lode discoveries were made about 1903 (Vanderburg, 1936; Kral, 1951). The prominently outcropping quartz veins in the district were alleged to have been noted as early as 1860 by Mormon pioneers, but the inaccessibility of the area made prospecting difficult if not impossible. The district was originally named the Montgomery, but between 1900-1910, gradually it became known as the Johnnie district, possibly alluding to the Indian known as Indian Johnnie who led the first recorded prospecting party to the area (Ivosevic, 1976). The town of Johnnie was inhabited from 1905 to the 1930's, with its heyday around 1907 (Labbe, 1960), after which the population shifted to the Johnnie Mine. The districts was reported active in 1905, with several mines and stamp mills in operation until the 1920's. The district's greatest period of recorded production was prior to 1920 with the district yielding up to that time well over a million dollars in both lode and placer gold.

While much lode ore was produced, the area is also known for its placer gold. Placer gold was discovered in 1921 by Walter Dryer and resulted in a second short boom for the district (Vanderburg, 1936). Placer operations were again in effect in 1935 below the Johnnie and Congress Mines and in 1949 (Kral, 1951) and the early 1960's (Cornwall, 1972), below the Johnnie and Overfield Mines.

Most of the workings in the district follow massive, prominent, white quartz veins, some of which range up to 3 feet wide and are traceable for long distances on the surface. The veins follow branching, high angle faults and bedding plane faults in the Precambrian through Middle Cambrian, clastic and carbonate rocks. The beds are generally horizontal with gentle dips east or southeast, with attitudes steepening near the vicinity of the veins (Ivosevic, 1976). Overlying the older sediments are Cenozoic fanglomerates, which contain megabreccia deposits, and Quaternary alluvium.

The bedded sediments experienced tectonic deformation, folding, low and high angle faulting with subsequent rotation by eastward tilting of the district during the Sevier Orogeny in the Late Cretaceous. At the end of the Sevier Orogeny, longitudinal faulting and additional thrust faulting occurred. The district was dropped down to the west during the Basin-and-Range faulting during the Miocene. (Ivosevic, 1976).

The high angle quartz veins were emplaced during hydrothermal activity of unknown origin, probably between the Paleocene and early Miocene epochs. These easterly trending veins are hosts for the mesothermal mineralization, carrying the mineralogical suites: gold-chalcopyrite-pyrite, chalcopyrite-galena, and galena (-calcite). Chalcopyrite which has oxidized to low-grade malachite, also occurs with specularite in hydrothermal stratabound quartz-poor lodes (Ivosevic, 1976).

Wall rock alteration in the hypogene deposits include sericite and pyrite in clastics and sericite in dolomite, while the alteration minerals chlorite, calcite, and specularite occur locally.

The gold mineralization is localized in the Zabriskie Quartzite and in the dolomites found near the top of the Wood Canyon Formation, where these rocks are partially capped by the shaly basal member of the Carrara Formation.

The placer deposits are classified as part hillside and part stream placers, and Kral (1951) suggests that, in some instances, they mightbe residual, resulting from the dissentigration of veins and the release of gold in place.

At the time the district wasexamined, the Congress Mine area was being staked by Earth Resources Co. from Ohio.

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KLONDYKE DISTRICT

The Klondyke mining district (sometimes called Southern Klondyke) is about 17 km south of Tonopah and approximately 3 km east of U.S. Highway 95. Silver lode deposits were discovered in March 1899 by J. G. Court and T. J. Bell, although Chinese miners worked placers in the area in the middle 1870's. Mines and prospects at Klondyke are concentrated in three localities which Chipp (1969) has called the main mining area (SE/4 S24,T1N,R43E), the east Klondyke mining area (C S30,T1N,R42E), and Klondyke Peak mining area (SW/4 S25,T1N,R42E).

The ore deposits at Klondyke have been described by numerous workers. Much of the following is from Bonham and Garside (1979) p. 131, 132). Lincoln (1923) gives a detailed list of older references. Hewett (1936) reports the production from 1903 to 1932 as 16,606 tons of ore yielding 2,405.64 oz gold, 425,583 oz silver, 10,861 lbs copper, and 257,080 lbs lead with a total value of $529,052. The workings consist of over 1,000 m of adits, shafts, drifts, and inclines.

Recent activity in the district consists mainly of sampling and claim staking. There does not appear to be much surface or underground work done since the district's workings were described by Chipp (1969). Recent sampling and drilling was done in 1981 on the playa at the east side of Mud Lake 10 km southeast of the Klondyke district.

The ore deposits of the Klondyke district are argentiferous quartz veins in argillite units of the Cambrian Emigrant Formation. Ball (1906) reports a few veins in muscovite granite in the main mining area. Veins can be up to 3 m wide but are more commonly 30 to 60 cm in width. The veins occur in fault zones which are commonly parallel or subparallel to bedding, and often pinch out within a short distance (Chipp, 1969). In the east Klondyke mining area, mineralization is associated with a thrust fault that has emplaced Ordovician Palmetto cherts and limestones over the Cambrian Emigrant argillites. Most of the production is from shallow workings less than 3 m deep (Chipp, 1969), and hypogene sulfide minerals are rare.

Most of the oxide ore mined consisted of a mixture of cerrusite, jarosite, hematite, limonite, and manganese oxides. Also reported are malachite, chrysocolla, chalcocite?, digenite, covellite, and minor anglesite (Chipp, 1969), as well as rare calcite, gypsum, turquoise, and native sulfur. Cerargyrite is reported to be the main silver mineral but could not positively be identified during Chipp's (1969) study. Spurr (1903, p. 375) reported the possible presence of stetefeldite, although it was not found by Chipp. Gangue minerals consist of milky-white quartz with a small amount of microscopic sericite. Supergene enrichment was apparently a major factor in the formation of the ore bodies, and Chipp (1969) reports that at depth the early miners rejected the denser vein material containing sulfides for the thin-walled quartz boxworks filled with oxidation minerals. Where cores of sulfide minerals are observed, bornite is replaced by digenite and covellite, and galena is partially altered to cerrusite.

Hydrothermal alteration in the district consists of silicification, sericitization, and bleaching of dark-colored carbonate rocks. The silicification has produced several large areas of jasperoid in carbonate rocks, especially in the southern part of the district. Calc-silicate minerals occur in a wide contact-metamorphic aureole around a muscovite granite intrusive.

Based on the above observation, unoxidized hypogene veins probably consist of argentiferous(?) galena, pyrite, bornite, and possibly some unknown silver minerals localized in a quartz gangue. Scheelite was reported from one thin vein. Assays of relatively unoxidized material assayed from 90 to 210 oz of silver and 0.13 oz of gold per ton (Chipp, 1969).

The muscovite granite at Klondyke is present near the mineralized area and contains a few silver veins. It is a distinctive rock, and is the only evidence of pre-Tertiary igneous activity in the area. It is likely that the argentiferous vein mineralization is related to the muscovite granite and is probably of the same age or very slightly younger. Medium to coarse muscovite collected from the granite was dated at 104 m.y. (Silberman and others, 1975).

A turquoise property, the Smith Black Matrix Min, is reportedly located in the district in the SW/4 S29,T1N,R43E. Turquoise occurs in veinlets that are reportedly up to 2 cm in width. A quantity was shipped from the prospect in 1910 by the California Gem Company (Morrissey, 1968, p. 9). Albers and Stewart (1972) have also reported iron from the Klondyke district. Several small bodies of specularite a few feet in maximum dimension occur in the Mule Spring and Emigrant Formations near the contact with muscovite granite.

Recent exploration activity on the eastern part of the Mud Lake Playa 10 km southeast of the Klondyke district is reportedly for gold. It is rumored that anomalous gold values were obtained from surface and shallow drill-hole samples. The gold is reportedly crystalline and less than 5 m in diameter, suggesting a supergene mode of formation, possibly precipitation from gold-bearing meteoric waters in an area of evaporation in the vadose zone of the playa. There is some suggestion that the gold values were present only(?) in the upper crust on the playa.

Anomalous amounts of As, Bi, Mo, Sb, Cu, Ag, Hg, Pb, Zn, W, and Mn are present in samples of vein matter and altered wallrocks from the Klondyke district (Bonham and Garside, 1982).

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LAS VEGAS/VIRGIN RIVER MANGANESE DISTRICTS

The manganese deposits in Clark County are thoroughly described in the literature and will only be reviewed here. The Las Vegas mining district is located approximately 16 miles southeast of Las Vegas on the northern flank of the rugged River Mountains immediately east of Henderson, in Clark County, Nevada. Access to the district is along well used paved and dirt roads. The Virgin River district is located along the southeast flank of the Black Mountains bordered by Lake Mead on the south and east. Access to the district is by boat or along dirt roads. The deposits are located within the boundary of the Lake Mead Recreational Area.

The main property in the Las Vegas district, the Three Kids Mine, was discovered by Edwards, Jefferson, and Marrs in 1917 during the prospecting rush inspired by WW I. That same year, the three men formed the Manganese Association and began production of manganiferous ore. In 1918, the mine changed ownership and although ore production greatly increased, the property was closed in 1919, probably because the end of WW I and the availability of cheap foreign ore depressed the market (Crittendon, 1964). During it's early period, the mine produced about 12,000 tons of 40% manganese ore at a rate of 60 tons per day (Lincoln, 1923). Production resumed again with the onset of WW II and an estimated 16,000 tons of 40% ore was mined. Mining was conducted by room-and-piller methods, and then later by oepn pitting. Low grade manganiferous ore was also mined from the properties east of the Three Kids Mine in the 1940's (Longwell, 1965). The district has had intermittent activity reported through 1961 with the percentage of manganese ore produced dropping to below 20%. The district has produced over 2.5 million long tons of crude manganiferous ore along with minor amounts of lead, copper, silver, and gold. At the time of inspection, the Three Kids Mine, along with the adjacent properties were inactive and the old pits were being used as landfill sites.

The Virgin River deposits were discovered about 1900 by Daniel Bonnelli, however, they were known by the Mormons as early as the 1850's (Lincoln, 1923). In 1941 and 1942, the USBM conducted an exploratory drilling program. No production has ever been recorded from the Virgin River deposits (Longwell, 1965). The Virgin River district was not visited.

The River Range where the Las Vegas manganese deposits occur are composed of the Pliocene Muddy Creek Formation (clastic, volcanic, and lacustrine sediments), which is in fault contact and is overlain by a series of Miocene basalt flows and rhyolitic/andesitic tuffs and breccias (Bell and Smith, 1980). The deposits are located in graben structures formed during faulting. The ore at the Three Kids Mine occurs in lenticular bodies varying in size and grade concentrated along the faulted limbs of a northeast trending open syncline. Van Gilder (1963) suggests the origin of the bedded deposits to be hydrothermal-sedimentary with ascending manganese bearing solutions following faults and fissure into a lake environment where manganese precipitated and formed oxides.

The principal ore mined was wad with occasional streaks and grains of pyrolusite, psilomelane, and other minor manganese minerals. Locally, the wad has been opalized forming a hard, vitreous rock. Impurities within the deposit are unreplaced material, usually sand or tuffs, or introduced impurities, such as lead and copper oxides. The deposit is cut by gypsum and calcite veinlets.

The Virgin River deposits located in the Black Mountains consist of Tertiary volcanics overlain by the Muddy Creek Formation. In the vicinity of the deposits, the Muddy Creek Formation consists of beds of pillow basalt, andesite flows and agglomerate interbedded with gypsum and fine clastics, that are overlain unconformably by conglomerates and massive basalt flows (Longwell, 1965). The deposits are localized on the south and east limbs of a southeast plunging syncline, the south limb dipping more steeply than the east limb. Minor north-south faults occur in the east limb. On the south limb, the manganiferous beds are separated by basalt flows.

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LEE DISTRICT

The Lee (Lee's Camp, Big Dune) mining district is located 10 miles southwest from U.S. 95 in the low hills outcropping in the Amargosa Desert, adjacent to the Nevada-California state line in southern Nye County, in T15S, R47E. Access to the district is by way of fair to washed out dirt roads. The district is bound on the west by the Nevada-California state line, and on the north, east, and south by the Amargosa Desert.

There is little recorded history of the district, although it was known prior to 1907 (Ball, 1907). Hewett (1936) suggests that the district was active during the Bullfrog boom in the early 1900's. There has been no production recorded for the district. It has recently been extensively investigated with many of the older workings obliterated from the surface and subsurface exploration. No activity resulted from these ventures.

The Lee district is in an isolated group of low hills composed of Precambrian Sterling Quartzite and Johnnie Formation which are in fault contact. The younger Sterling Quartzite encircles a north-northeast trending wedge of the Johnnie Formation. Structurally, the area appears to be a northeast plunging, anticline which is faulted relatively parallel to the hinge of the fold. The fault contacts exhibit multiple stages of movement, are highly brecciated, rebrecciated, and are cemented with quartz. Opaline silica coats the breccia zones, representing at least two periods of late stage silica flooding.

The Johnnie Formation is composed of fine-grained quartzite, sandstone, siltstone, and shale with thin interbeds of dolomite (Cornwall, 1972). Within the district, the dark green shale beds outcropping have a strong vertical, northeast striking foliation. Locally, interbedded siltstone and quartzite of the Sterling Quartzite was observed to have been metamorphosed to a garnetiferous muscovite schist north of the main part of the district. The stratigraphic relationship of the two formations suggests that the upper or middle unit of the Johnnie Formation outcrops in the wedge between the Sterling.

Parallelling the fault zones are massive and crystalline quartz veins which carry oxidized pyrite and according to Ball (1907) free gold. All workings follow the quartz veins associated with the fault zones or are in the Sterling Quartzite. The country rock and quartz veins are heavily iron oxide stained and are coated with minor malachite. Barite was also noted associated with the quart veins on the east side of the range.

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LIDA DISTRICT

Mines of the Lida district are located in the vicinity of the town of Lida in the southern Palmetto mountains. Most of the prospects in the district are to the east of the town and north and south of Lida Canyon.

Lincoln, 1923, gives 1871 as the year of discovery of mineralization in the area. Stamp mills were operating in 1875, and additional production was made during the period 1908-21. Recorded production from the district between 1871 and 1940 is given as slightly under $600,000 (Couch and Carpenter, 1943). As is the case with many old districts, the names of the original producing mines have been lost over the years. None of the mines listed in Couch and Carpenter's 1948 publication can be matched with current mine names.

The ore was mostly hornsilver or silver-bearing galena, although gold and copper occur in varying amounts (Ball, 1906, 1907). The deposits occur in quartz or calcite veins mostly in limestone of the Deep Spring, Poleta, and Harkless Formations (Albers and Stewart, 1972).

The original mines of the district are probably those located to the west of Lida on the east base of Palmetto Mountain. The district shares a boundary and actually some mines with the adjacent Palmetto district, and the occurrences around the Blue Dick mine (Palmetto district) and the Centennial mine (Lida district) may be those mines listed in Lincoln as the original Lida discoveries. Just south of Lida, in the area of the Florida mine, numerous old workings explore quartz veins in brecciated limestone. Fine-grained dike rocks occur in conjunction with the veins. The veins are oxidized to shallow depths; malachite and azurite are seen in the oxidized zone, galena, sphalerite, and chalcopyrite in the deeper workings.

Most of the recent activity in the district has been centered around the Mount Jackson area about six miles east of the old Lida area. Exploration for porphyry-type copper mineralization has been done by several companies, including

Hughes Mining Company and, most recently, by Continental Oil Company. Conoco was active in the area from 1975 through 1977, and conducted a program of detailed geophysical, geochemical, and geological evaluation of the large Mount Jackson claim group. The results of this work are on file at the Nevada Bureau of Mines offices in Reno.

Geochemical sampling and alteration mapping of the property presented the picture of a large area of alteration and quartz veining with high copper and molybdenum values at surface. Drilling, however, apparently failed to confirm the presence of porphyry mineralization.

The area was quiet when visited in 1982.

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LONE MOUNTAIN/WEEPAH DISTRICT

The Lone Mountain/Weepah (West Divide, Alpine, General Thomas Hills) mining district is centered around the periphery of Lone Mountain, a prominent geographical landmark approximately 10 miles west of Tonopah, in Esmeralda County, Nevada. The district is bounded on the north and northwest by the southern end of the Big Smoky Valley, on the east by Montezuma Valley and Paymaster Ridge, on the south by the northern end of Clayton Valley, and on the west by the approximate longitude 117°35'. Access to the district is along good dirt roads and jeep trails from U.S. Highway 95 and Nevada Highway 47. However, due to the excessively wet winter of 1982-83, many of the dirt roads are washed out or badly damaged.

Throughout Lone Mountain/Weepah's history, the district has been characterized by intermittent exploration and production. The earliest recorded mining activity dates back to 1863 when Mexicans made discoveries within the district (Thompson and West, 1881). The district was organized in 1864, abandoned in 1866, and reopened again in 1878. There was little recorded activity in the district until 1900 when the Tonopah rush generated renewed interest and exploration began again in the district. Production peaked for the Alpine district on the northwest side of Lone Mountain between 1903 and 1908, amounting to over $200,000 in gold and base metals (Phariss, 1974). Minor barite was produced south of the Lone Mountain from 1907 to 1919. In the Weepah district, activity between 1904 and 1927 was confined to mining the high grade surface gold deposits. The discovery of a large low grade gold deposit in 1927 by Horton and Traynor resulted in what has been described as the "last gold rush" in the western United States. Production from the deposit lasted from 1935 to 1937 and exceeded 1.8 million dollars (Sonderman, 1971). The district has produced in excess of $3,500,000 in gold, silver, lead and turquoise, with minor values in zinc, copper, and barite (Tingley, Muldonado, 1982). Activity within recent years has been confined to exploration and evaluation of existing properties, drilling and sampling, and performing assessment work. Many of the older workings have been milled to recover residual minerals. At the time of examination private individuals were claim staking in the General Thomas Hills area. The district is currently non-producing.

The Lone Mountain/Weepah mining district is situated around the periphery of the Lone Mountain and Weepah plutons which intrude Precambrian to Late Cambrian clastic and carbonate sediments. The Precambrian units consist of the Wyman Formation, a quartzitic siltstone and sandy limestone interbedded with limestone and dolomite, and the massive Reed Dolomite. Overlying the sediments are the allochthonous Cambrian Deep Springs, Campito, Poleta, and Harkless Formations (Sonderman, 1971). Small, random roof pendants of Wyman Formation are scattered over the surface of Lone Mountain. The sediments are metamorphosed to hornsfels, phyllite, schist, marble, and tactite along the contact with the plutons.

The Weepah and Lone Mountain plutons are predominantly medium to coarse grained quartz monzonite with irregular gradations into granodiorite and granite and irregular masses of biotite granite. Phenocrysts within the igneous bodies exhibit parallel arrangements, suggesting flowage. Cutting the plutons are random, closely spaced aplitic dikes grading into pegmatitic dikes. Structurally controlled lamprophyre dikes fill northeast trending joints in the igneous masses (Sandy, 1965). The intrusives are moderately sericitized, epidotized, and argillically altered along fractures. Minor Late Tertiary trachyte dikes, possibly related to the volcanic activity in the Monte Cristo Range, cross cut rocks along the northern edge of Lone Mountain (Sandy, 1965). In the General Thomas Hills, diorite porphyry masses intrude Paleozoic sediments.

Subsequent to the intrusion of the dikes, late stage hydrothermal fissure quartz veins, lenses, and irregular masses were emplaced in the metasediments and igneous masses along fault and shear zones, forming prominent outcrops in the central and southern part of the district. Locally, the quartz veins are crushed, brecciated, and cemented with hematite stained silica. Adjacent to the veins, the carbonates are silicified (Phariss, 1974).

The intrusion of the Lone Mountain pluton domed the bedded sediments into an anticline structure which subsequently eroded to it's present form. The metasediments are draped around the pluton with the remnant limbs dipping away from Lone Mountain on three sides (Sandy, 1965; Sonderman, 1971). These anticlinal structures exhibit broad, complex, and en echelon folds; minor thrusts; flexures and high angle faults of small displacement. The metasediments are most intensely folded along the contact with the intrusive. The districts and mining areas are located along the limbs of the anticlinal structures (Sandy, 1965; Phariss, 1971), with most of the workings following either the igneous-sedimentary contact, or the northeast trending fault and vein system.

Sonderman (1971) suggests that tectonic activity preceeded or was contemporaneous with the early emplacement of the Weepah pluton. He also suggested that the dominant northeast-trending, right-lateral rotation shear pattern of the district is typical of Walker Lane tectonics and was probably Late Mesozoic age. Prominent normal and block faulting occurs on the northwest side of the mountain, paralleling the contact between the sediments and intrusive. Sandy (1965) attributes the block faulting and overall uplift of the district to Cenozoic basin and range faulting.

Mineralization in the district occurs in the skarn zones along or adjacent to the contacts of the intrusive bodies; as replacement bodies along bedding shears in the carbonates, primarily dolomites; or in shear zones in the tactite bodies. Sonderman (1971) suggests that the Weepah deposits are epithermal, precious metal veins of gold-silver type, probably emplaced in the Late Mesozoic. The main Weepah deposit is located along a quartz-filled, northeast-trending, right-lateral shear zone. Shallow, high grade pockets of auriferous sulfide ore occurs as replacement deposits in the carbonate rocks adjacent to the quartz veins. Gold occurs free in a quartz matrix intergrown with hematite after pyrite and chalcopyrite altered to gossan. Low grade gold ore occurs in granulated fault gouge. Alteration zones are minimal within the deposits (Sonderman, 1971).

The workings in the Alpine district occur in the skarn zone along the igneous-sedimentary contact. The low grade gold deposit, which occurs in the Precambrian Wyman Formation, is essentially the same as the Weepah deposit. The prevalent mineralization in Alpine is the high grade lead-zinc-silver replacement bodies in the Reed Dolomite. The ore deposits occur as irregualr lenses, pods, and pinching stringers along bedding planes and at the intersection of joints and bedding planes. Much of the primary sulfide ore has altered to carbonate, sulfate, and silicate minerals. Phariss (1974) suggests that the mineralization in Alpine is mesothermal and genetically related to the intrusion of the Lone Mountain Pluton with faults and shear zones serving as hydrothermal conduits and sites of hypogene mineralization.

The mineralization in the General Thomas Hills area is primarily supergene copper and lead minerals associated with shear zones and jointing in Precambrian and Cambrian bedded sediments which were intruded by Jurassic diorite masses.

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MONTEZUMA DISTRICT

The Montezuma mining district is situated on and around Montezuma Peak in the northern half of the Montezuma Range in T2S, R41 and 42E, in Esmeralda County, Nevada. The district is located about 7 miles west of Goldfield, Nevada, and is accessible by way of good dirt roads east from U.S. Highway 95. The range forms the eastern limb of the Silver Peak-Palmetto-Montezuma oroflex structure (Albers, 1967).

The Montezuma district was discovered by Nagle, Carlyle, and Plunket in 1867 and organized shortly afterwards. A 10 stamp mill was brought from Yankee Blade in 1870, but operated for only 4 month; however, the district continued until 1887 to produce and ship ore 65 miles to Belmont, for processing (Ball, 1907). During this time the district produced approximately $500,000 in silver with minor amounts of gold. The district was inactive until around 1905, when the Tonopah boom caused the outlying districts to be explored once again. The district made intermittent ore shipments until 1923, and reported production until 1931 (Lincoln, 1923; Hewett, 1936). The quicksilver deposit in the southern part of the district were discovered in 1923 by Sweeney and McMillion, however, there has been no recorded production from the site.

During the recent examination, many of the more working recent observed appeared to be exploratory and many of the older mine workings have been obliterated by the recent surface exploration. Some of the dumps have been removed, apparently to extract residual values. Water has been found in many of the mines which probably hampered early activity. Ongoing activity in the district is confined to assessment work and there are currently year round residents living near the townsite of Montezuma. A placer claim block covering several thousand acres and several patent claims, covers much of the southern slope of Montezuma Peak, extending from the forested areas south to the main access road.

Montezuma Peak is a mass of Tertiary rhyolitic air fall tuff and tuff breccia overlain unconformably with patches of Tertiary agglutinate, primarily dark rhyolite or rhyo-dacite; Quaternary-Tertiary basalt flows; and interbedded with Tertiary fresh water lake deposits (Esmeralda Formation?) (Albers, Stewart, 1972). The ash tuff breccia was observed to be locally silicified and carry very fine grained pyrite. Beneath the tuff along the west and north side of the mountain outcropping blocks of Cambrian and Precambrian clastic and carbonaceous sediments are in thrust contact. Albers and Stewart (1972) suggests that the presence of numerous small granite, quartz monzonite, and diorite plutons and dikes intruding the sediments indicates plutonic rocks at shallow depth underlie the north end of the Montezuma Range.

The mineralization in the Montezuma district is primarily found in the quartz and calcite veins cutting the Precambrian and Cambrian limestone and shale; in replacement bodies in the marbleized limestone in the Cambrian Poleto Formation along the contact with a quartz monzonite intrusive body; and to a lesser extent, in the stratigraphic units above and below the Poleto. After the quartz and calcite veins were emplaced, they were crushed and surface waters altered the primary sulfides to supergene minerals. On the surface, the ore minerals include cerussite, malachite, and azurite, altered from galena, chalcocite, pyrite, and chalcopyrite which are found at depth. Minor jarosite and psilomelane were noted along fracture surfaces. Values derived from silver are in the form of chlorides at the surface and argentite at depth (Lincoln, 1923).

The quicksilver deposit in the southern part of the district occurs in altered Miocene lake beds and tuffs faulted against the Precambrian Deep Springs Formation, the Miocene units forming the hanging wall. Along the fault, the beds are extensively altered to form an opalite rib. Cinnabar is mostly concentrated in the opalite rib minor amounts of cinnabar was observed coating the open spacing in the fault breccia and disseminated in the unsilicified tuff beds. It was noted the fault breccia fragments appeared milled and were coated with drusy quartz and minor pyrite.

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NEWBERRY DISTRICT

The Newberry (Truman) mining district is located in the southern part of the Newberry Mountains in T30,31S;R65E, in the extreme southern tip of Clark County. Most of the properties are north of Christmas Tree Pass in the vicinity of Spirit Mountain, approximately 17 airmiles southeast of Searchlight, Nevada. Access to the district is by way of several good dirt roads east from U.S. Highway 95. The district is bound on the west by the Piute Valley, on the south by Nevada Highway 77, on the east by the Lake Mead National Recreation Area (LMNRA), and on the north by approximately latitude 35°32'. Previous to the building of Hoover (Boulder) Dam, the district extended eastward to the Colorado River and many of the workings are now within the LMNRA.

The earliest mention of activity in the district was in the 1860's when soldiers from Ft. Mohave, Arizona, discovered gold and silver on the Homestake Claim Group, now within the LMNRA. The next recorded activity was not until 1906 when John Thurman made discoveries in the area now known as Camp Thurman in the northern part of the district. Vandenberg (1937) implies that there was intermittent activity in the district between 1906 and the 1930's, after which several properties began producing gold and silver ore. The district has probably experienced stages of exploration and minor production coincident with the rise and fall of precious metal prices. The estimated total production for the district prior to 1937 is approximately $250,000 in gold and silver; however, this figure does not reflect additional production due to subsequent activity. Currently, the 5000 acre Jetco Claim Block covers the main part of the district. At the time of examination, the owners were having difficulty securing financing and all activity has ceased with only the caretaker and his family on the premises. The claim block encompasses most of the older workings outside of the LMNRA.

The Newberry district is situated in the central portion of the Newberry Mountain Range, a north-south trending complex of Precambrian metamorphic rocks intruded by granitic masses of Precambrian, Jurassic, and Tertiary age. The Precambrian metamorphics are layered and banded gneisses, schists, granites, and mylonite that have been partially melted, remobilized, and foliated in the Late Mesozoic during the Laramide Orogeny. The basement rocks are intruded by rhyolite, diabase, pegmatite, and aplite dikes (Volborth, 1973). The regional metamorphism probably resulted from the intrusion of the large, central, Tertiary, granitic Spirit Mountain, dikes, and extrusive volcanic activity (Volborth, 1973).

The Spirit Mountain Pluton is composed of microgranites, rapakivi and muscovite granite. It is intruded by structurally controlled rhyolite and diabase dikes along axial zones of weakness.

The structure of the Newberry Range developed in the Tertiary and Quaternary and represents a broad zone of uplift along an axis trending northwest. Normal, and thrust faulting and strike-slip movement produced a string of tilted blocks, some of which are elongated graben and horst structures (Volborth, 1973). Banding in the Precambrian metamorphics parallel the northwest trending axis and dip steeply east-northeast.

Many of the workings follow the general trend of the mafic and felsic dikes and the contact between the Tertiary Spirit Mountain Pluton and the Precambrian metamorphics where the granitic gneisses have been thrust easterly over the pluton. The workings also follow gold-sulfide (pyrite, chalcopyrite, galena) bearing hydrothermal quartz veins which cement the fault and shear zones and outcrop prominently along exposed ridges and slopes. The quartz veins cut all rock types. Rocks adjacent to the veins and dikes are sericitic and chloritic altered. Gold occurs freely or is associated with pyrite and chalcopyrite in a quartz matrix. It was also noted that sulfides occur in the mylonite. Fresh sulfide-rich ore was observed only a few feet below the surface. Antimony in the form of tetrahedrite and oxides has been reported north of the Camp Thurman area (Lawrence, 1963).

In the area along the boundary of the National Recreation Area, just north of Copper Mountain, old prospects south of the Rockefeller mine expose very interesting breccias apparently related to andesitic plugs and dikes. The geology of this area seems to vary slightly from that presented on the available geologic maps. Large outcrops of brecciated Precambrian rocks and brecciated andesite were observed to form pipe-like bodies and, in one case, a ring of breccia that borders a volcanic plug. The breccias are cemented with silica, are heavy with hematite staining, and sometimes contain barite crystals in open spaces. Wall rock, and the breccia fragments themselves, are commonly chloritized. Most of the old prospects are in areas where the breccias are stained green from the presence of copper oxide minerals.

The only evidence of recent activity in this area was just west of the old Rockefeller mine. Recent dozer work and blasting has been done on a propsect just on or just outside of the Recreation Area boundary.

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NON METALLIC DISTRICTS - CLARK COUNTY

The non-metallic districts in Clark County include the Arden, Sloan, Moapa, Jean, and Muddy Mountain districts, and the Overton and Dry Lake Areas. All of the districts are accessible along well used, paved and dirt roads.

The literature available concerning the geology, history, and deposits of the areas is extensive, and will not be reviewed in this report.

Production of non-metallic commodities in Clark County, has generally far exceeded metallic commodities since the turn of the century where most of the discoveries were made after the early exploration for metallics. According to Papke (oral communication, 1983) the following three areas are the only currently producing properties in the county:

Gypsum is produced at the Apex operation of Pacific Coast Building Products, Inc., 25 airline miles northeast of Las Vegas. Mining is done from a high-grade near surface gypsum deposit that has very large reserves. The open pit and plant are in S7 and 10, T20S, R64E. The nearly flat lying deposit apparently occurs in the Muddy Creek Farmation of Pleiocene(?) age. The gypsum is processed, calcined and used in the manufacture of sheetrock and other products at the adjacent plant.

Limestone and lime are produced at Apex, about 20 miles northeast; the operation is owned by Genstar Cement and Lime Co., who purchased it in 1982 from Flintkote Lime Co. The high-purity calcium limestone is produced by open pit mining from the Crystal Pass Limestone member of the Devonian Sultan Limestone. Some of the material is crushed, sized, and sold for use in sugar refining and other useages. The rest is calcined and sold as lime, mostly for the construction industry.

Silica sand is producted several miles south of overton, Clark County, by Simplot Silica Products, Inc. The material comes from the Cretaceous Baseline

Sandstone, a second generation material formed by reworking of the iron-rich Aztec Sandstone. The Baseline Sandstone crops out in a northwestward-trending belt about 5 miles long, the formation has a thickness of about 500 feet and dips about 30°NE. Portions of the formation, especially the lower and upper parts, contain excessive amounts of iron oxides and are not useable. The better material is light colored, friable, and has well-rounded grains. The material has been mined in a number of open pits, but current mining is from the large Florence pit in the northern part of S11, T17S, R67E. The sandstone is slurried, pumped 4 miles, and washed to produce a product used mostly in manufacture of glass. Typically the product contains 99.4% SiO_2, 0.45% Fe_2O_3 and .555% combined Al_2O_3 and TiO_2. Reserves are large.

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PALMETTO DISTRICT

The Palmetto district is located in and around the Palmetto Mountains, a southeast trending spur of the Silver Peak Range lying generally south of Clayton Valley and north of Palmetto Wash.

The first recorded activity in the district was in 1866, a stamp mill was constructed that year to work prospects in the vicinity of what later was known as the Palmetto mine. The Palmetto and adjacent mines are very large, with extensive dumps, and obviously were major operations in their day. Production records from the district are very scant, but Lincoln credits the district with $6,500,000 in silver from the Palmetto mine itself. The McNamara mine was discovered in 1880 (Lincoln, 1923), and is credited with a considerable production of lead-silver ore. There is little exploration activity in the district, and only one mine, the Buster, was reported to be active in 1982 (Directory of Nevada mine operations, 1982).

Deposits in the Palmetto district are largely of silver, gold, and lead and occur in veins in the Palmetto pluton or in flanking lower Paleozoic strata. Most of the veins trend northwest or west, generally parallel to the long direction of the Palmetto pluton (Albers and Stewart, 1982). The mines of the district are clustered about four general centers, two along the northeast margin of Palmetto Mountain, and two along the southwest margin of the mountain. The major area, that around the Palmetto mine, contains at least two parallel, northwest-trending vein systems that can be traced along strike for at least a third of a mile (Quade, 1982). Samples of vein material collected from the Palmetto dump contain galena, in white quartz, some of the sulfide material present appears to be antimony-bearing, and cerussite fills small fractures and lines vugs in the vein. Nearby, on what is suspected of being the same vein system, chalcopyrite occurs in a white quartz vein that contains fragments of black shale and silicified limestone.

Quade, 1982, mentions that skarn minerals are present on the dump of the Silver Champion mine, near the Palmetto, and he also mentions observing scheelite at the Buster mine which is about two miles southeast of the Palmetto. No scheelite has been before reported from this area.

Further to the southeast, and still on the southeast margin of Palmetto Mountain, manganese-copper mineralization with associated barite, is found in veins in silicated rocks of the Campito and Deer Springs Formations.

Along the northeast margin of the district, the 4-mile-long Paymaster zone (Spurr, 1906) extends from the area near Birch Creek Spring to the base of Palmetto Mountain. This area apparently never developed into any major mine. The McNamara mine is to the east, at McNamara Spring along what Spurr, 1906, shows to be a parallel vein system.

The Palmetto district, following its early silver producing period, has not been really active. The vein systems described by Spurr in 1906 and by Quade in 1982 are large and well developed. The presence of skarn minerals indicates that there may be potential for discovery of tungsten ores in the district.

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RAILROAD SPRINGS DISTRICT

The Railroad Springs district covers a small area in and around Railroad Pass in the western Palmetto Mountains. It is immediately east of and actually overlaps the Palmetto district. The Lida district is to the south. Mines in each of these districts are sometimes included in any one of the others, and the district boundaries are in no way definite or clear. According to Lincoln,(1923) small lots of copper ore and of silver-gold ore were shipped from properties in the district around 1908. Lincoln mentions several mine names, but none of the names can be matched with current names or locations within the district. The main concentration of mines and prospects is located just west of Railroad Pass and about two miles south Clayton Ridge. This area is probably the location of the mines producing in 1908. There was activity here at the Imperial (Helen) mine in the 1930's, and the area had been freshly staked when visited in 1982. To the east of Railroad Pass about 4 miles, an isolated group of prospects are located on the eastern tip of the Palmetto Mountains, and a few other prospects are scattered to the southwest along the trend of the mountain prong.

According to Lincoln (1923) the district includes gold, silver, and copper-bearing veins in limestone and shale that have been intruded by diorite dikes.

At the Big Three mine, in the western part of the district, east of the old Imperial mine, copper, lead, zinc, silver mineralization occurs in vein quartz in an altered zone in silicified, brecciated quartzite and limestone of the Cambrian Poleta Formation. A manganese mine occurs just east of the Big Three.

The Joshua claim area on the east end of the district contains showings of copper mineralization in brecciated quartz veins near the contact of thinly bedded limestones of the Cambrian Emigrant Formation with Tertiary granitic rocks and dikes (Quade, 1982).

The Railroad Springs district was being explored in 1982 by several companies, one of which was Energy Resources of Golden, Colorado.

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ROCK HILL DISTRICT

The Rock Hill mining district is located about 10 miles northwest of Coaldale, Nevada, on the eastern flank of the rolling Candelaria Hills between U. S. Highway 95 and the Esmeralda-Mineral County line. Due south of the district is the Columbus salt marsh. Access to the district is along fair to poor dirt roads west from U.S. Highway 95 and east from the Candelaria mining district.

The Rock Hill district is characterized by intermittent exploration with little or no reported production from the mining ventures. Little is known of the early history of the district, but it is probably intimately related to the history of the Candelaria/Columbus mining district, which was founded and prospected by the Mexicans in the 1860's. Early mining was hampered by the lack of nearby water, however, camps soon sprang up in the area. By 1872, Columbus, the settlement on the southern edge of the district, was the most flourishing town in Esmeralda County, mainly due to salt and borax production from the salt marsh. Activity in the Candelaria/Columbus area was reported from 1870-1893, and again in 1905-1926 (Shamberger, 1978).

Early production from the Rock Hill district is largely unknown, however it was probably small, and would have been included in the production figures for the Candelaria district. A few tons of iron ore was produced from the Boak Mine in 1952, but the low grade of the deposit caused the mine to be shut down (Reeves, 1958). A total of approximately 200 units of tungsten concentrates were produced from the Rock Hill Mines area in 1958 and 1972-1979, mostly from placer with some lode operation (Schilling, 1964). The Rock Hill Mine area has been the subject of extensive drilling and surface exploration over the past 20 years. Bear Creek Mining Company, Inspiration Copper Mining Company, and Moly Corporation, a subsidiary of Union Oil Co., have all conducted drilling ventures at the time. Tingley (1972) conducted an on-site inspection of the placer operation and scheelite recovery plant which at the time was held by the DHW Corporation and in production. The remains of the recovery plant are still standing. At the time of the field examination (1982) there was no observed activity in the district.

The Rock Hill district is underlain by the Ordovician Palmetto Formation which is unconformably overlain by the Permian Diablo Formation and the Middle Triassic Excelsior Formation and in places with angular discordance by the Lower Triassic Candelaria Formation. Elsewhere, the Candelaria Formation and Excelsior Formation overlies the Diablo Formation along a marked erosional unconformity. Overlying all rock types are erosional remnants of Miocene welded ash flows. Intruding the sedimentary rocks are Jurassic to Tertiary granitic masses and andesite-diorite dikes and masses.

The Palmetto Formation consists of slate, siltstone, quartzite, and limestone, the Diablo Formation of massive dolomite and conglomerate composed of Ordivician chert fragments; the Candelaria Formation of silicious clastics, which intergrade laterally, and tuffaceous sandstone; and the Excelsior Formation of greenstone breccia, thin lava flows, and tuffaceous sandstone (Ferguson, et al, 1953).

The Jurassic-Tertiary intrusives, outcropping in the eastern and southern parts of the district, range from quartz monzonite to granodiorite in composition. Along the intrusive contact, the sedimentary units are metamorphosed to shales, hornfels and tactites, and are locally silicified. The sediments and intrusives are intruded by quartz veins and veinlets, and later coated with chalcedonic and drusy quartz.

Pre-Permian tectonic activity resulted in the Monte Cristo Thrust Fault where folded slates and cherts of the Palmetto Formation were thrust over the greenstone breccias of the Excelsior Formation in the northern part of the district. Drag folds in the Palmetto indicate eastward movement of the upper plate. Further northeast, later tectonic activity thrust massive Permian conglomerates of the

Diablo Formation over the Palmetto Formation. Later normal, minor thrust, and strike-slip faulting in the region further complicated the structure of the district (Ferguson, 1953). Throughout the district, a strong, distinct northeast trending fault zone was observed. Many of the workings explore the thrust fault zone which ranges up to 2 feet in thickness in places. It is sericitized and heavily stained with iron and manganese oxides and the fault gouge is filled with quartz veins and coated with chalcedonic silica. The quartz veins are generally massive, range from milky white to smokey grey, and carry fine pyrite and chalcopyrite grains.

Mineralization in the district is generally erratic, low grade, and is most prominent along the thrust fault, the northeast trending fault zone, or disseminated in the country rock adjacent to the quartz veins. An iron ore deposit occurs northeast of the townsite of Columbus in an east-west trending belt as hematite and magnetite in shear zones and as small replacement bodies in the Diablo Formation. Turquoise, along with variscite, has generally been found in the southwest part of the district as veins up to 2 inches thick along intensely kaolinized shale and as nodules within silicified limestone breccia along northeast trending bedding plane shears. The turquoise ranges from plae blue to blue green in color and exhibits varying degrees of hardness. Turquoise was reported by Morrissey (1968) at the Carl Riek Mine, now the Hilltip Claims, however, no turquoise was observed during the inspection. Copper mineralization at the site consisted of minor copper oxides staining fracture surfaces in the Candelaria Formation. The mine workings follow shallow dipping quartz veins which carried oxidized pyrite and chalcopyrite crystals. The formation was intruded by a fine-grained granitic mass.

The Rock Hill mines area is currently staked by Tungsil, Inc., from Carson City. The workings explore highly contorted and shattered beds of the Palmetto

Formation which are metamorphosed to tactite. The beds are cut by crushed, sulfide-bearing, vertical quartz veins and white to greyish-black calcite veins which are coated with copper oxides. The mine and surrounding area has been extensively drilled. Northeast of the workings is a small ridge of Jurassic granodiorite which has been repeatedly brecciated and recemented with massive quartz veins. The quartz veins are crushed and heavily coated with psilomelane. The intrusive is cut with a prominent northeast trending fault which is traceable southwest through the Rock Hill Mine area. Scheelite, along with minor hubnerite, is reported to occur as disseminated crystals in the tactite, and as a thin coating along fractures adjacent to the quartz veins. Scheelite rich gravels are found down slope of the mine (Tingley, 1972).

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SEARCHLIGHT DISTRICT

The Searchlight mining district is located in and around the town of Searchlight, along U.S. Highway 95, about 55 miles south of Las Vegas, Nevada. The district is mainly within T28 and 29N, R63 and 64E, and is bordered on the east by the Lake Mead National Recreation Area, on the south and west by the Piute Valley, and on the north by the latitude 35°30'. The main port of the district is situated in low hills and alluvium covered areas on the southwestern arm of the Opal Mountains. All parts of the district are accessable along paved or maintained dirt roads leading from the town of Searchlight. The Searchlight area appears to now be somewhat of a retirement-recreation area, and parts of the old mining area are now serving as residence sites.

Gold deposits were discovered around Searchlight in 1897, and the district was organized the next year. The district was most productive from 1903 to 1910 (Vandenburg, 1937), with only moderate and intermittent activity up to the present, mostly by lessees and private owners. Early mining was mainly for gold, occurring in the upper, oxidized portions of the ores. Latter production gave way to mainly silver as the high-grade oxidized ores were exhausted (Longwell, et al, 1965). The largest and most productive mines in the district, the Quartette and Duplex, are located within the town of Searchlight, but all of the surrounding area has been extensively prospected.

The Searchlight district has a recorded production, from 1902 to 1962, of about $7,000,000, mainly in gold with some silver, copper, lead, and zinc.

The district is generally underlain by Tertiary igneous rocks which overlie Precambrian dioritic gneisses. The oldest Tertiary rocks are andesites. Both andesites and gneisses are intruded by sills and masses of andesite porphyry and later by a quartz monzonite pluton which subsequently altered the andesites to hornsfels. Later fracturing of the hornsfels, near the contact of the quartz monzonite permitted the ascent of mineral enriched solutions and deposition of metalliferous quartz veins near the contact. At a later unknown time, andesite flows and tuffs (Patsy Mine Volcanics ?), exposed in the northwest part of the district were lain down and were followed by a period of erosion (Callaghan, 1939).

The brecciated country rock is cemented with hydrothermal quartz which differs from north to south. The southern veins are simple quartz veins with specular hematite associated with copper and gold is in excess of silver. Wulfenite is present in small amounts in oxidixed ores from some mines in this part of the district. The veins originally carried considerable sulfides and little or no wall-rock alteration is associated with the veining. The northern veins contain quartz with lamellar calcite and the host rocks are adularized and silicified. Lead exceeds copper and silver exceeds gold; base metals are absent or scarse in adularia-quartz-calcite gangue (Callaghan, 1939; Shrivastava, Proctor, 1962). The veins form an en-echelon pattern along the western and southern margins of the quartz monzonite pluton, and generally, have a N40-65W strike and dip 20-80SW. (Callaghan, 1939). The sulfide ore have been, with a few exceptions, altered to silicates, carbonates, and sulfates, with cerussite the main lead mineral and hemimorphite the main zinc mineral. Visible gold occurs in the richer ores.

The regional variations of ores and wall rock alteration suggest a crude zonal distribution of ore deposits, which is not radialwith respect to the distribution of quartz monzonite outcrops. There is no indication of zonation within the quartz monzonite pluton (Shrivastava, Proctor, 1962).

Within the past 5 years, the district has experienced a surge in interest resulting in extensive surface and subsurface exploration. Many of the older dumps have or are being treated for residual minerals. Activity at the time of examination was largely confined to independent and private owners of properties. Due west of the Duplex Mine, the area was being actively developed, e.g., leach pads were being contructed, men and heavy equipment and a trailer park were on site. There was no indication of production, or where the ore would come from.

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SILVER PEAK DISTRICT

The Silver Peak district covers a large area in the east-central Silver Peak range, extending between Piper Peak on the west and the town of Silver Peak on the east. The larger Silver Peak district includes what were originally two separate centers of mining activity, Red Mountain to the south, just east of Piper Peak, and Mineral Ridge to the east, on the east point of the Silver Peak range. These two areas, as well as being geographically separated, are geologically distinct, and the type and age of mineralization are unique to each area.

Earliest recorded discoveries in the area were in the Red Mountain part of the district in 1863, and discoveries were made in the Mineral Ridge area the following year (Lincoln, 1923). In the 1920's, activity around the Francis (Sanger) mine immediately north of the old Red Mountain area, resulted in the name Argentite district being applied to that area. This name, however, did not survive.

The Silver Peak district has the second largest recorded production within Esmeralda county, and its geology and mineral resources are well described in the literature. The best information sources are: Shamberger (1976) for history and general background; Spurr (1906) for mine descriptions in the Mineral Ridge area, Keith (1977)for descriptions in the Red Mountain area. The references should be consulted for detailed information on the various subjects. Our work in this district was limited to reconnaissance and limited sampling in a few selected areas.

Ore deposits in the southern (Red Mountain) part of the district are silver-bearing veins in volcanic rocks of mid-Pliocene age that are related to the Silver Peak caldera. The Nivloc, Sixteen-to-One, and Mohawk mines, as well as several smaller deposits, lie in a mineralized zone that trends northwest. The veins themselves, however, strike northeast (Albers and Stewart, 1972). The veins are typically banded, with fine-grained argentite occuring in a gangue of quartz, calcite, barite, siderite, and locally, manganosiderite. The veins are within Tertiary volcanic host rocks that have been dated at 5.9 m. y. (Albers and Stewart, 1972). The deposits in the northern (Mineral Ridge) part of the district are mainly gold bearing quartz veins and irregular quartz masses within the Precambrian Wyman Formation. The lenses generally dip at low angles, and typically wedge, split, and fork along both dip and strike Spurr (1906). Spurr (1906) states that the ore is a typical white crystalline quartz which contains finely disseminated free gold. Some gold is also present in pyrite and galena. Mines in the Mineral Ridge part of the district include the Mary, Drinkwater, and Vanderbilt deposits, all northwest of the town of Silver Peak.

From the descriptions available, it is obvious that there are at least two periods of mineralization present within the district, an older set of gold-bearing veins in the Mineral Ridge area, and a younger system of silver-bearing' veins associated with volcanics related to the Silver Peak caldera. The known silver deposits at the Mohawk and Sixteen-to-One mines occur along northeast-trending faults, possibly related to the ring fracture zone along the southeast margin of the caldera. There are numerous other northeast-trending structures that are mapped cutting the caldera. These features seem to be concentrated along the southeast margin of the caldera, but there are some which cut through the area of Piper Peak but do not extend into the caldera itself. It would seem that the entire area around the margins of the caldera feature would demand attention as an exploration target.

The only major metal mining activity within the district at the time of our examination was at the Sixteen-to-One mine. Sunshine Mining Company began operations there in 1982 on an orebody with estimated reserves of 9.5 million ounces of silver and 36,729 ounces of gold.

Also included within the Silver Peak district is the large lithium-brine operation of the Foote Mineral Company. Lithium-rich brines are pumped from wells in Clayton Valley, northeast of Silver Peak, and are allowed to flow into large surface ponds and evaporated. The lithium salts are then recovered from the surface of the dry ponds.

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STONEWALL DISTRICT

The Stonewall mining district is located on the north slope of Stonewall Mountain, a prominent geographical landmark in the nortwest quarter of T5S, R44E, about 15 miles south of Goldfield in Nye County, Nevada. The mountain is due east of Lida Junction, where Nevada Highway 3 ends at U. S. Highway 95. Access to the district is east from the highway along good dirt roads.

According to Ball (1907) and Lincoln (1923), the district was prospected around 1904 with minor gold discoveries made by 1907. Small shipments of gold-silver ore were reported in 1911 and 1915. The Yellow Tiger Cons. M. Co. of Goldfield conducted development work in 1923. In the winter of 1951, Pius Kaelin mined ore from the Gold Crater district, now on the Nevada Test Site, which he stockpiled at Stonewall Spring and milled during the summer in a two-stamp mill (Kral, 1951). There has been no other recorded activity in the district up to the present. The Stonewall district is currently not producing however, the Stonewall Mountain Silver Mine area on the northwest side of the mountain had been drilled and staked by the E.W. Lewis, Co., of Reno in the spring of 1932, and the Sterlog claim had been staked in March, 1982. Ball (1907) suggests that the mountain was named after Stonewall Jackson, but others have suggested that the name came from the precipitous, wall-like northern face of the mountain.

Stonewall Mountain is underlain mainly by masses of Pliocene rhyolite welded tuffs with local flow breccias which are intruded by Pliocence quartz latite plugs. In the vicinity of the workings, the tuffs strike north and dip 60-70^{o} west. Outcropping on the northern side of the mountain are blocks of the Precambrian Wyman Formation, a phyllitic siltstone with limestone interbeds, which are overlain conformably by the Precambrian Reed Dolomite, a massive, coarsely crystalline dolomite (Cornwall, 1972). The sediments are cut by fine, randomly oriented calcite veins and along the intrusive contact the carbonaceous units are metamorphosed to epidote-rich marble. The sediments are horizontal to steeply south dipping with broad folds and local closed folds. East of the mountain are Pliocene flat-lying ash fall tuffs, non-welded ash flow tuffs, and Miocene rhyolite flows and masses. The Stonewall Mountain is thought to be a small, localized volcanic caldera between 6 and 17 million years old (Stewart and Carlson, 1976).

The most prominent structure in the Stonewall district is the fault scarp formed on the north side of the mountain by the northeast-trending, north steeply dipping Stonewall Spring Fault. The downdropped block on the north side is now covered with Quaternary alluvium. Faulting and sheeting are generally parallel to the main fault and extends up to a half mile south. The main fault and associated shear zone cuts across minor north-trending faults and all rocks types on the mountain, implying that tectonic movement occurred after the Tertiary volcanic (caldera ?) activity. Stonewall Mountain lies along or southwest of the structural disruption described as the Walker Lane Mobile Belt (Locke, et al, 1940).

Gold and silver values at Stonewall are carried in quartz veins which fill fractures and joints and cement fault breccia associated with the Stonewall Spring Fault. Secondary silica flooding coats the quartz veins and host rocks with drusy quartz and chalcedony and hyalite are deposited in open spaces and vugs. Later tectonic activity crushed and displaced the quartz veins. The quartz veins carry gold and silver-bearing sulfides which are locally oxidized to limonite and azurite. Silver values of the ore are reported to increase with depth.

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SUNSET DISTRICT

The Sunset (Lyons) mining district is located on the southern end of the narrow, north-trending Lucy Grey Range, in the southwest quarter of T27S, R60E, near the California-Nevada state border in Clark County, Nevada. Access to the district is from the southwest from Desert, California along rough dirt roads. The district was established in 1897 when the only producing property in the district, the Lucy Grey Mine, began operations. By 1912 the mine was operating a small cyanide plant and leaching tanks. Gold production continued until 1919 (Lincoln, 1923). Activity at the mine after 1919 has been intermittent and minor,with production figures reported for the years 1911-1928, 1940, and 1941. No activity has been reported after 1941 (Longwell, et al (1965). Production for the district has been estimated at about $50,000 (Vanderburg, 1937), principally in gold, with minor silver, copper, and lead. Feldspar deposits in pegmatite dikes were located in 1936, however,none have been mined. Within the last 3 years, the rise in gold and silver prices has prompted extensive surface and subsurface exploration at the mine and along the surrounding ridges.

The Precambrian rocks which host the Lucy Grey deposit are garnetiferous quartz-feldspar-biotite gneisses, carrying small masses of quartz. The gneisses are locally intruded by pegmatite dikes carrying subangular fragments of dark schist (Bingler, Bonham, 1973). North of the mine, outcrops of a Precambrian quartz monzonite pluton are found and east of the workings the Tertiary Mount Davis Volcanics overlie the east slopes of the Lucy Grey Range.

The Lucy Grey mine is located along the southeast border of an elliptical breccia pipe in Precambrian granite gneiss. The pipe covers an area approximately 200 by 150 feet. Breccia fragments within the pipe range up to 1 foot wide,are cemented with quartz, and are cut by quartz veins up to several inches wide (Longwell, et al, 1456). The pipe experienced at least one more period fracturing. The breccia is heavily stained with iron and manganese oxides, but the surrounding gneisses are relatively free from such stains. The high grade gold ore within the pipe is confined to the hydrothermal quartz veins and along post-brecciation fractures (Hewett, 1956). Gangue minerals include jaspery quartz and iron oxides.

The western workings follow an east-west shear zone in quartzite and schists and show a greater degree of iron staining that the eastern workings where the Lucy Grey mine is located. The shear zone is cemented with sulfide bearing quartz both of which are cut with calcite/siderite veins.

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Bingler, E. C. and Bonham H. F. (1973) Reconnaissance geologic map of the McCullough Range and adjacent areas, Clark County, Nevada: NBMG Map 45.

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SYLVANIA DISTRICT

The Sylvania mining district includes all of the northern Sylvania mountains in the area south of Palmetto wash extending generally along the Nevada-California state line to Cucomungo Canyon.

Prospects here were first noted in 1870, and the district was organized as the Green Mountain district. The name was changed to Sylvania before any production was made. A lead smelting furnace was constructed in 1875, and operated for several years (Lincoln, 1923). Only a small production of lead and silver is credited to the district, mostly from the old Sylvania mine and from the nearby Four Aces mine. Small quantities of tungsten were produced from the district in the 1940's and 1950's (Stager, in preparation). There was no activity at the Four Aces mine when it was visited in August, 1982, but it had apparently operated to a limited extent during 1974-75.

The Sylvania district has been an important producer of talc and chlorite, and is credited with producing some 87 percent of all of the talcose material mined in Nevada through 1973 (Papke, 1975).

Beginning in 1960, exploration for porphyry-type molybdenum became active in the district and was centered around the old Sorenson property (Cucomungo Prospect) at the head of Alum canyon. A succession of major companies examined this area up through the 1970's, but it is quiet at the present time.

The geology of the Sylvania district is dominated by the granitic rocks of the Sylvania pluton. This large composits intrusive body underlies the Sylvania mountains and extends southeast to the Last Chance range as well as northeast to the Palmetto Mountains. Essentially all of the mineral deposits of the Sylvania district, metallic and non-metallic, are associated with skarn zones which formed along the margins of the Sylvania stock or skarns which formed in small pendants of sedimentary rock contained within the stock itself.

The Cucomungo molybdenum prospect is located within a large area of alteration within the stock itself, but it occurs where two separate bodies of quartz monzonite are in contact with a wedge of metasediments (Schilling, 1962).

According to Papke, 1975, the metasedimentary rocks within which most of the skarn formed consisted of both Precambrian Wyman Formation and Precambrian Reed Dolomite.

At the old Sylvania mine, the site of the earliest mining in the area, gossan can be seen along replacement lenses which follow bedding in a band of garnet skarn. The band of marble and skarn is exposed over an approximate width of 100 feet between two walls of porphyryitic granite. The granite-skarn contact parallels bedding in the skarn, and the bedding trends N60°-70°W. Galena, sphalerite, and pyrite are present in the replacement lenses associated with silicate minerals. The most recent work reported at this site was for tungsten, but no scheelite was noted in samples collected during this examination (1982).

The Four Aces mine, about one mine to the northwest from the old Sylvania, is located in skarn within what may be a continuation of the metasedimentary pendant exposed at the Sylvania mine. Mining at the Four Aces was centered in two areas. On the southeast end of the camp, old shafts and a fairly recent decline explore a skarn area within the pendant. Massive sphalerite and galena are visible on dumps here, and one dump contained garnet skarn loaded with coarse-grained molybdenite. The second area, to the northwest near the present mill building, is probably located on the same skarn lense, but the workings appear to be older. There was no activity at the property at the time of the examination.

Papke, 1975, describes in detail the many talc and chlorite deposits within district. His work (NBMG Bull. 84) should be consulted for information on the talc occurrences.

The geology and exploration history of the Cucomungo molybdenum prospect is summarized in NBMG Report 2, and is described in detail in Schilling 1979 open file release, "Molybdenum Resources of Nevada" (NBMG OFR 79-3). Drill core from one stage of exploration at Cucomungo is on file at the NBMG core library in Reno, and an extensive file of geochemical sampling results from the property are also on file in the NBMG offices. Placer deposits along the east side of the Sylvania district, in East Sylvania Canyon and in the canyon south of Pigeon Spring, are sometimes included in a separate Pigeon Springs district, are sometimes included in the Palmetto district to the northeast, or are sometimes included in the Sylvania district. Since these occurrences are located within the Sylvania mountains, it is logical to include them within the Sylvania district. The gold placer prospects in east Sylvania canyon were not active at the time the area was examined, but equipment was still in place at the placer treatment plant near the mouth of the canyon, and a watchman was living at the site. In the canyon south of Pigeon Spring, a small gravel washing plant was in place, and some prospecting work was in progress. None of activity in the placer area appeared to have long-term potential.

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TOKOP DISTRICT

The Tokop (Bonnie Claire, Gold Mountain, Oriental Wash) mining district is located around the abandoned townsite of Tokop and along the southwest-northeast trending ridge that includes Gold Mountain, in Esmeralda County, Nevada. The district is bounded by Oriental Wash on the west, Slate Ridge and the Gold Point (Hornsilver) mining district on the north, the eastern edge of R42E on the east, and the south flank of Gold Mountain on the south. There is access to all areas of the district, the easiest being from the east from U.S. Highway 95; however, the excessively wet winter of 1982-83 left many of the roads badly damaged.

The district was originally discovered in 1866 by Thomas Shaw but was largely ignored until the Oriental Mine, one of the richest properties in the district, was discovered by Shaw in 1871 (Lincoln, 1923). Originally, the Tokop and Gold Point mining districts were one district, but were separated before 1900 into two distinct districts. Prior to 1900, several mills operated in the district with early prduction estimated at $500,000 (Hewett, et al, 1936). Ore and concentrates produced during this early period were hauled to Belmont and Austin for processing. A second period of production occurred from 1902 to 1929, and sporadic activity has continued up to the present. Minor placermining developed in Oriental Wash in the 1930's, but no placer activity of any consequence has since been recorded (Vandenburg, 1936). The district has produced primarily gold, silver, copper and lead.

The district has recently experienced a surge in surface and subsurface exploration activity which is still ongoing. During the recent field examination, drilling was observed in progress below the old townsite of Tokop at the head of Oriental Wash. Many of the older workings in and around the townsite have been obliterated by the recent activity.

Most of the workings in the district are located in the Precambrian Wyman Formation, within the metamorphic halo found along the contact between the Jurassic Sylvania Pluton and the Wyman Formation, or following the quartz veins along the general east-west trending fault zones which cut both the Wyman and pluton. The Wyman consists of silt/sandstones, silty claystones with limestone interbeds, sandy and silty limestones, and very fine grained sandstones. The sediments are metamorphosed in varying degrees to slate, shale, phyllite, schists, marble, calc-silicates, tactite, and hornsfels. The metasediments exhibit remnant bedding and fine laminations. The formation has been intruded by the fine to coarse grained quartz monzonite Sylvania Pluton, which has been dated at 149 ± 6, 153 ± 5, and 155 ± 6 million years (Albers, Stewart, 1972). The quartz monzonite grades irregularly into quartz diorite and is extensively chloritized. Some of the Wyman outcrops are roof pendents included within the outcropping Sylvania pluton. In other areas, the formation has been faulted against Tertiary igneous rocks. At most exposures along the contact, the limy members of the Wyman have been metamorphosed to a garnet-epidote rich tactite. At the Pinon Claims the tactite was slightly magnetic. The Wyman and the pluton have both been intruded by massive quartz veins which grade into pegmatite dikes, and aplitic and mafic dikes which appear to follow the structure related to the east-west fault zones. Sericite was observed along fault surfaces and in the rocks adjacent to the dikes and veins. Overlying the pluton and Wyman are remnant patches of Tertiary-Quarternary basalt flows (many of which bear petroglyphs left by early inhabitants of the region) and air fall, non-welded and welded ash flow tuffs of the Ammonia Tanks member of the Tertiary Timber Mountain Tuff.

Faulting throughout the district follows a distinct east-west trend, which appears to be associated along the south end of what has been described by Albers (1967) as the Silver Peak-Palmetto-Montezuma Oroflex. The fault zone breccia is cemented primarily with hydrothermal quartz and calcite, and the breccia and quartz veins are coated with two or more infusions of late stage silica flooding. Prominent faulting also occurs along the bedding planes in the Wyman Formation. Psilomelane and jarosite were observed along fractures in the country rock and coating vein material. The Sylvania Pluton is highly fractured with prominent east-west jointing which appears to act as structural controls on the ore-bearing quartz and calcite veins. The fine-stringer quartz veins cutting the metasediments suggests stockwork veining.

Mineralization within the district occurs mainly as argentiferous and auriferous sulfides (pyrite, chalcopyrite, galena, tetrahedrite) carried by quartz veins which cut both the metasediments and the pluton. Much of the observed sulfides were oxidized and altered to secondary supergene minerals. The quartz veins are massive, locally crushed and brecciated, and cemented with silica. At several properties the quartz veins carried crystalline calcite, and at the Side Hill Claims barite was noted. At the Big Blossom Mine, ferberite-heubnerite (?) was observed in clots in the quartz veins associated with oxidized sulfides. Minor mineralization also occurs within the metamorphic halo along the contact between the intrusive and metasediments. Scheelite has been reported as finely disseminated grains within the tactite zones.

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TONOPAH DISTRICT

The Tonopah mining district is centered on the town of Tonopah, in T2,3N, R42,43E, Nye and Esmeralda Counties. The main productive part of the district is located in Nye County, just outside the Esmeralda Resource Area (in S35,36, T3N,R42E). The workings in the district consist of many thousands of meters of underground drifts and crosscuts, with vertical shafts to the surface, Bonham and Garside (1979, fig. 73) show the location of the principal shafts.

The district was discovered by Jim Butler in 1900, and was worked by lessees in the first few years. Tonopah had steady production until 1930, and sporadic production until the late 1940's. There has been no recorded production since 1961. Hughes Tool Co. (Summa Corp.) purchased mining claims that comprise a substantial part of the district in 1969. Houston International Minerals Co. purchased these in 1977, and has done considerable exploration drilling, underground sampling, and mapping in the district in the search for new ore bodies or extensions of ones previously mined. No commercial discoveries have been announced to date. Cordex Exploration Co. drilled low-grade disseminated gold-silver mineralization at the Three Hills property 2.5 km west of Tonopah in the late 1970's. The company has not announced a discovery, and the property was inactive in 1982.

The Tonopah district has produced 57,890 kg (1,861,200 troy oz) gold and 5,416,878 kg (174,152,628 troy oz) silver from epithermal bonanza precious-metal veins in volcanic host rocks. The geology and ore deposits of the district have been described by numerous workers; these studies are cited in Bonham and Garside (1979). The underground geology is described in detail by Nolan (1935). The most recent work in the district was done by Fahley (1981).

The ore in the Tonopah district occurs in veins which cut Tertiary volcanic rocks ranging in composition from dacite to rhyolite. The veins are composed largely of quartz but also contain varying amounts of K-mica, adularia, pyrite, and rhodochrosite.

High-grade, primary metallization in the veins consists of argentite, polybasite, pyrargyrite, electrum, sphalerite, galena, and chalcopyrite. The volcanic rocks adjacent to the veins are altered to quartz, K-mica, and adularia. This zone of potassium-silicate alteration grades outward into an intermediate argillic zone consisting of kaolinite, halloysite, K-mica, and montmorillonite which in turn grades outward into propylitized rocks.

The ore bodies in the Tonopah district occur in a zone approximately 200 m thick, which is elongated in an east-west direction. This zone reaches its highest altitude in the central part of the district, which is the only place that ore bodies are exposed at the surface. The zone is controlled by several sets of pre-ore faults, which are both high and low angle. The exposed ore bodies are oxidized to an average depth of about 30 m, although some deeper oxidation occurs locally along faults, which cut the ore. Supergene enrichment was not a significant factor in the Tonopah district. Silver-gold ratios in oxidized ore were essentially the same as those in unoxidized ore, which indicates that relatively little supergene migration of silver or gold occurred. Most of the silver in the oxidized ore occurred as silver haloids.

The age of the bonanza silver-gold mineralization described above is well defined by K-Ar age dating of pre- and post-ore rocks and hydrothermal vein minerals (Bonham and Garside, 1979, p. 111-112) as 18-19 m.y.

In addition to the silver-gold deposits described above, younger low-grade gold-silver mineralization and hydrothermal alteration occur in intrusive rhyolite (Oddie Rhyolite) and tuffaceous sediments (Siebert Formation). These mineralized units are younger than the main-stage Tonopah mineralization.

Very little ore has been produced to date in the district from rocks mineralized in this later period of hydrothermal activity. Generally, the mineralization is distinctly lower grade than in the earlier phase and has a higher gold/silver ratio. Mineralized veins of this later period occur on

Mount Oddie and Ararat Mountain. Disseminated, low-grade, gold-silver mineralization also occurs in silicified, tuffaceous sediments of the Siebert Formation and Oddie Rhyolite of the Three Hills property 1 km northwest of Siebert Mountain.

Because unaltered rocks of the Brougher Rhyolite unconformably overlie hydrothermally altered rocks of the Siebert Formation, the age of the Brougher Rhyolite places a lower limit on this later period of mineralization in the Tonopah district. The Brougher Rhyolite in the Tonopah district has K-Ar ages of 16.1 and 16.3 m.y. The available evidence indicates that this second period of mineralization in the Tonopah district is the same age as the mineralization in the nearby Divide district and is probably genetically related to it, as adularia and adularized whole rock from mineralized lodes in the Divide district were dated by the K-Ar method at 16.3 and 16.4 m.y.

Anomalous Au, Ag, As, Sb, Zn, Ba, Mn and other metals are reported from vein and wallrock samples in the Tonopah district. The details of the geochemical anomalies are reported in Bonham and Garside (1982).

Olson (1964, p. 188) reports a clay deposit in the Tertiary Siebert Formation a few kilometers northwest of Tonopah. Also, the Tonopah Summit Members of the Fraction Tuff is extensively altered to zeolite minerals (predominantly mordenite) over a considerable area south of Tonopah (Papke, 1973; Bonham and Garside, 1979, p. 50).

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TULE CANYON DISTRICT

The Tule Canyon mining district has, at times, been called a sub-district of the Lida mining district, and at others, a separate district unto itself. For administrative purposes, the CRIB and field sheets have been included in the Lida file, but a separate report is submitted for Tule Canyon.

The Tule Canyon mining district is located in Tule Canyon in T7S, R40E, adjacent to and north of the California-Nevada state line in the southwest part of Esmeralda County, Nevada. Access to the district is from the south by way of Death Valley, California, or Oriental Wash; from the east by way of dirt roads from Nevada Highway 3; or from the north over jeep trails through MaGruder Mountain or Pidgeon Springs. During the wet season the roads are impassable and the canyon becomes a shallow free flowing river.

According to Vanderburg (1936) placer gold was discovered in 1876, although it has been reported the placers were worked by Mexicans around 1848 when Nevada was still part of Mexico. Chinese workers were imported in 1876 to work the placers in the northern part of the canyon. Due to the scarcity of water during most of the year placer mining was worked by hand methods. The next recorded period of activity occurred in the 1930's when individuals and small companies were reported to be exploring the economics and logistics of future placer gold operations in the canyon. Minor lode operations were noted along the east and west sides of the canyon, and the southern part of the canyon has been extensively explored, but no production has been reported from these workings.

The district is situated in a north-trending, dog-leg canyon which cuts through the Jurassic Sylvania Pluton. The quartz monzonite pluton is highly weathered and fractured, and is cut with massive quartz veins and alaskite dikes running parallel to fault and shear zones. About midway through the canyon is what appears to be a remnant roof pendant of Precambrian Wyman Formation, surrounded by intrusive. The thinly bedded, silicious, metasediments of the Wyman are tilted to the vertical and are further metamorphosed to hornfels, phyllites and schists. Along the contact aureole the rocks are chloritized and carry galena and tetrahedrite. Remnants of Quaternary-Tertiary basalt flows cap the surrounding ridges and overlie the pluton near the pendant (Albers, Stewart, 1972).

Passing through the district are a series of east-west trending, high angle fault zones, tentatively marking the southern boundary of the Silver Peak-Palmetto-Montezuma Oroflex (Albers, 1967). Associated with the fault zone are abundant quartz veins and stringers which locally carry stringers, pods, and clots of pyrite, chalcopyrite, galena and tetrahedrite. Some iron oxides and supergene copper minerals are present. The fault breccia and quartz veins are coated with several phases of late stage silica flooding. Extensive sericitization was noted throughout the district associated with the shear zones and the metamorphic aureole along the igneous-sedimentary contact.

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WINDYPAH DISTRICT

The Windypah or Fesler district is located in the southwestern Silver Peak range just north and south of Oasis Divide and about six miles northeast Nevada-California state line. The district was discovered in the winter of 1903 by J.E. Fesler (Spurr, 1906) and, according to Lincoln (1923) a little lead ore containing gold and silver was shipped from the district in 1908. The workings in the district are not extensive, and show no evidence of recent work. No production records are available; apparently Windypah production has historically been reported with that of the Palmetto district.

Mines and prospects in the Windypah district occur partly in granitic rocks of the Palmetto and Palmetto Wash plutons and partly in flanking lower Paleozoic hornfels, slate, and marble. Four classes of veins have been described by Spurr (1906) but his classifications seem to more reflect host rock than vein type. Spurr's description of the district in U.S.G.S. Professional Paper 55 (1906) is, however, the best description of this area.

During the examination in 1982, three general areas of mineralization were noted, and all three are basically related to northwest trending dikes or shear zones which cut both granite and the Paleozoic sediments. In the northern part of the district, around the Magpie and Gold Dust prospects, vein quartz containing pyrite and presumably gold occurs in a N60°-80°W shear zone along the margin of an aplite dike within the granitic outcrop. The dike is exposed for about 500 feet of width near the Magpie prospect, and it is laced with stockworks type quartz veins. Both the vein material and the dike are stained with limonite, the aplite itself is locally slightly greenish in color due to minor chloritic alteration.

To the southwest of the Gold Dust area, in the low, rolling hills which flank the main range, numerous small prospect cuts and pits explore small skarn zones which are associated with a series of mafic dike rocks. The dikes trend northwest, and cut the older granitic rocks as well as small pendants of sediments. The skarn bodies are lenticular pods of silicated rocks containing irregular masses of white quartz, gossan clots, and patches of green copper staining. At the Copper Stack prospect, samples collected contained clots of coarse-grained scheelite. There is no record of tungsten production from this district, but some of the more recent exploration activity may have been for this commodity.

In the southermost part of the district, just south of Oasis Divide, prospects both northwest and southeast of the road over the pass explore northwest trending quartz veins which cut metasediments of the Cambrian Harkless Formation. The vein exposed at sample site 1264 is about 15 feet wide, is brecciated, and is stained with copper-manganese-iron oxides. This vein projects to the northwest to the North Star claim, which is near the old Festler discovery area. There was no sign of recent mining activity in this part of the district, but the camp at the North Star is apparently serving as a weekend retreat for the current surface owners. An odd assortment of cabins, old machinery, wind machines, signs, bottles, and assorted collectables litter the claim area, giving it a Disneyland appearance.

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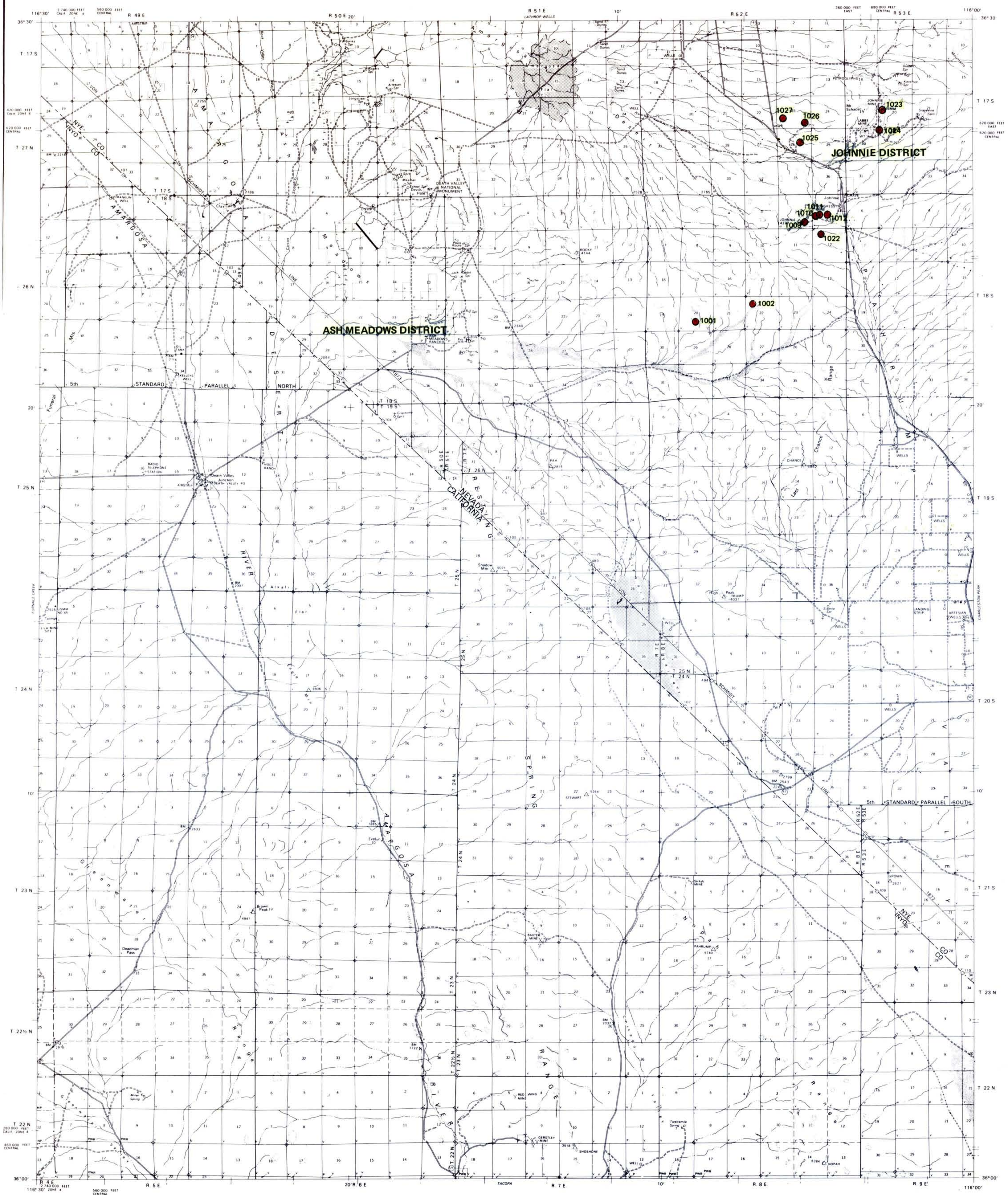
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ASH MEADOWS, NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photographs

Section lines on this map are not based on reliable ground control and are subject to revision

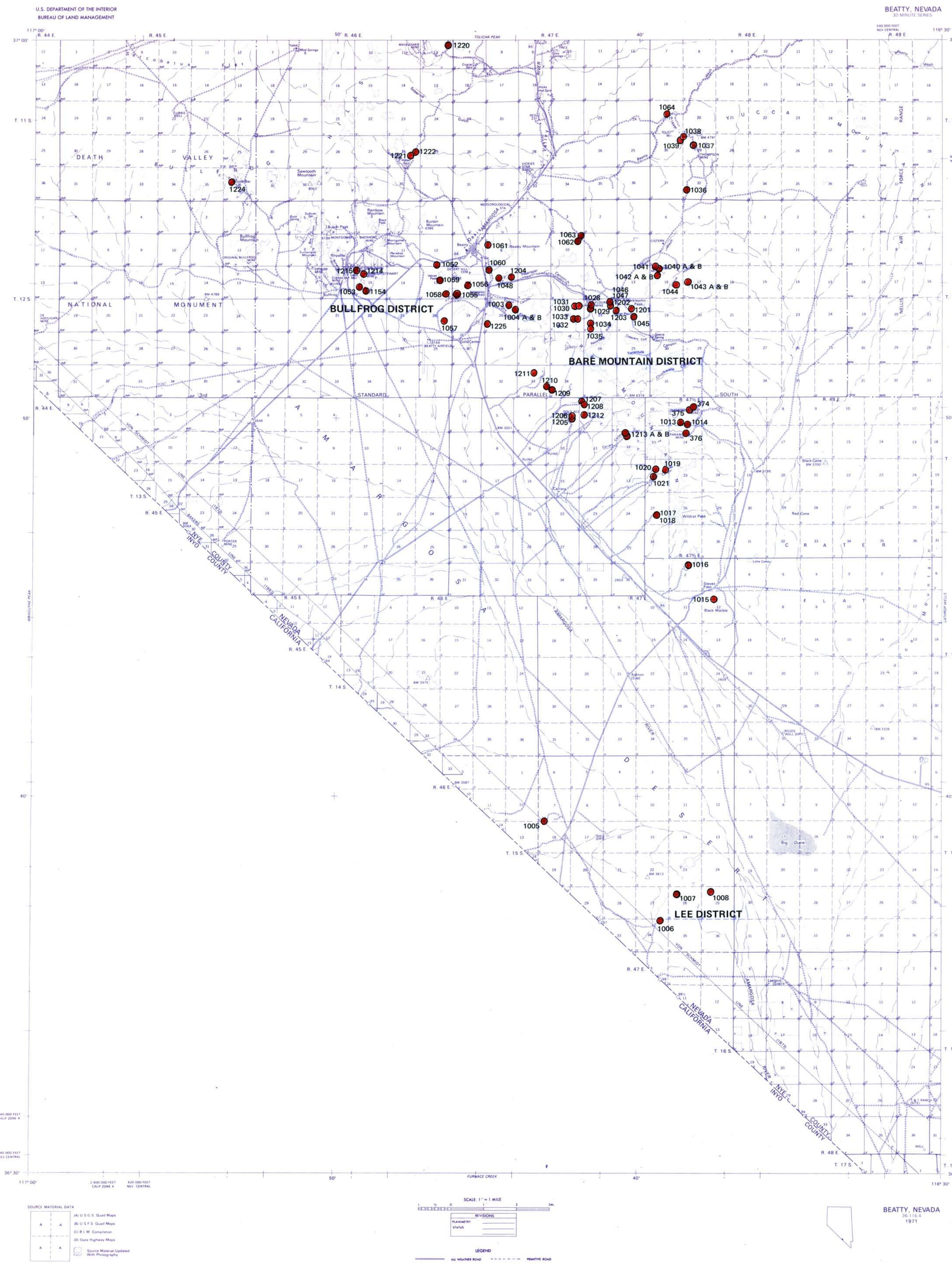
SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

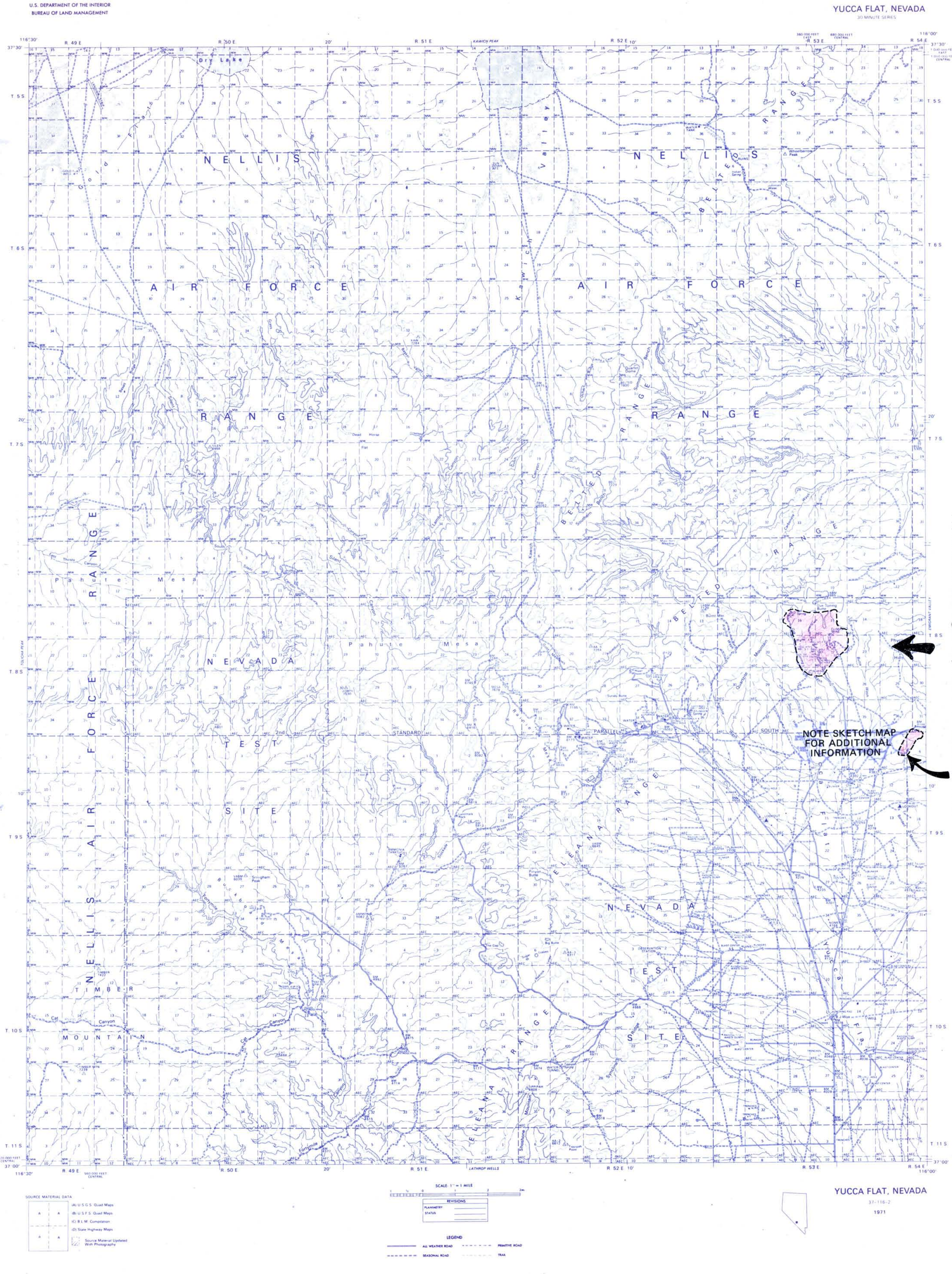
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

ASH MEADOWS, NEVADA–CALIFORNIA
36-116-2
1971
1973

NBMG 83-11F12



NBMG-83-11+12A



1802	1851
1822	1852 A & B
1823	1854
1824	1870
1825	1871
1826	1872
1827	1873
1828	1874
1829	1875
1830	1876
1831	
1832	1929
1833	1930
1834	1931
1835	1932
1836	1933
1837	1934
1838	1935
1839 A & B	
1840	1936
1841	1937
1842	1938
1843	
1844	
1845	
1846-A	
1846-B	
1847	
1848	
1849 A & B	
1850	

1801
1806
1807
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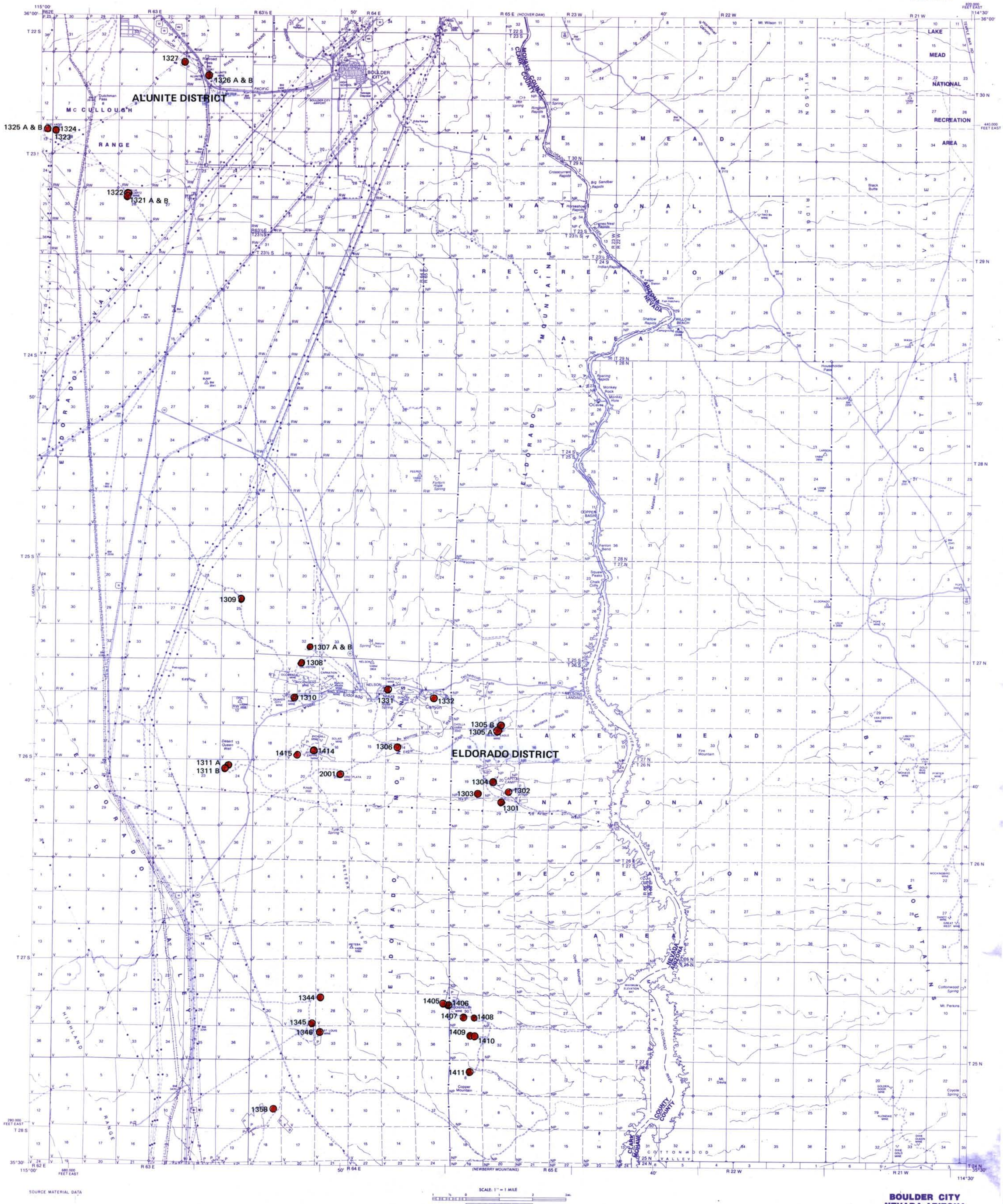
1819

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

BOULDER CITY
NEVADA-ARIZONA
30 MINUTE SERIES



SOURCE MATERIAL DATA

A A (A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
A A (D) State Highway Maps

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

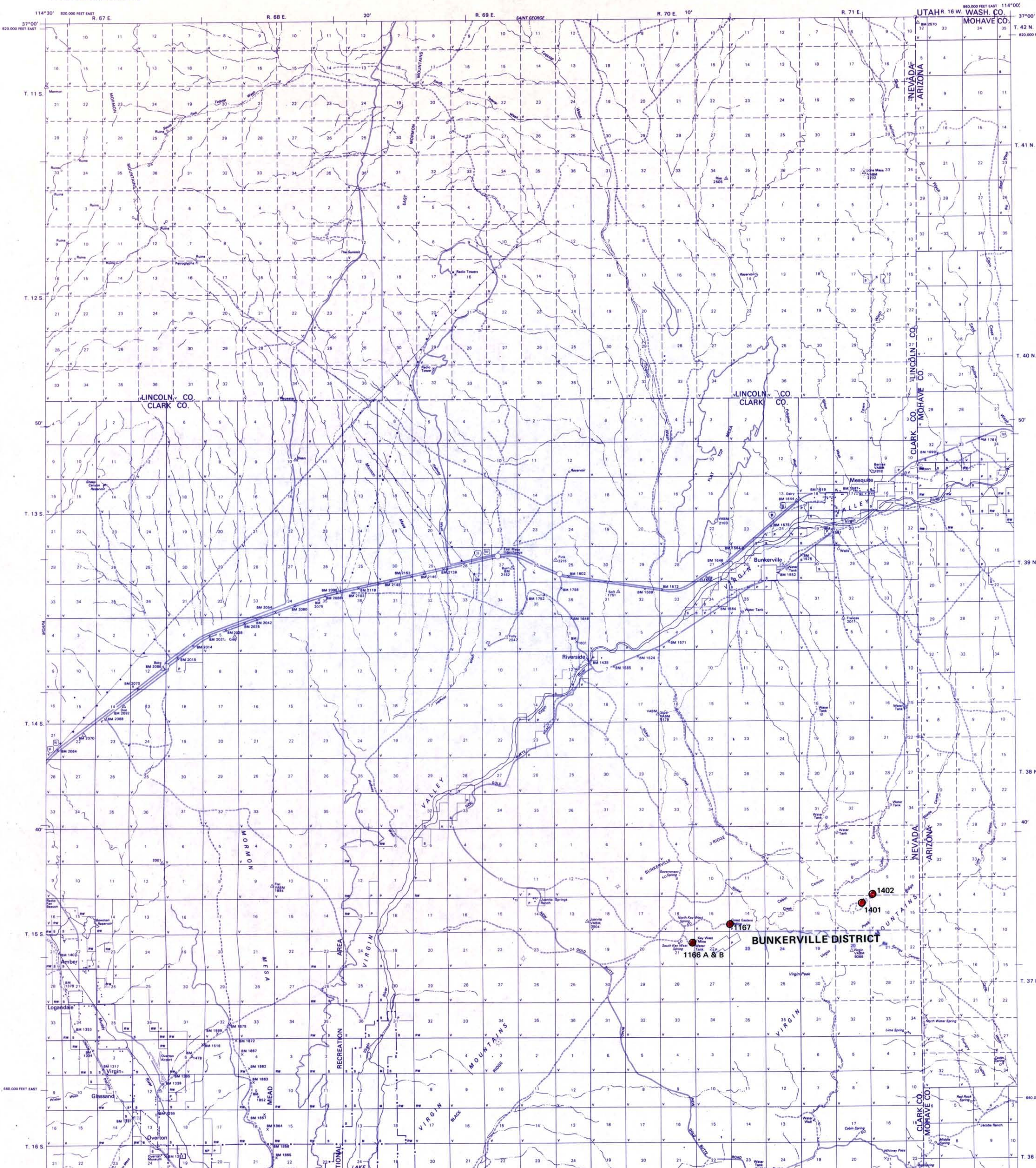
ALL WEATHER ROAD
SEASONAL ROAD
PRIMITIVE ROAD
TRAIL

BOULDER CITY
NEVADA-ARIZONA
35-114-4
1978

NBMG 83-11 #12B

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

BUNKERVILLE NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

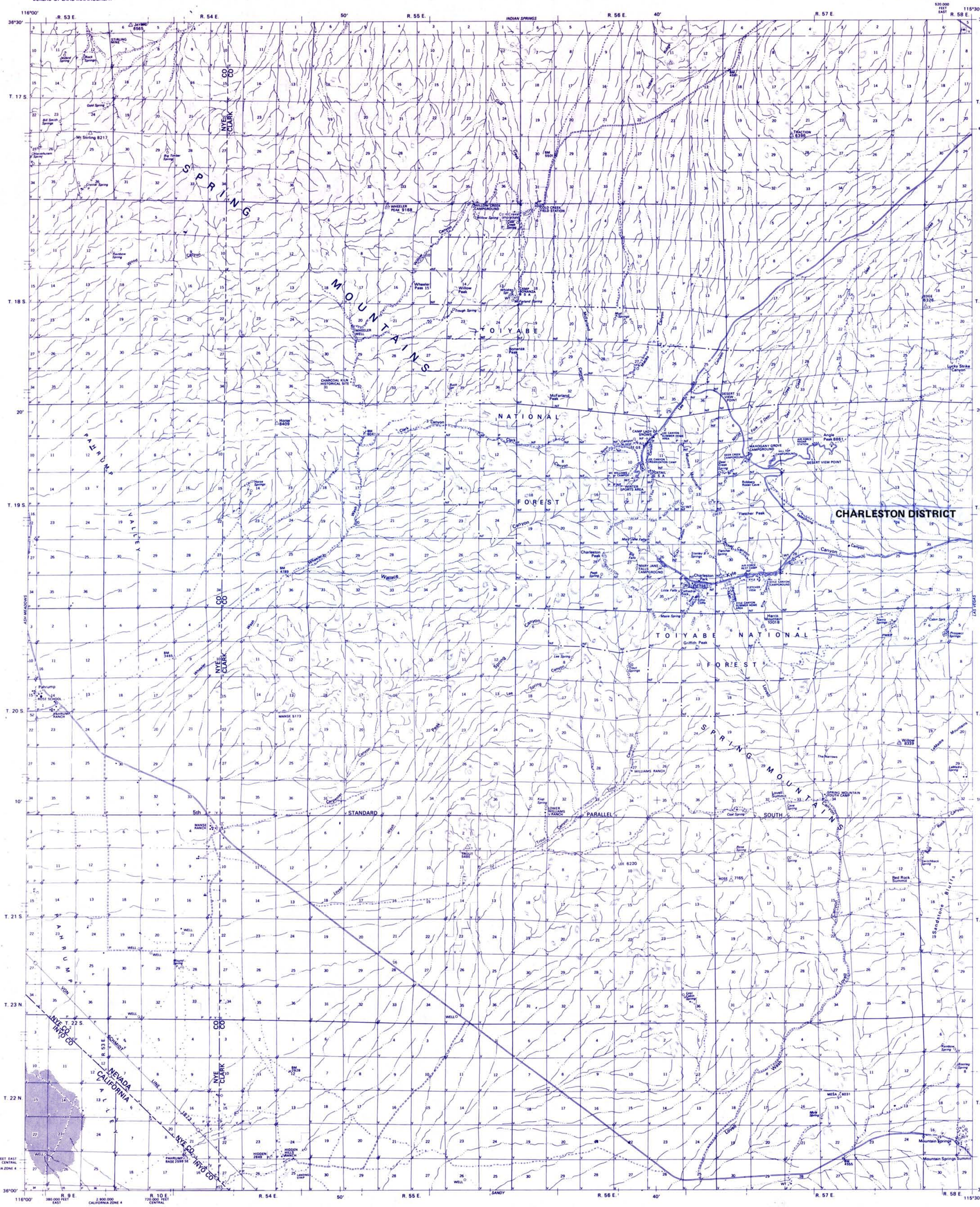
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

BUNKERVILLE, NEVADA
3630-114-1
1976

NBMG 83-1142

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

CHARLESTON PEAK, NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

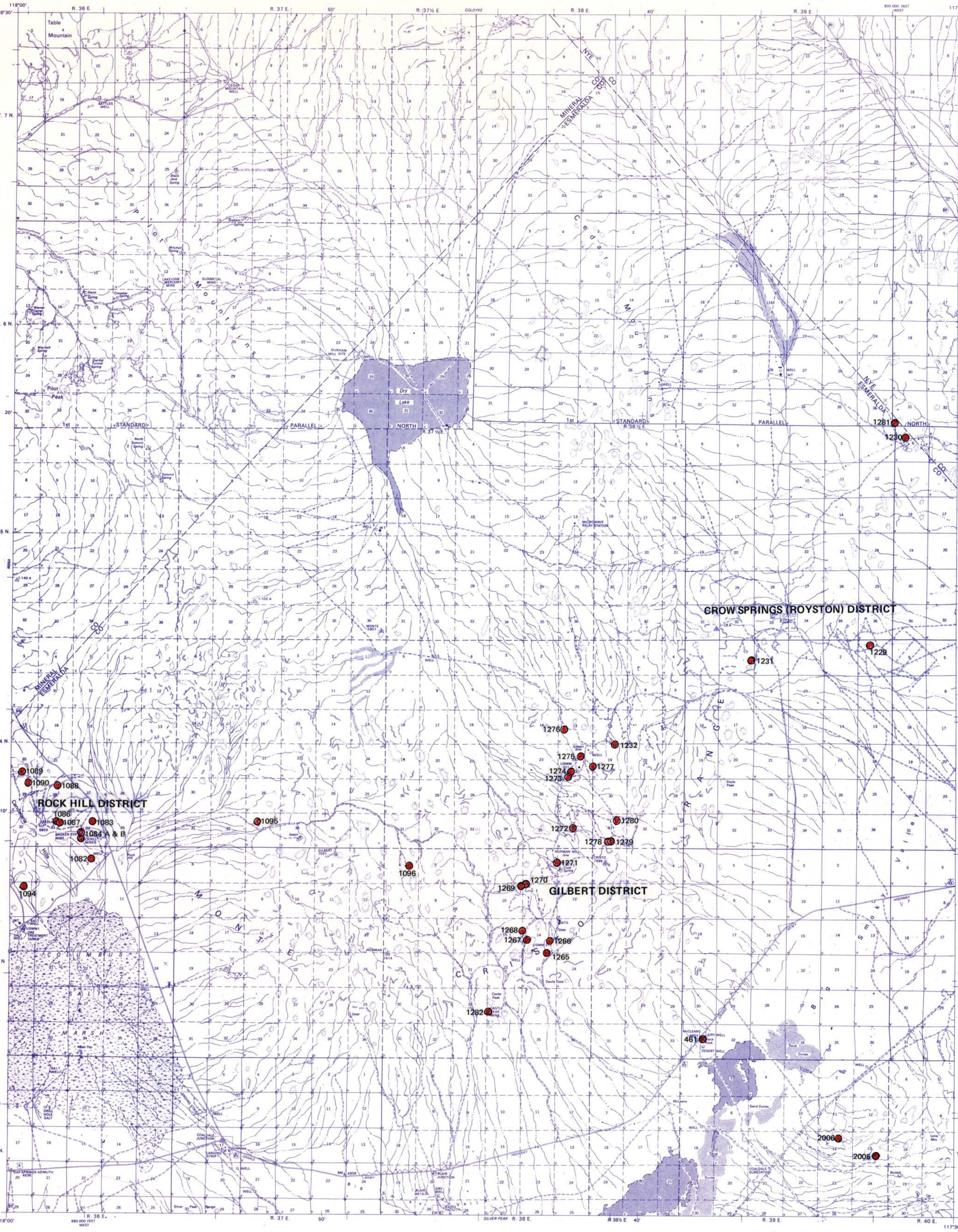
LEGEND

NO SAMPLE SITES RECORDED
CHARLESTON PEAK, NEVADA
36-115-3
1971

MF 83-1141 D

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COALDALE, NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography 1967

SCALE: 1" = 1 MILE

REVISIONS	
PLANIMETRY	
STATUS	8-1978

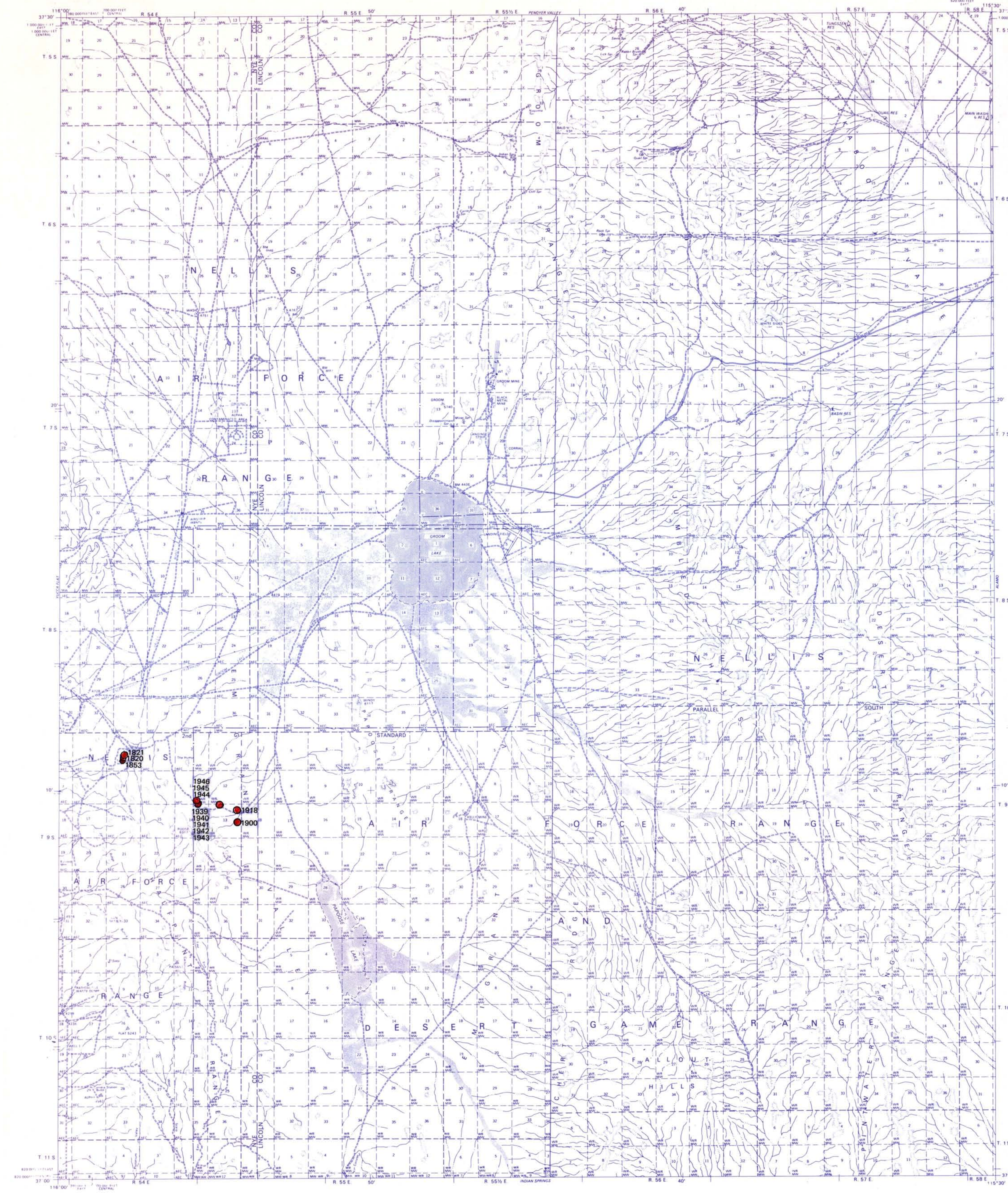
COALDALE, NEVADA
38-117-3
1971

NBMG 83-11 E

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

EMIGRANT VALLEY, NEVADA

30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(A1) U.S.G.S. Orthophotos (1968)
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

SCALE: 1" = 1 MILE

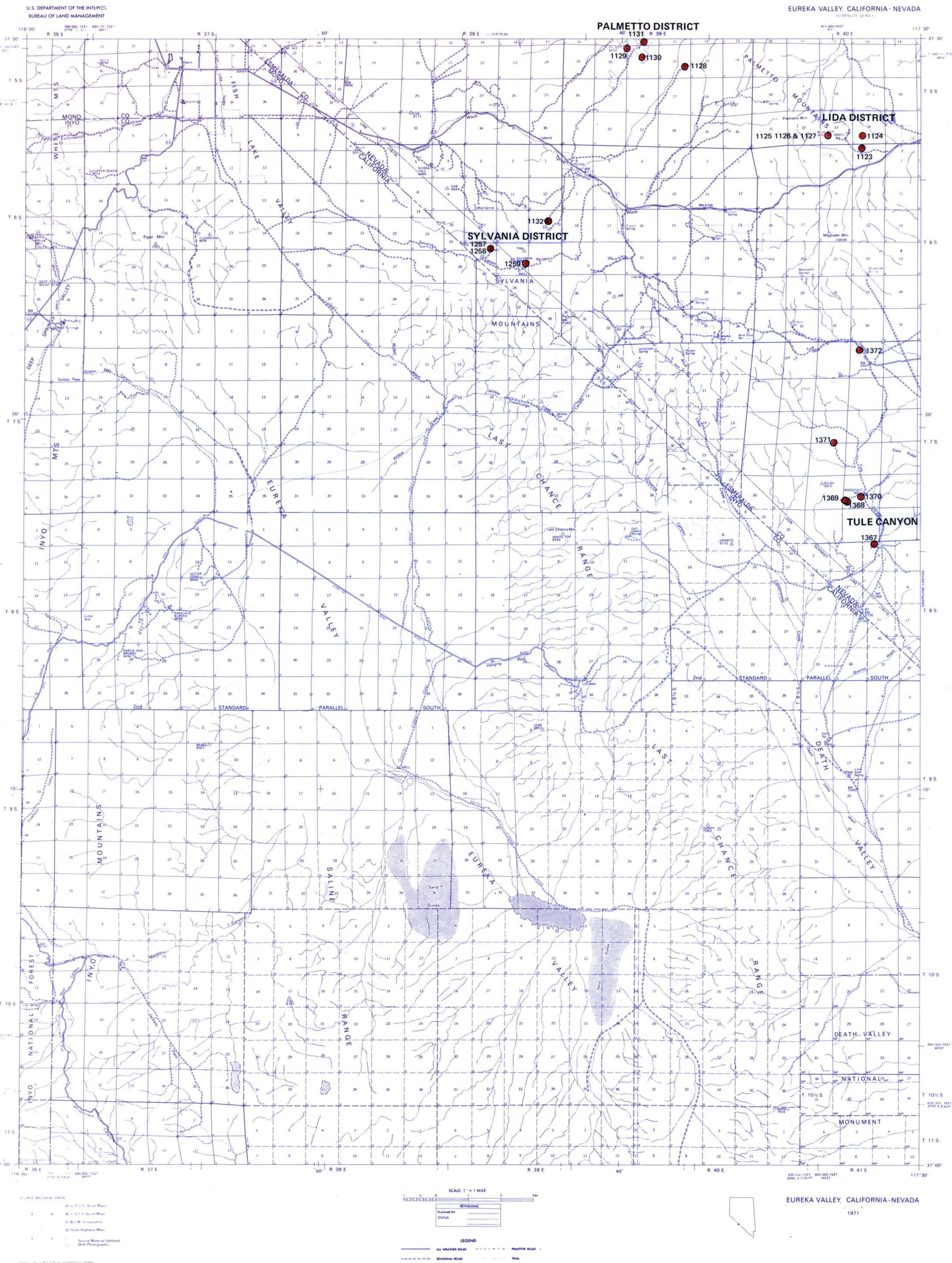
REVISIONS
PLANIMETRY
STATUS

LEGEND

ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

EMIGRANT VALLEY, NEVADA
37115-3
1973

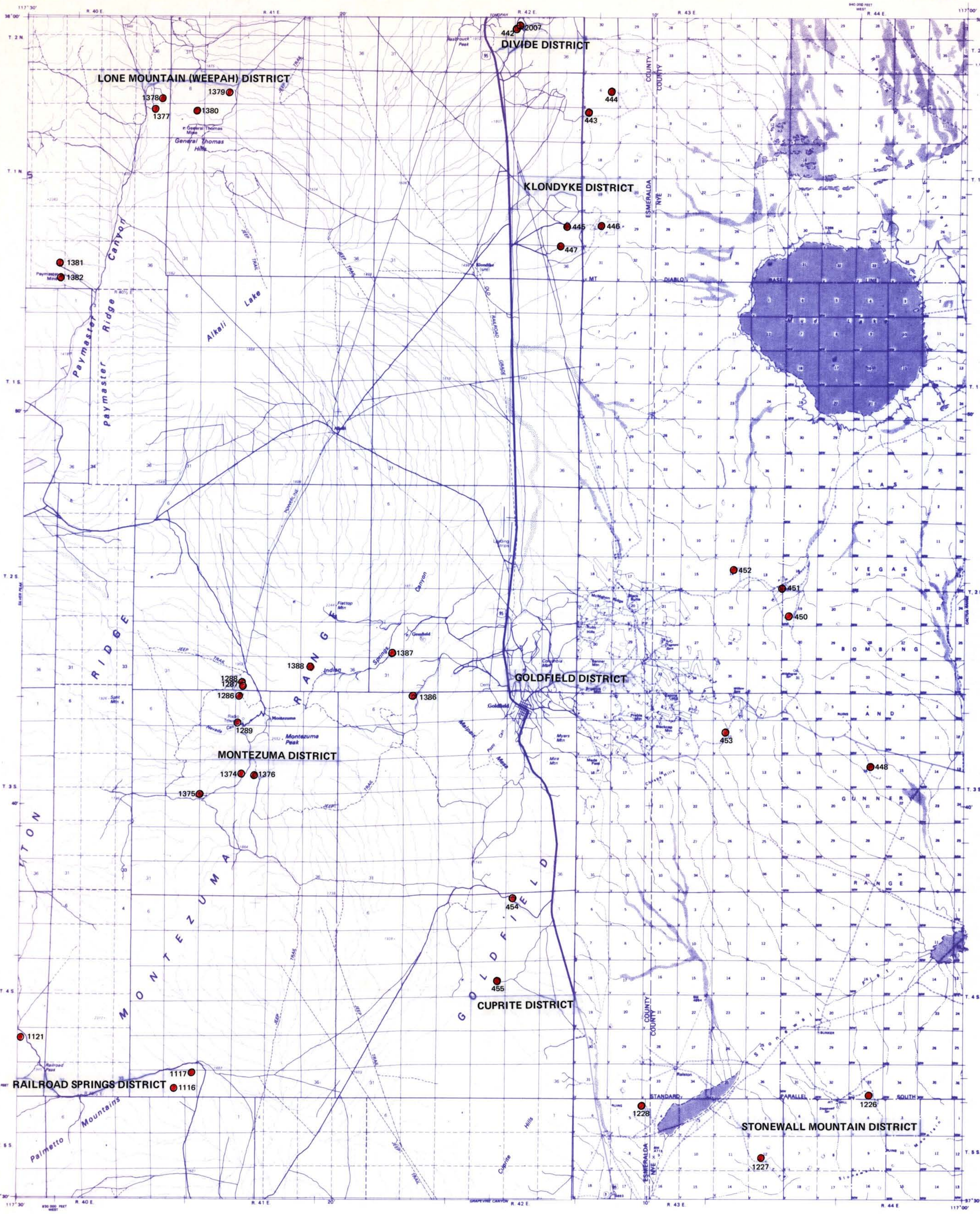
NBMF 83-11#2



WBMG 83-11 * 12 H

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

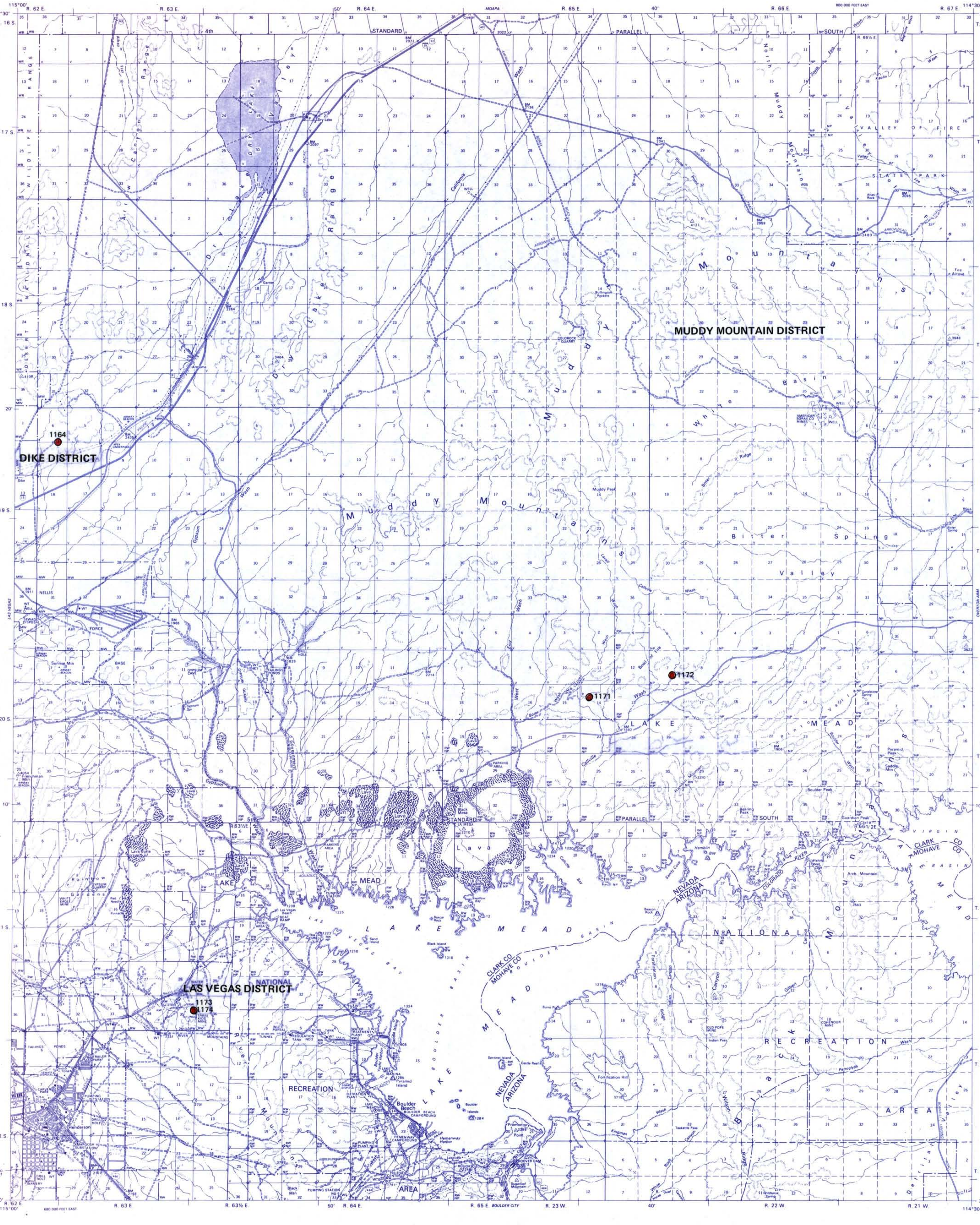
GOLDFIELD, NEVADA
30 MINUTE SERIES



GOLDFIELD, NEVADA
37-117-1
1969

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

HOOVER DAM, NEVADA-ARIZONA
30 MINUTE SERIES



SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

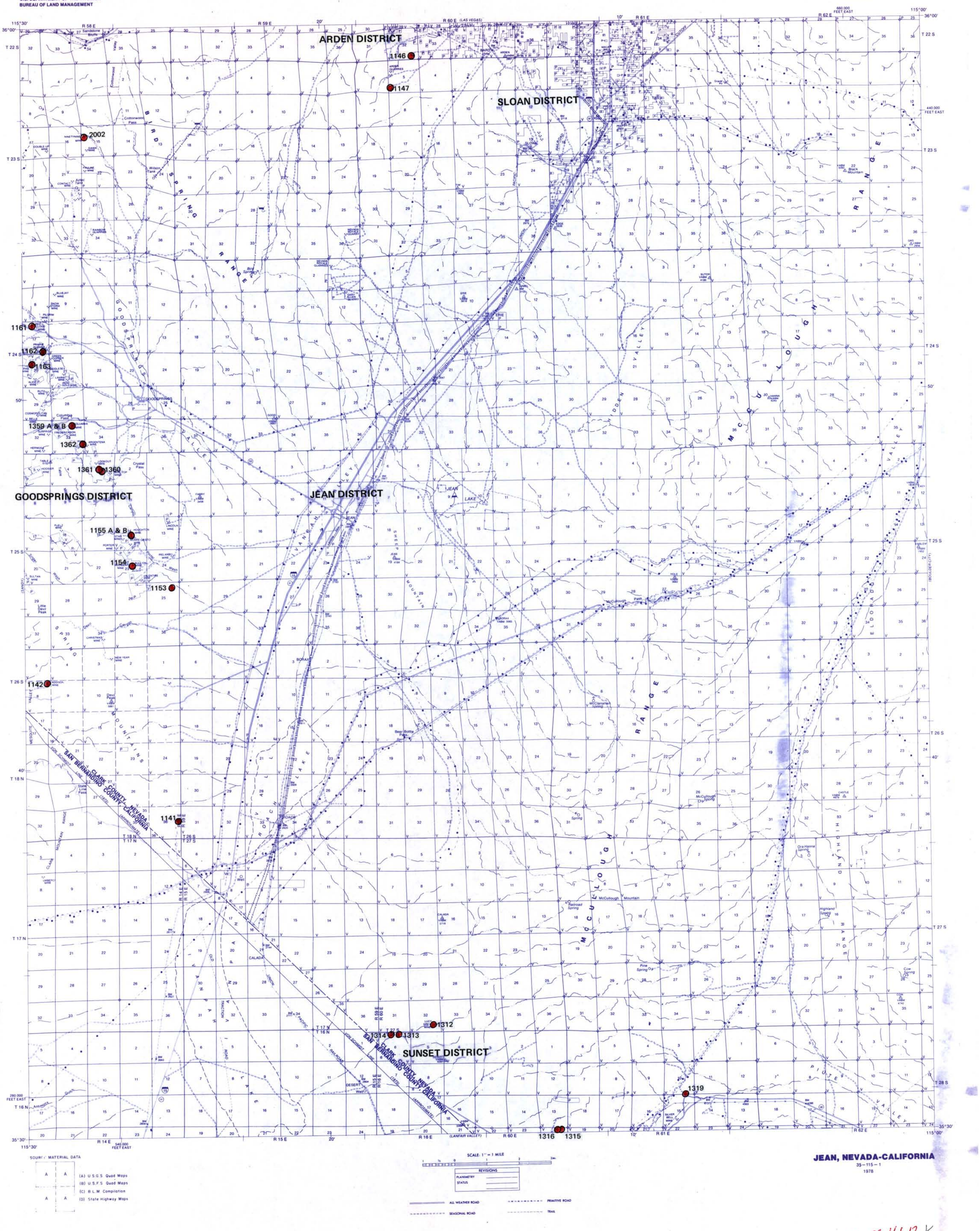
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD

HOOVER DAM, NEVADA-ARIZONA
36114-3
1973

NBMG 83-11 #12J

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

JEAN, NEVADA-CALIFORNIA
30 MINUTES SERIES

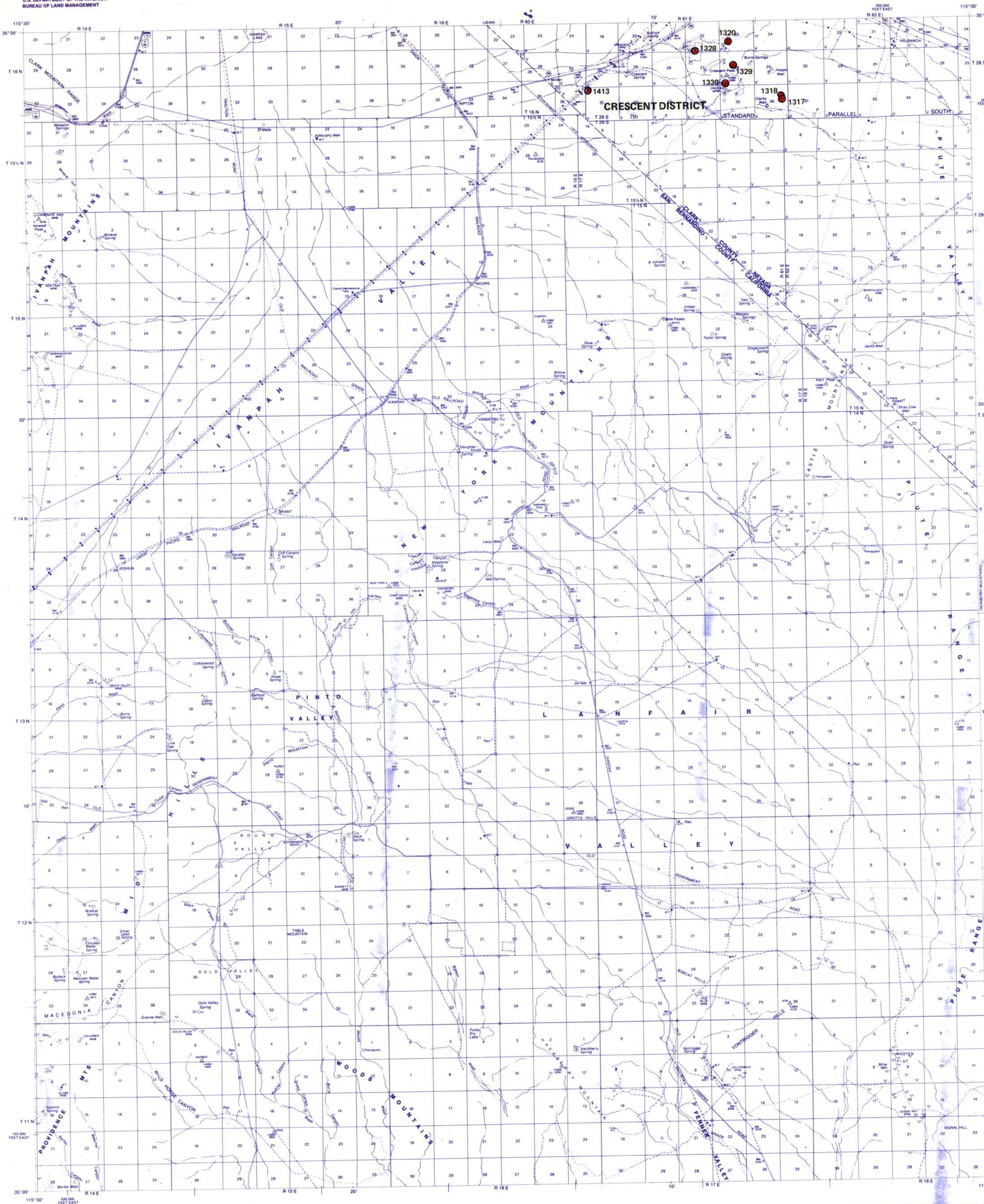


NBMG 83-11+12 K

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

LANFAIR VALLEY, CALIFORNIA-NEVADA

30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

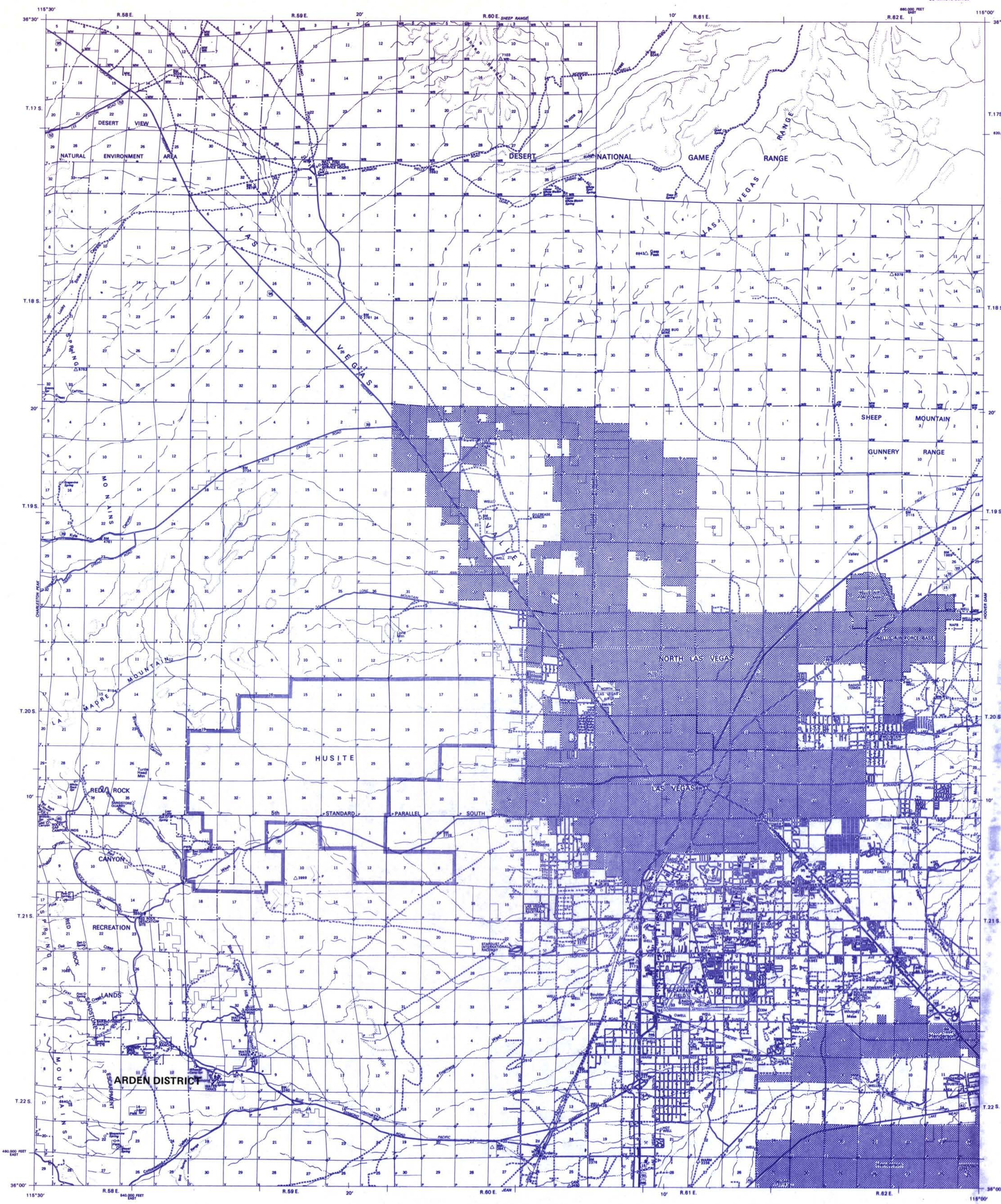
LANFAIR VALLEY, CALIFORNIA-NEVADA

36-115-2
1978

NBMG 83-11+12L

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

LAS VEGAS, NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

Section lines on this map are not based on reliable ground control and are subject to revision.

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

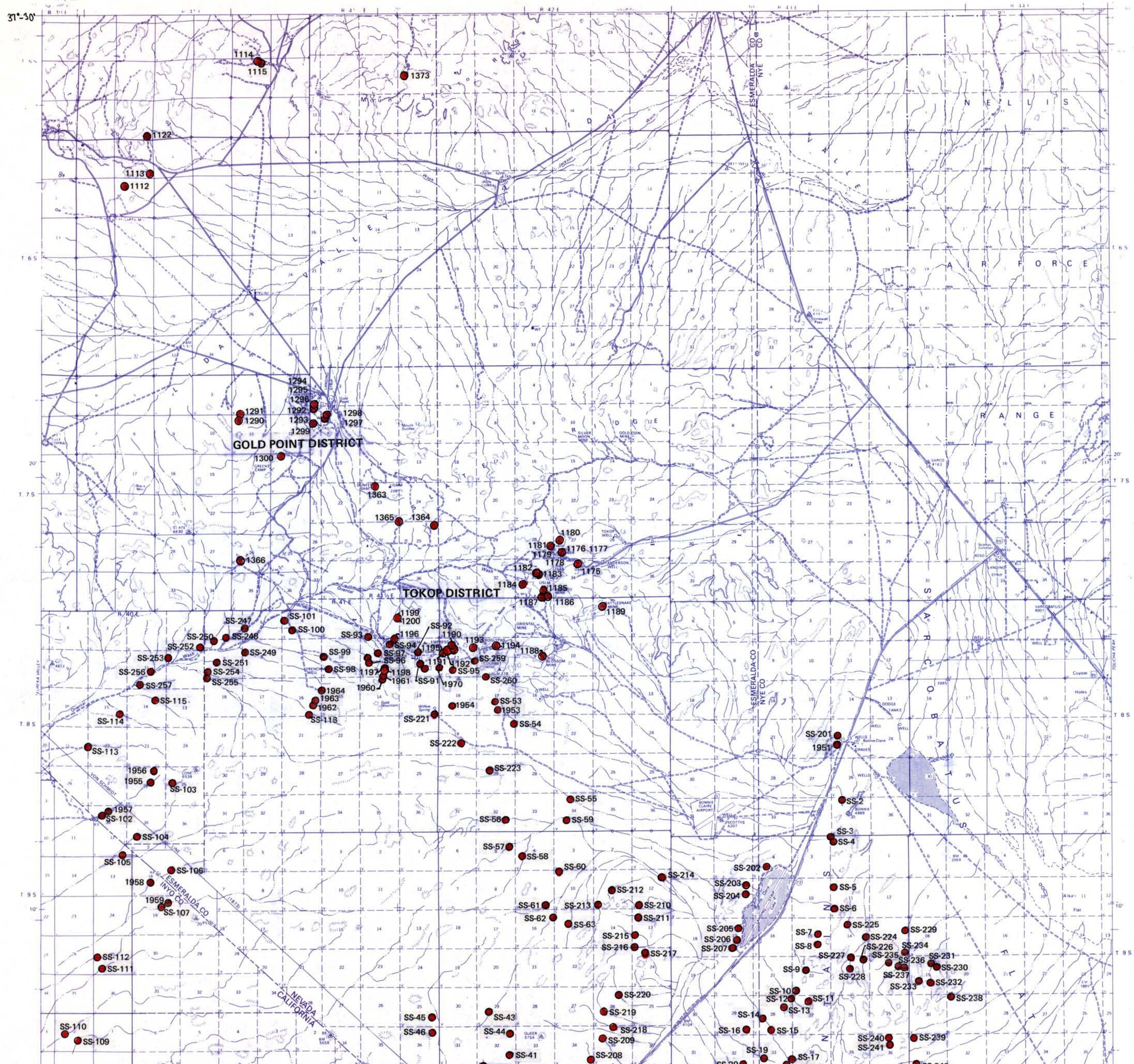
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

NO SAMPLE SITES RECORDED
LAS VEGAS, NEVADA
36-115-2
1971

NBMG 83-11 12M

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GRAPEVINE CANYON, NEVADA-CALIFORNIA



GRAPEVINE CANYON, NEVADA-CALIFORNIA

1971

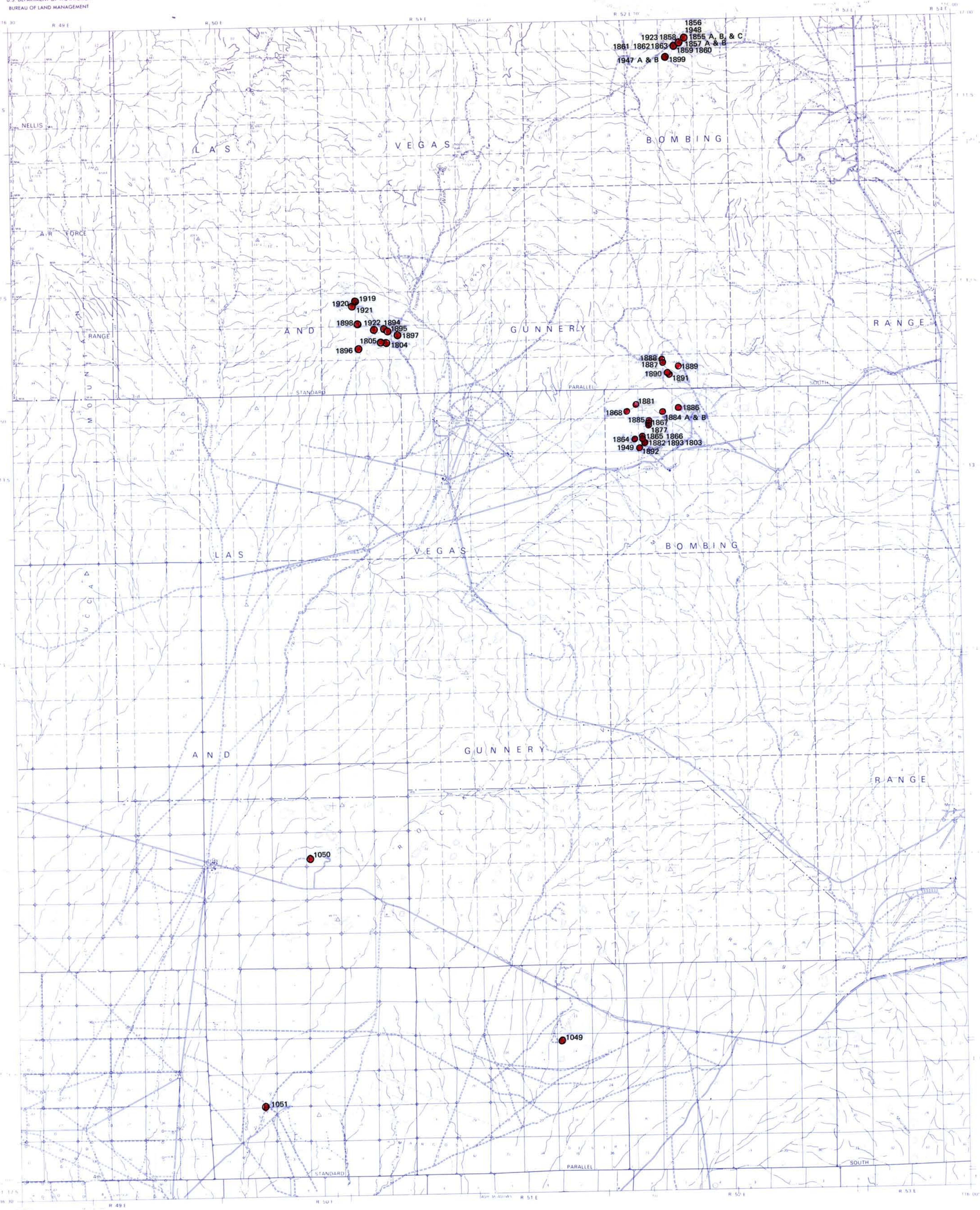
SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

LEGEND
ALL WEATHER ROAD
SEASONAL ROAD
PRIMITIVE ROAD
TRAIL

NBMG 83-11 #12N

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT



LATHROP WELLS, NEVADA

1972

LEGEND

ALL WEATHER ROAD

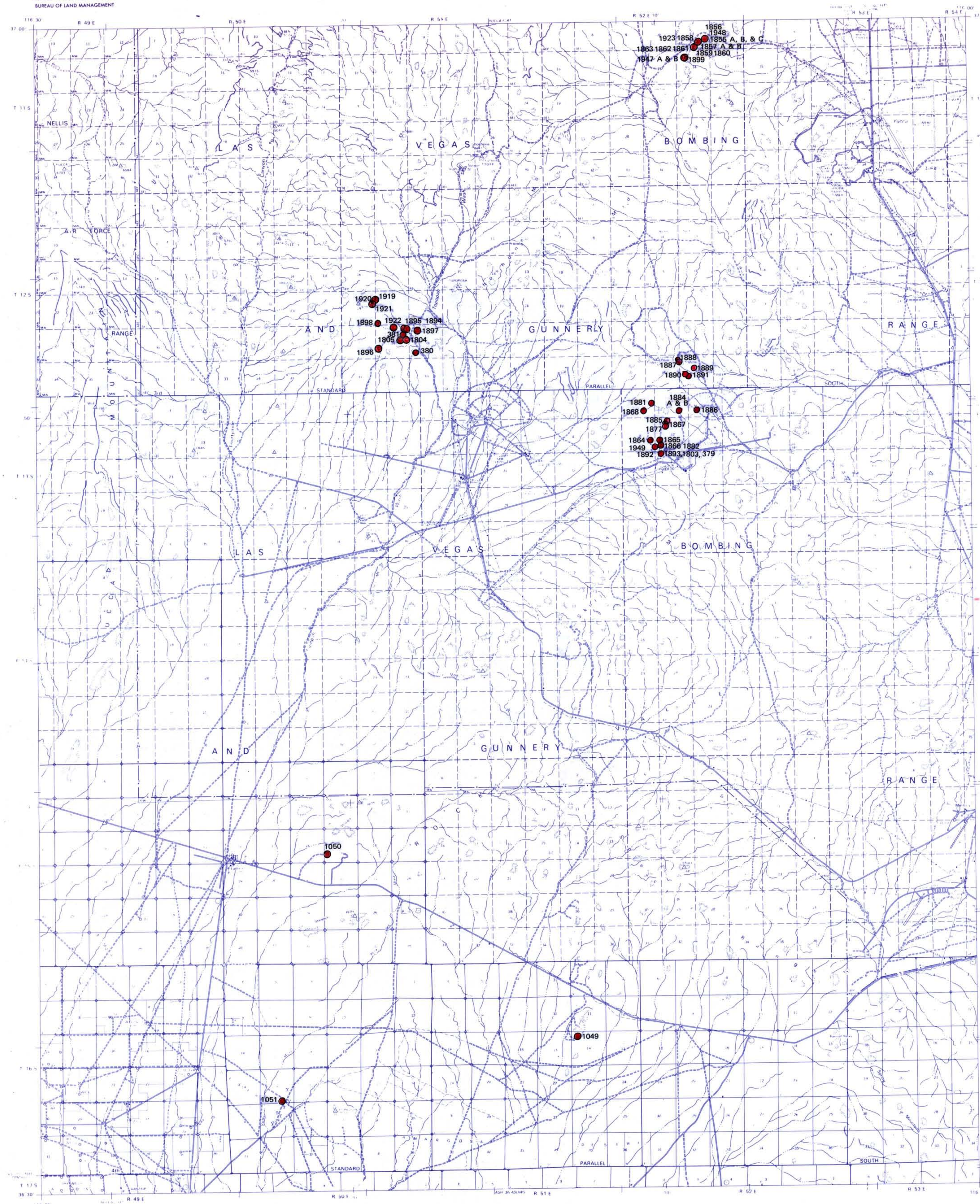
SEASONAL ROAD

PRIMITIVE ROAD

TRAIL

NBMG 83-11*120

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT



LATHROP WELLS, NEVADA

1972

SCALE 1" = 1 MILE

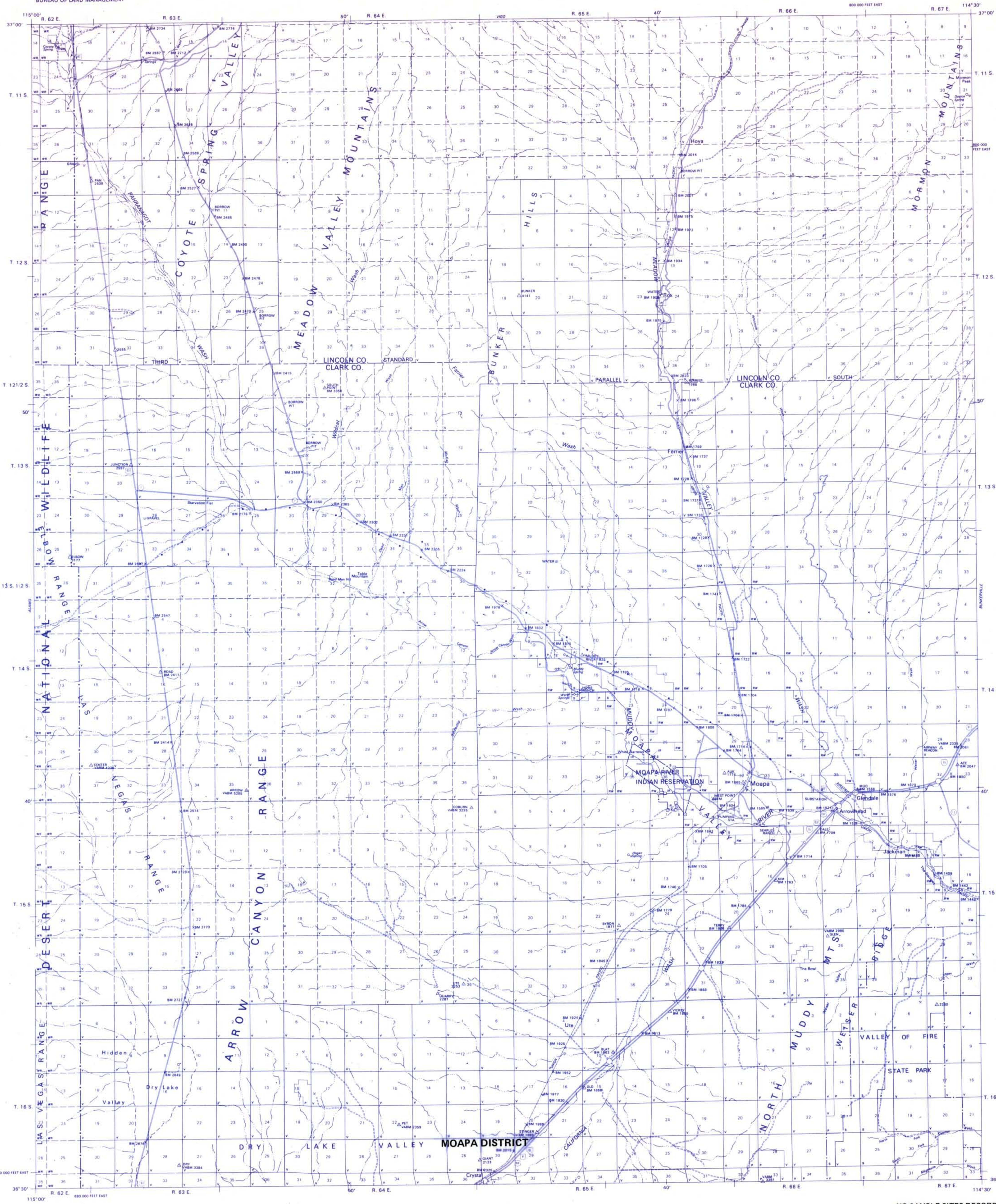
REVISIONS

LEGEND

NBMG 83-11 #12p

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MOAPA, NEVADA
30 MINUTE SERIES



NO SAMPLE SITES RECORDED
MOAPA, NEVADA
3630-11430-4
1976

SCALE: 1" = 1 MILE

SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps

REVISIONS
PLANIMETRY
STATUS

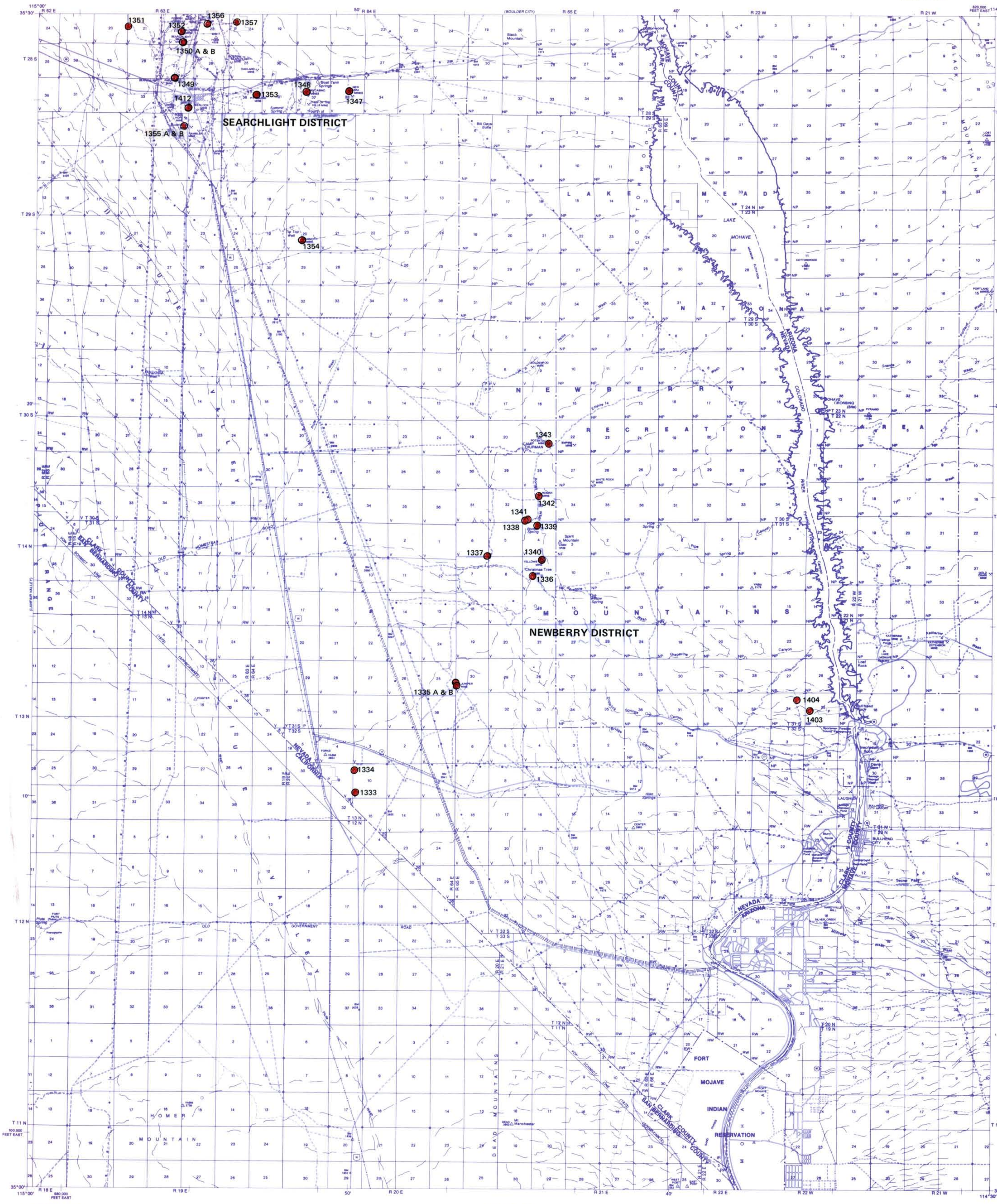
ALL WEATHER ROAD
SEASONAL ROAD
PRIMITIVE ROAD
TRAIL

NBMG 83-11 #129

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NEWBERRY MOUNTAINS, CALIFORNIA-ARIZONA-NEVADA

30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps

SCALE: 1" = 1 MILE

REVISIONS

PLANIMETRY
STATUS

ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

NEWBERRY MOUNTAINS, CALIFORNIA-ARIZONA-NEVADA

35-114-3

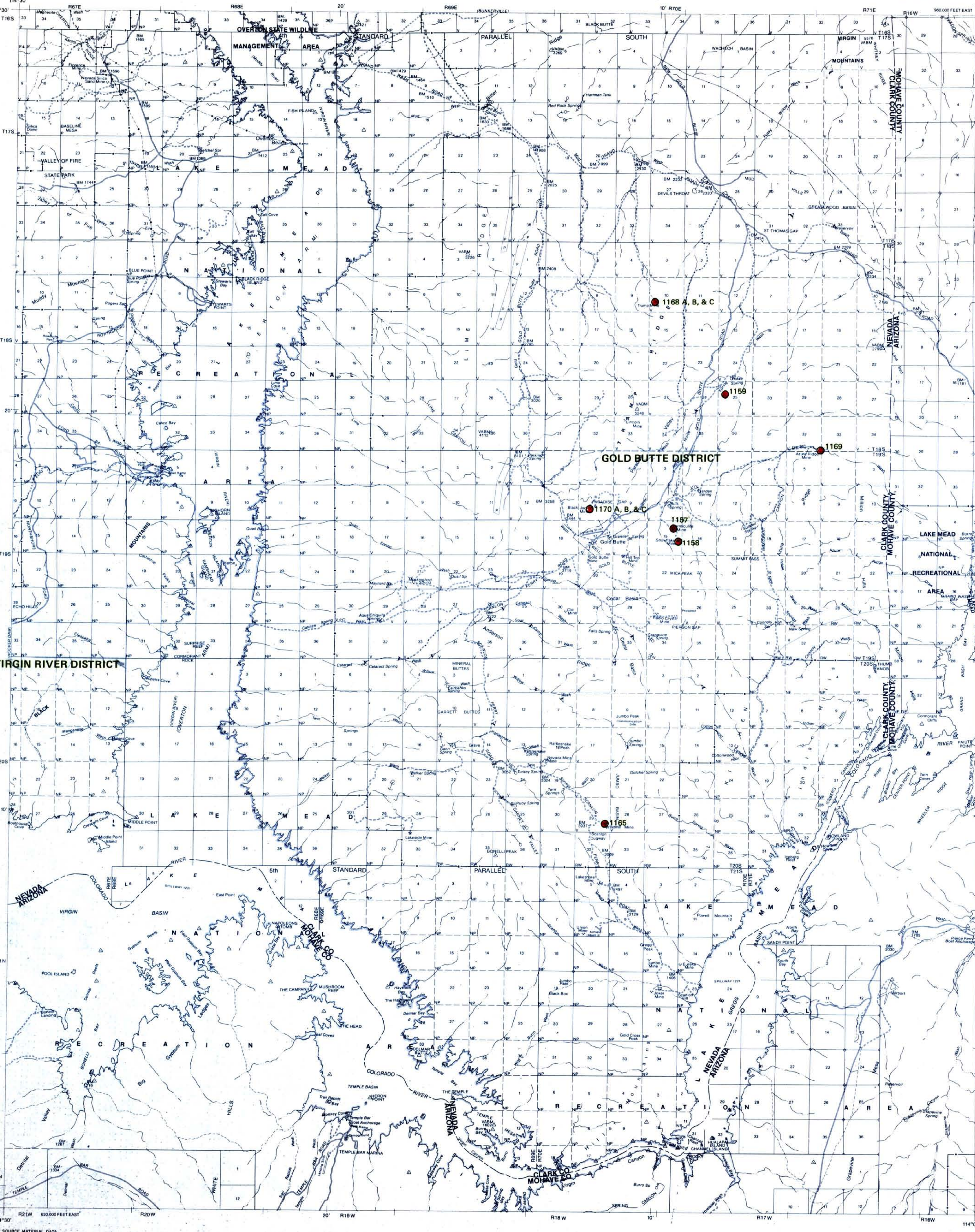
1978

NBMG 83-11+12R

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

OVERTON ARM, NEVADA

30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps

SCALE: 1" = 1 MILE

REVISIONS

PLANIMETRY

STATUS

ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

OVERTON ARM, NEVADA

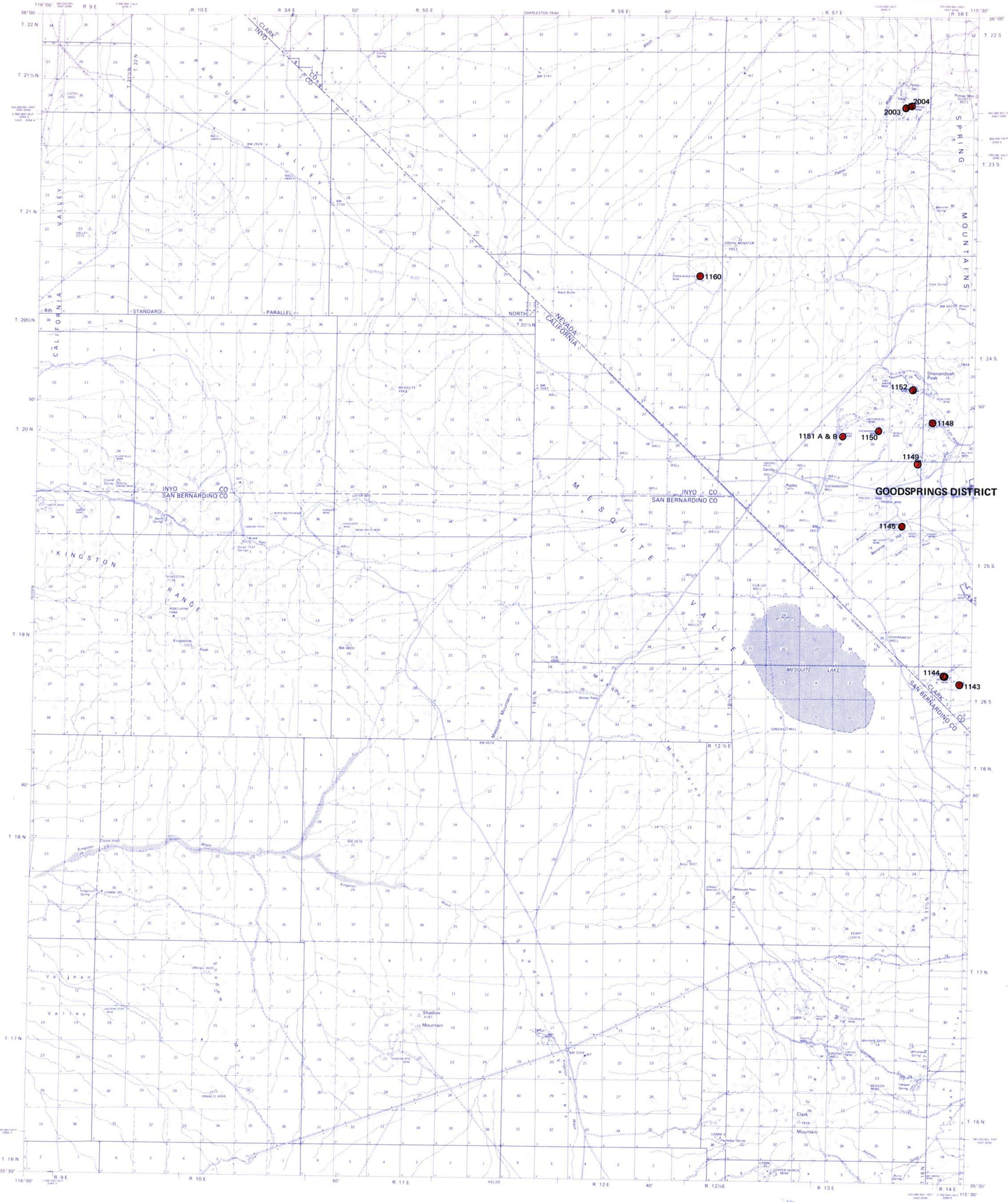
36-114-2

1977

NBMG 114 125 83

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SANDY, CALIFORNIA-NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA

SCALE 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

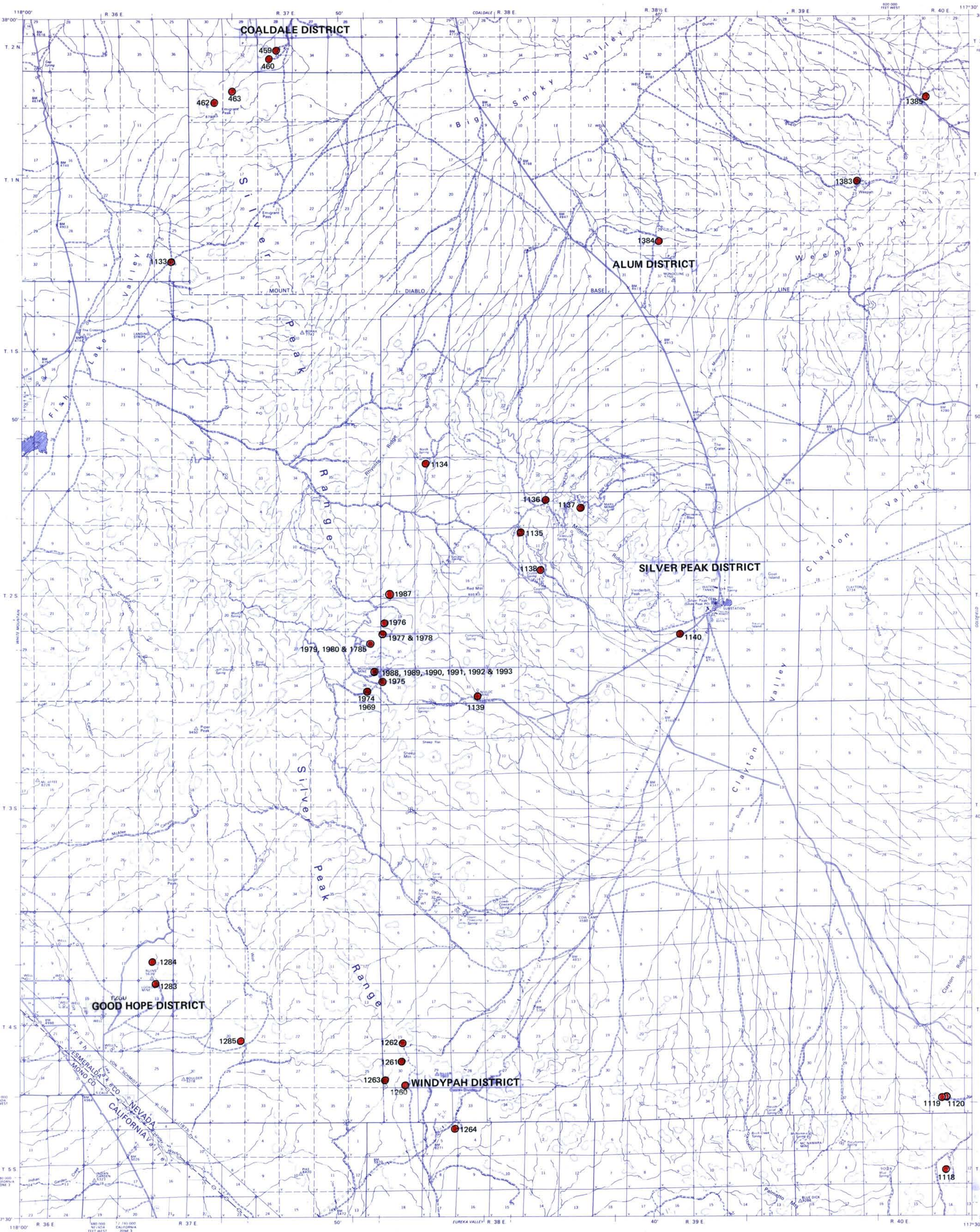
Section lines within the following townships are unreliable and should be used with caution:
T. 18 N. R. 10 E.
T. 22 S. R. 59 E.
T. 23 S. R. 59 E.
T. 24 S. R. 59 E.

SANDY, CALIFORNIA-NEVADA
35 115 B
1973

NBMG 83-11#12T

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SILVER PEAK, NEVADA
30 MINUTE SERIES



SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

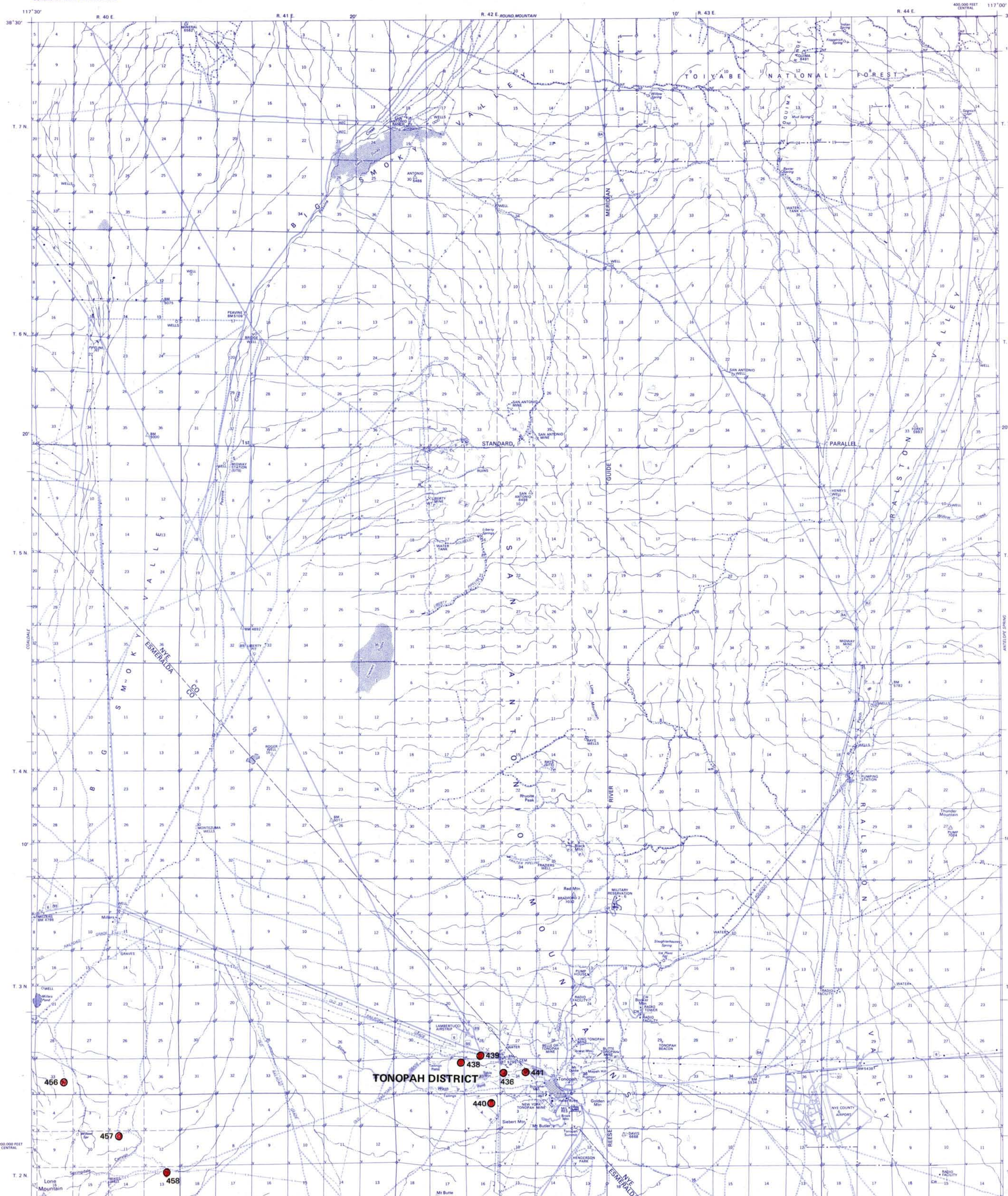
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

SILVER PEAK, NEVADA
3 117 4
1972

NBMG 83-11+12U

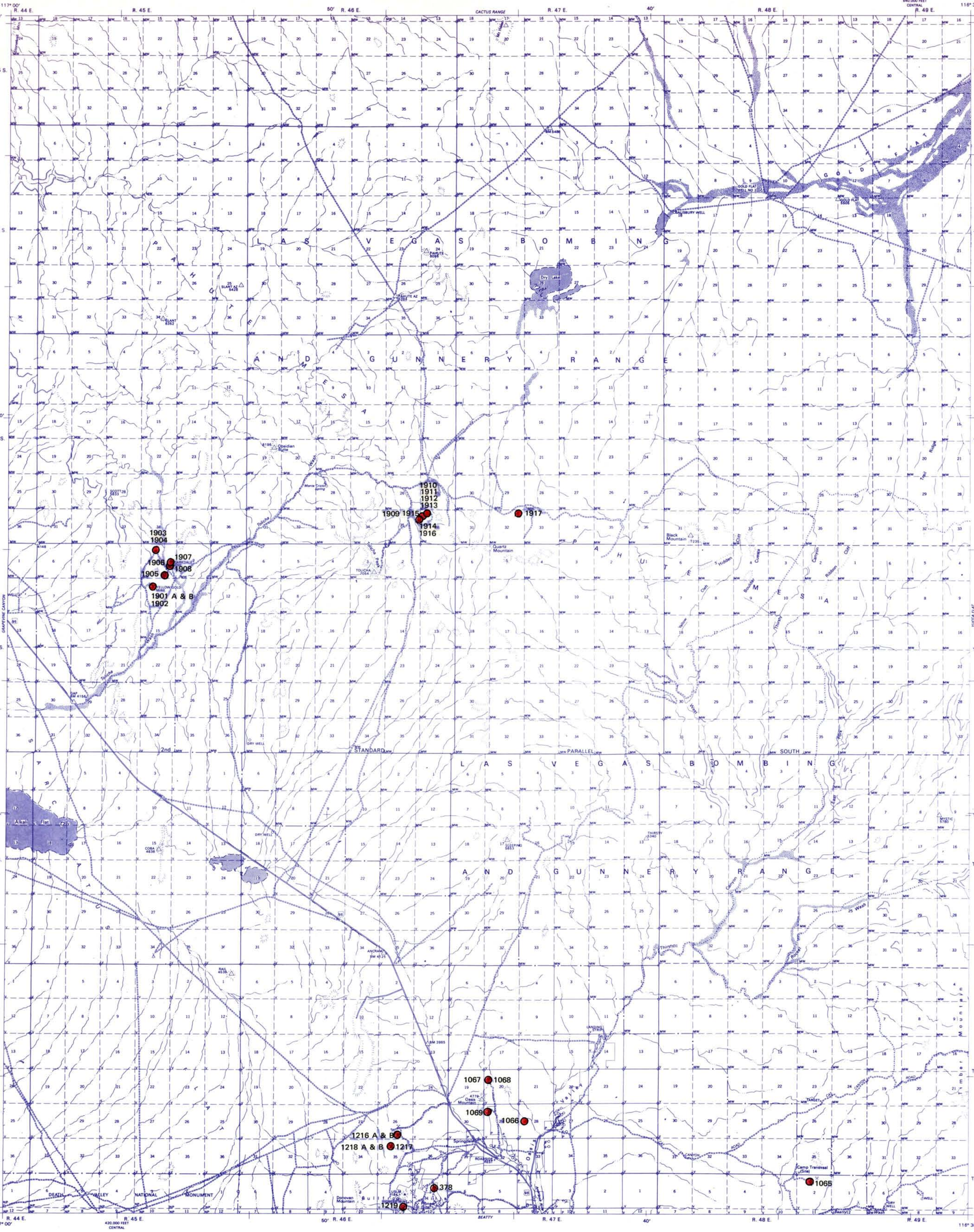
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TONOPAH, NEVADA
30 MINUTE SERIES



TONOPAH, NEVADA
38-117-2
1969

NBMG 83-11+12



SCALE: 1" = 1 MILE

SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

REVISIONS
PLANIMETRY
STATUS

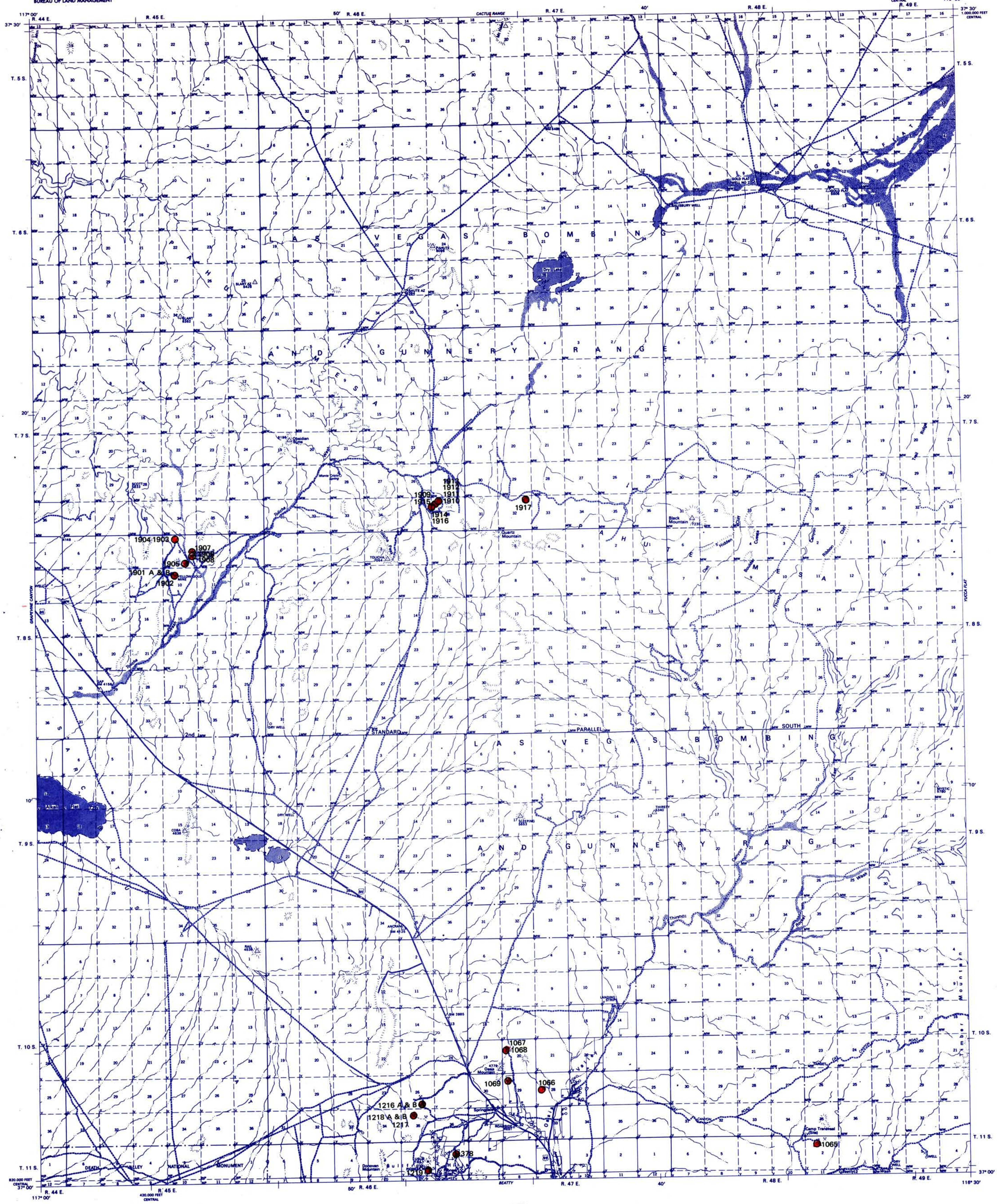
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

TOLICHA PEAK, NEVADA
37-116-3
1971

NBMG 83-11 + 12W

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

TOLICHA PEAK, NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA

(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photography

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

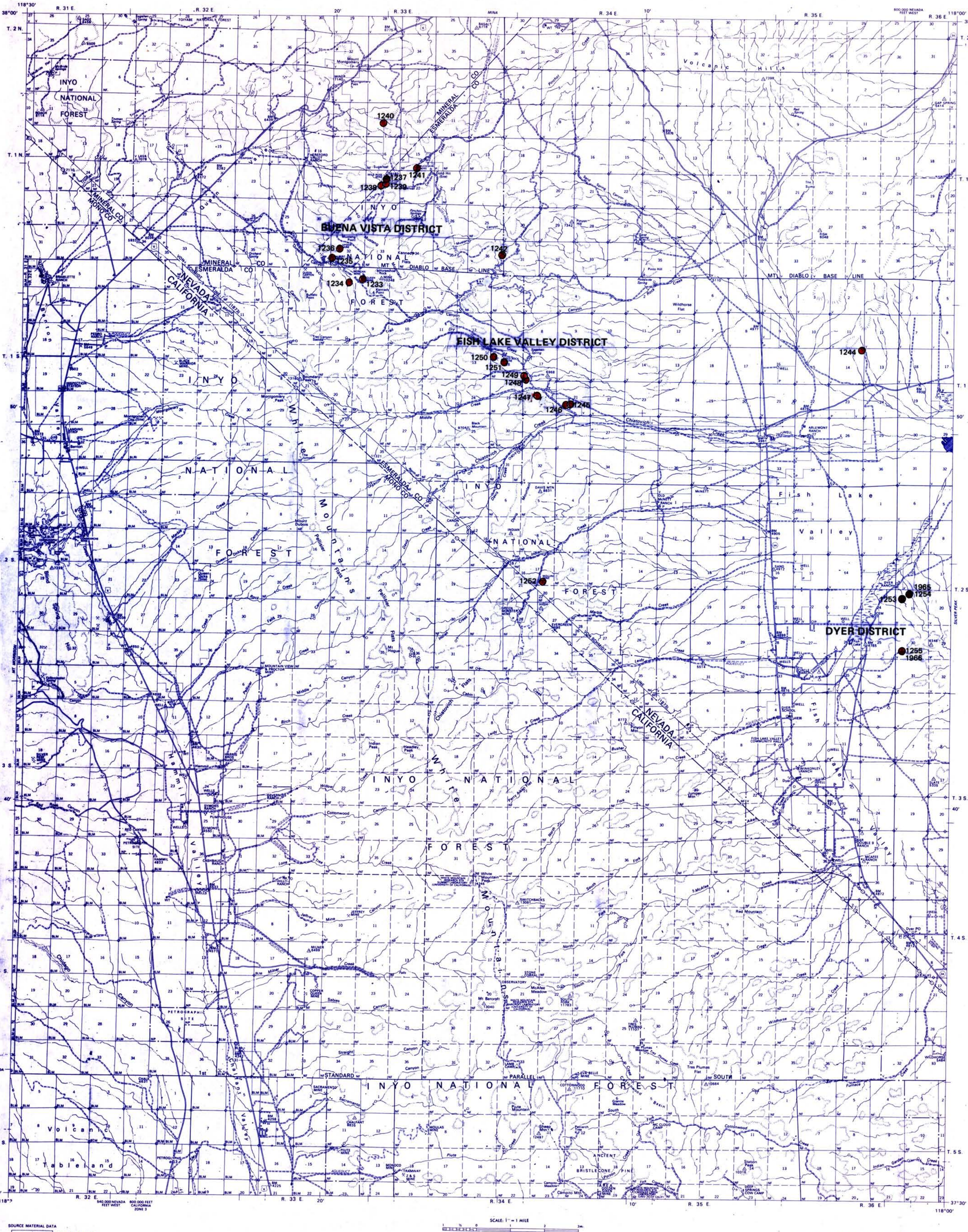
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

TOLICHA PEAK, NEVADA
37-116-3
1971

NBMG 83-11#12 X

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

WHITE MOUNTAINS, CALIFORNIA-NEVADA
30 MINUTE SERIES



SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.F.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Update With Photography

Section lines on this map are not based on reliable ground control and are subject to revision.

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

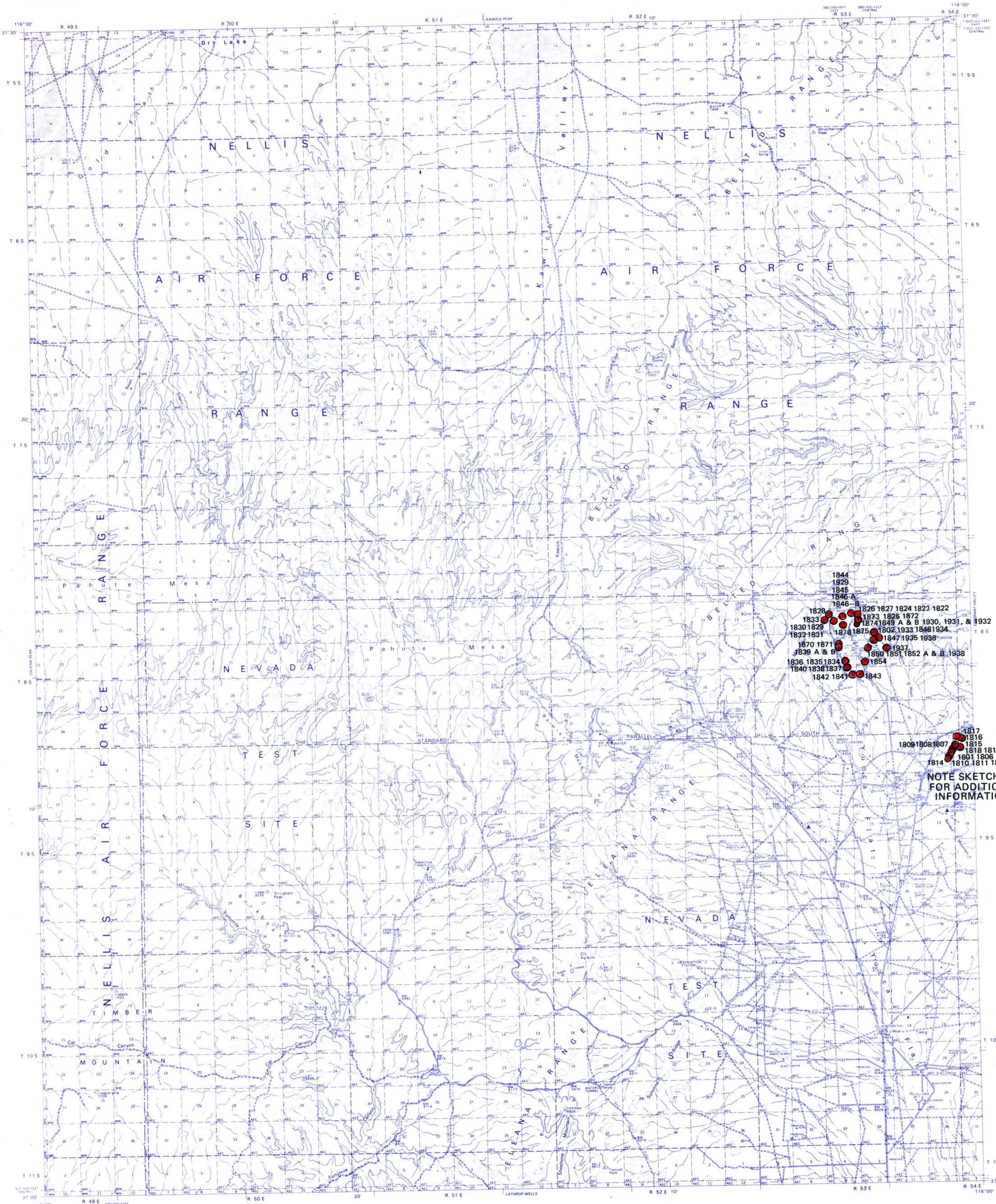
LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL

WHITE MOUNTAINS, CALIFORNIA-NEVADA
37-118-1
1971

NBMG 83-11#12

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

YUCCA FLAT, NEVADA
30 MINUTE SERIES



YUCCA FLAT, NEVADA
37-116-2
1971

SCALE: 1" = 1 MILE

REVISIONS
PLANIMETRY
STATUS

SOURCE MATERIAL DATA
(A) U.S.G.S. Quad Maps
(B) U.S.G.S. Quad Maps
(C) B.L.M. Compilation
(D) State Highway Maps
Source Material Updated With Photographs

LEGEND
ALL WEATHER ROAD
PRIMITIVE ROAD
SEASONAL ROAD
TRAIL