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Mineral Resources of Douglas, Ormsby, and Washoe Counties

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JAY A. CARPENTER, *Director*

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PREFACE

The first summary of all the State's mineral resources to be published was "Mining Districts and Mineral Rosources of Nevada" by Francis Church Lincoln in 1923. This was prepared by him while Director of the Mackay School of Mines of the University of Nevada and before the Nevada State Bureau of Mines came into existence in 1929. The Bureau has since distributed this authoritative 300 page book to a very appreciative public. Naturally, the treatment of each mining district was restricted to a short statement, but accompanied by an excellent bibliography.

In the '30's the United States Bureau of Mines started a study of the State as to the mining activities in each county. This work was carried out by William O. Vanderberg, and before this work was discontinued, by war necessity, there had been issued as information circulars, the "Reconnaissance of Mining Districts in Churchill County," I. C. 7093; "in Clark County," I. C. 6964; "in Eureka County," I. C. 7022; "in Humboldt County," I. C. 6995; "in Lander County," I. C. 7043; "in Mineral County," I. C. 6941; and "in Pershing County," I. C. 6902, or seven in all. While these reports covered only the active mines in those counties at that time, they have proved to be of great value to our Bureau and to the mining fraternity. They are now practically out of print, but our Bureau secured a few extra copies for loan purposes.

As Lincoln's figures on the gross value of the metal production from counties, districts, and mines was not accurate, our Bureau in 1943 issued a bulletin prepared by Mr. B. F. Couch, its secretary, giving this production data as taken from the tax statements required in the State since its early Statehood days.

By 1943 the geological bibliography in Lincoln's book was two decades in the past, therefore, in 1945 the Bureau issued a very complete combined, Bibliography of Geologic Literature by Vincent P. Gianella and Bibliography of Geologic Maps of Nevada Areas by Robert W. Prince.

In 1945, began the study to check more thoroughly on the early history of Nevada mining districts than given in Lincoln's book and to cover the interesting time since its publication, with the plan to issue county bulletins, covering first those counties not

covered by the United States Bureau of Mines Information Circulars.

In planning to make such an exhaustive search of mining literature on Nevada it was evident that for efficiency this data should be collected for all the counties at the same time. This entailed many long months of preparation before the writing of the first bulletin could be undertaken.

This work has been carried on by the Director and Secretary of the Bureau and by its engineers at various times, including Messrs. Fred L. Humphrey, Robert W. Prince, Byron S. Hardie, and Theodore D. Overton, with much assistance on questionable data from the members of the Mackay School of Mines staff. The writing of this particular bulletin was the careful work of Mr. Overton, which in turn was edited by the Director.

Particular attention was paid to finding and listing all technical articles published on Nevada mining since Lincoln's bibliography, and to consulting the Bureau's index and clipping file of mining news from Nevada newspapers, as the history of many mining properties can only be found therein.

This accumulated data, including United States Government and private reports, has been classified into county and district files, and while all this material cannot be included in the bulletins, reference is made to it, and it is readily available to all who may call at our office, thus avoiding a long and tedious search on their part. It also enables the Bureau to quickly obtain the information requested by correspondence.

In writing this bulletin on the Mineral Resources of Douglas, Ormsby, and Washoe Counties a special effort has been made to give data on idle properties that have been neglected or forgotten, and to give the names of engineers and of individuals who now have knowledge of or own them, in order to expedite the work of those seeking Nevada mining properties.

The accompanying maps were chosen and secured through the courtesy of the State Highway Department because of the inclusion of so much engineering data, to which has been added the location of the mining districts of the counties.

As most of these districts have no definite boundaries, their general locations are simply shown as small circles on the maps. Properties between districts are described with the closest one. Often two or more names are in common use for the same district and are so shown.

Mining districts existed before Nevada became a State. The

miners met and defined the limits of the district, made regulations, and appointed a recorder for the claims located. The State laws make no provision for legalizing such action nor for filing such information with the State, but only define the duties of the recorder. It would be presumed then that the counties by commissioner action would regulate the formation of districts and require copies of the organization proceedings and the election of recorders to be filed at the county court house. Inquiry of county officers, and a search of the list of all county records of Nye County made by the Historical Records Survey of the W. P. A., failed to find any such official information.

The United States Geological Survey issued a map in 1907 showing the mining districts in the West, and in 1912 issued Bulletin 507 on "The Mining Districts of the Western United States." This bulletin states: "for many districts these (district) limits are uncertain and vague and cannot always be ascertained, though the data are supposed to be on file with the county authorities."

The U. S. Government has no record of claims until patent is applied for. In the application the survey location is given with the name of the district. The latter is not checked, but the Public Survey Office in Reno has issued a map locating districts based upon that uncertain information. This varies greatly from the present Lincoln's "Mining Districts and Mineral Resources of Nevada."

The State law provides that claim location shall also be filed with the County Recorder, and with the present easier and faster means of travel of mail and persons, the older mining districts, with one or two exceptions, apparently no longer have duly elected recorders, and newer districts are seldom organized.

The only advantage of segregating claims into districts named after localities is the ease of finding the same on maps or in the field.

The geological descriptions in this bulletin are based almost entirely upon publications and maps of the United States Geological Survey, too numerous to mention individually.

The two best general references are the Bureau's two publications, Mining Districts and Mineral Resources of Nevada, by Francis Church Lincoln, and Bibliography of Geologic Literature of Nevada, by Vincent P. Gianella, with the Bibliography of Geologic Maps of Nevada Areas, by Robert W. Prince.

JAY A. CARPENTER,
Director Nevada State Bureau of Mines.

MINERAL RESOURCES OF DOUGLAS, ORMSBY, AND WASHOE COUNTIES

TOPOGRAPHY, GEOLOGY, AND MINERAL RESOURCES

The west border counties of Douglas, Ormsby, and Washoe form a transitional zone between the rugged and well-watered region of the Sierra Nevadas through a series of longitudinal depressions to the adjacent desert ranges. One of the most striking topographical features of this area is the long and abrupt frontal ridge of the Sierra Nevada Range, which can be followed northward from West Carson Canyon near Woodfords to the northern end of Washoe Valley opposite Mount Rose, at which point andesite flows begin to cover and obscure the continuation of the escarpment. This scarp imparts a youthful appearance to the associated topography due to steep slopes and the absence of appreciable quantities of talus at the fault base where the displacement is in excess of 4,000 feet, yet comparatively recent.

Northward from Mount Rose the volcanic hills show more mature erosion features, with alluvial fans sloping down to the level of the Truckee River and reaching from two to four miles into the Truckee Meadows. Evidence of glacial transportation of a part of this debris has been observed in the form of striated rocks or "shoes" and large boulders that have been transported far below their normal outcrop. For instance, the large subangular granitic rock on the north side of the highway just east of Verdi weighs in excess of 300 tons, which is over the normal carrying capacity of the Truckee River. Gianella (1947) found the outcrop of this rock formation several miles up the Truckee River Canyon.

North of Lake Tahoe the Sierra Nevada Range trends northwest to meet the Cascade Range, so that the region north of this point and east of the 120th meridian is wholly within the Great Basin and shows the typical Basin Range structure and topography. Immediately north of Reno the terrain slopes up to the crest of Peavine Mountain whose fault-block structure is the exception to the usual northward trend. In this case the prominent escarpment strikes northwest, and is roughly paralleled by both highway and railroad extending north from Reno.

North of the Truckee River Canyon the topographic highs shift eastward to the Virginia Range and thence to the Lake Range beyond Pyramid Lake. These ranges slope down to expansive playas that were once a part of Lake Lahontan, locally designated as Smoke Creek, San Emidio and Granite Creek Deserts, the latter being near Gerlach. Granite Range dominates the area north of this point for 35 miles, and as its name implies the range is composed mainly of granitic rocks with limited flanking areas of older sediments and later lavas. West of Granite Range expansive basalt mesas cover most of the terrain. In general, they slope gently westward and show abrupt east bluffs, typical of the western Basin Range structure.

In the northern portion of Washoe County beyond the Granite Range older sediments and intrusive rocks are not exposed. Where deformation and subsequent erosion have cut through the prevalent lava capping of this area, thick beds of tuff and lacustrine deposits are exposed. These formations are of recent origin and therefore not likely areas to prospect for common metal deposits.

This northern end of Washoe County is characterized by many expansive but shallow lakes and mud playas, which were noted by Capt. John Fremont in 1844 who conducted the first official exploration of this area.

The topography and geography of the three west border counties are shown on the following list of topographic quadrangle sheets: Long Valley, Granite Range, Wadsworth, Reno, Wabuska, Carson, Wellington, and Markleeville. These maps can be obtained from the office of the United States Geological Survey or purchased from distributors of drafting supplies in Reno.

The principal mineral resources occurring in these three counties are briefly as follows: Favorable mineralization occurs infrequently in the southwestern portion of this region, where the frontal ridge of the Sierra Nevada Range forms an almost continuous wall of granitic rock. Limited outcrops of Mesozoic sediments and metavolcanics[1] are exposed near Genoa and in the Voltaire district west of Carson City. East and southeast of Carson Valley, where intrusive rocks penetrate both the extensive Tertiary lava flows and older sediments of the Pine Nut Range, more and varied mineralization is exposed.

All of the major depressions immediately east of the Sierra Nevada scarp show lake deposits among the sediments, which

[1]Rock subject to more or less change in mineral and chemical composition through metamorphism.

were accumulated as a result of the interrupted drainage by tilting and displacement of block faulting. This orogenic deformation apparently became active in late Miocene time. These older drainage systems were similar to the present day Carson and Truckee Rivers, flowing northeasterly from high mountainous areas. Consequently, when the course of these streams was interrupted by uplift along the west face of the Pine Nut and Virginia Ranges, lakes were formed in the depressed areas west of the barrier. Judging from the intercalated lake beds, agglomerates, tuffs, and breccia exposed at the base of the Truckee formation, a condition of intermittent uplift, erosion, and volcanism existed at this time.

The lake deposits accumulated at that time and in the later

Figure 1—Marl Deposit near Zenobia, Washoe County, Nevada.

Lahontan period, have been commercially exploited for salt, sodium sulphate, marl, and diatomaceous earth. Sandstone was mined from the State Prison quarry for the erection of the Capitol and other State buildings. This endurated sediment is also a source of interesting fossil bird and mammal tracks which indicates the types of life existing on the shores of these ancient lakes.

Southeast of Carson Valley contact tungsten, copper-gold replacements, with some silver-lead and zinc deposits, occur on the west slopes of the Pine Nut Range, while copper and gold are the principal metals found on the east slope. Corundum and

andalusite occur in the Buckskin district, and auriferous gravels are found near Mount Siegel. Amorphous graphite occurs in the schist formations southwest of Carson City, together with silver-bearing veins and limited copper contact mineralization.

Impure lignites occur in the Tertiary beds of the Peavine district near Verdi, which, according to Palmer (1936), contain a high ash and moisture content. A similar formation situated southwest of Reno was unsuccessfully tested for petroleum by the Washoe Oil and Development Company. The well, according to Anderson (1908), was drilled on section 21, T. 19 N., R. 19 E.,

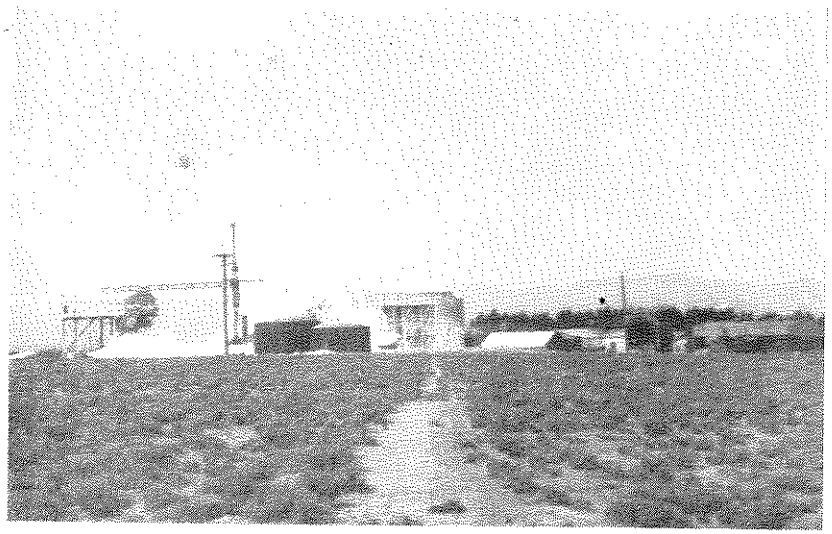

Figure 2—Gypsum Plant of the Pacific Portland Cement Co., near Gerlach.

and encountered a streak of lignite at 1,545 feet. The bore hole was bottomed in "blue shale" at a depth of 1,890 feet.

Immediately northwest of Carson City in Little Valley an occurrence of Tertiary river gravels has been exploited for their gold content, Reid (1911). The uppermost segment of this channel traverses the ridge between Lake Tahoe and Little Valley at an elevation in excess of 8,000 feet, while lower segments situated near the south end of Washoe Valley lie just above 5,000 feet, indicating an aggregate displacement in the channel of over 3,000 feet.

East and northwest of Washoe Lake metallic deposits are found in the Jumbo and Galena districts. Gold and silver occur sparingly in both localities; however, in the Galena deposits lead-zinc ores occur, accompanied with accessory minerals of arsenic, copper, and iron sulphides.

Steamboat Springs, situated nine miles south of Reno, is an interesting deposit, not because of the limited production of mercury, sulphur, and clay, but for the unique deposition of many minerals in the fissures and sinter accumulating over these thermal springs. It is literally an active geological laboratory which has and will continue to contribute valuable information regarding hydrothermal mineral deposits, White (1947).

North of the Truckee River, Peavine, Wedekind, Pyramid, and

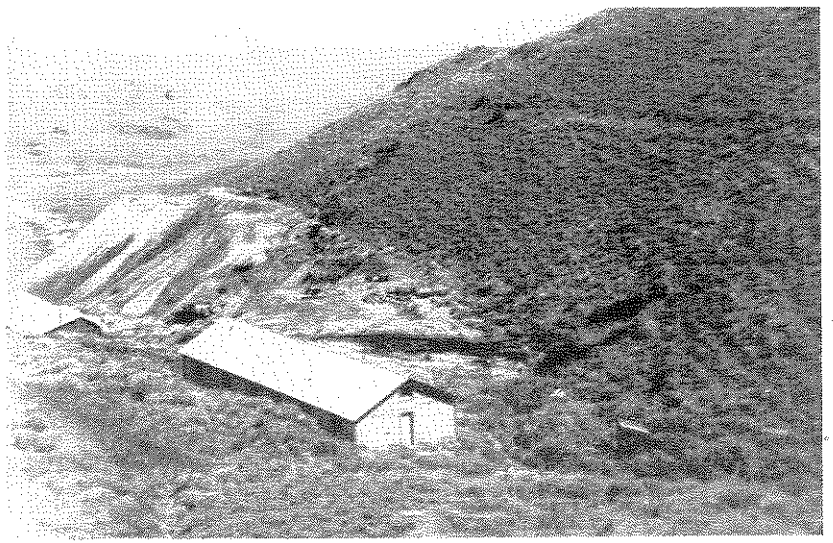

Figure 3—The Leadville Mine north of Gerlach.

Olinghouse districts have been mined fairly consistently from the time of their discovery. Peavine district contributed copper, gold, silver, and some lead. Wedekind, two and one-half miles north of Sparks, was a producer of high-grade secondary silver ores. The adjoining Arkell property was mined for silver-lead and zinc ores. The Pyramid district, situated approximately six miles southwest of Pyramid Lake was exploited for copper, silver, gold, and lead minerals, occurring in vein deposits in Tertiary lavas. Tungsten ore containing scheelite was found on the northeast side of Wilcox Canyon, Hardy (1947).

The Olinghouse district in southeastern Washoe County and eight miles west of Wadsworth, has been a steady producer of precious metals and a haven for independent lessees working the high-grade streaks of gold and silver ore.

Interesting high-grade specimens of ore were obtained by the Mackay School of Mines from the Gus Schavee property, which

contained mercury, gold, silver, and tellurium. The intense alteration of the ore made determination of the minerals difficult, but they are believed to be a mixture of coloradoite and petzite, Palmer (1947).

Chara marl deposits occurring in valleys adjoining Pyramid Lake and situated northwest of Sutcliffe, near Zenobia, and at Sand Pass are being mined for their calcium content for use as soil neutralizers and conditioners. The deposits mined to date all lie approximately 100 feet above the present surface of Pyramid Lake and were laid down in the now extinct Lake Lahontan, Humphrey (1945). (Figure 1.)

Another product of the Lahontan Basin is the salt and sodium sulphate beds which lie on the west side of Smoke Creek Desert near Buffalo Springs, from which 1,500 tons of salt were produced prior to 1885. This crude salt was used mainly for treating silver ore in western Nevada by the chloridizing process.

Remnant areas of Mesozoic sediments and metamorphic rocks occur over widely separated areas near and northward from Gerlach, where the gypsum processing plant of the Pacific Portland Cement Company is located. (Figure 2.) The quarry, which supplies this plant, is just over the Pershing County boundary in an isolated area of older sediments. Numerous other contact deposits in which scheelite occurs are situated in the Granite Range north of Gerlach.

A small occurrence of native sulphur, situated southwest of Gerlach, was mined several years ago.

Leadville, situated 38 miles north of Gerlach has a production record of over half a million dollars in silver-lead ore which was produced from quartz veins in Tertiary andesites. (Figure 3.)

Low-grade cinnabar occurs associated with Tertiary andesite flows and tuffs in the Lone Pine district, situated in northern Washoe County near the southern border of Sheldon Wild Life Refuge, Ross (1941).

DOUGLAS COUNTY

LOCATION AND TOPOGRAPHY

Douglas, one of the nine original counties created by the Nevada Territorial Legislature, November 25, 1861, lies on the California border at the abrupt change of direction of the State line from south to southeast, thus bordering on Lake Tahoe and thence southeasterly to Topaz Lake. It is one of the smaller counties of the State, with Ormsby on the north and Lyon on the east.

The east frontal ridge of the Sierra Nevada rises rather rapidly from Lake Tahoe to an elevation of over 9,000 feet and then plunges abruptly to the Carson Valley floor where the elevation is generally just below 4,700 feet. East of that valley a series of rolling hills rise gently to culminate in a series of peaks at the crest of the Pine Nut Range of Mount Como, Mount Siegel, Oreana Peak, Bald Mountain, and Eagle Mountain, all 9,000 feet or more in elevation. The east side of the range drops steeply to Smith Valley and is cut by a number of deep narrow canyons, the largest of these being Red Canyon, for which the district is named. Southward the Pine Nut subsides to a low transverse pass, beginning near Mountain House at an elevation of 5,500 feet and traversing easterly to the West Walker Canyon where that river flows from Antelope Valley into Smith Valley. South of the Canyon the topography again rises rapidly to the crest of the Sweetwater Range.

The majority of snow and rain is precipitated on the west of the Pacific slope of the Sierra Nevada mountains, due to their barrier position, but normally there is sufficient runoff which reaches the Carson River drainage to furnish an abundant water supply for the western portion of Douglas County. Precipitation is, however, limited in the eastern portion of the county, and because most of the mineral resources are situated in this area there is created a critical shortage of water for mining purposes.

GEOLOGY AND ORE DEPOSITS

With the exception of limited exposures of sediments in the Carson Valley, which is filled with recent and Pleistocene gravels and coarse clays, the rocks exposed in Douglas County are almost wholly composed of igneous members. On the west border, granitic intrusives of the Sierra Nevada dominate that area with

only occasional remnants of older metamorphosed sediments outcropping along the lower flank of the range, such as the slates and schists exposed near Genoa.

A wide variety of flow rocks are exposed in the northern area of the Pine Nut, mostly andesites in which occur several ferromagnesian minerals, including augite, biotite, hornblende, and hypersthene. Where erosion has cut deeply into the lava series there is exposed coarser, more massive and porphyritic forms. Granular rocks occur on the eastern scarp and near the summit of the main range, which are, according to Spurr (1903), hornblende-biotite granite with occasional porphyritic alaskite.

About half way down the slope, in Eldorado Canyon, there are hills of gently folded gravels and clays, derived almost entirely from the andesites. They are exposed best in the canyons, where they are overlain unconformably by 8 to 10 feet of stratified boulders and soil, which represent the recent stream deposits. Farther down the canyon a water-laid breccia with well-rounded andesite boulders is exposed in the stream cuts. Southward toward Wellington the central ridge of the Pine Nut has a massive aspect and is made up of granular rocks. Where the road from Gardnerville to Wellington crosses the range, hornblende-biotite andesites occur on the western slopes, which is similar to the formation in Eldorado Canyon. Near the summit of the low pass on this road are exposed massive volcanic breccia with horizontal bedding and containing pebbles of rhyolite only. Above the breccia are beds of rhyolitic tuff, coarse volcanic grit, and overlain by conglomerate with large well-rounded pebbles of biotite rhyolite. A variety of rhyolite flows are exposed north and east of the pass, with detrital fans below. These are essentially quartz-feldspar rocks, generally containing biotite, and range from very fine-grained rhyolite to coarse alaskite. West of this old granite-rhyolite area, similar andesite flows come in above the siliceous rocks.

According to Hill (1915), the south end of the Pine Nut Mountains is composed mainly of quartz-monzonite, granular in texture that is intrusive into sediments supposedly Triassic in age. A zone of metamorphism in some places marks the contact between the intrusive and the sediments. A typical exposure of this intrusive is pink to pink-gray, coarsely granular to porphyritic in color and texture. Pink orthoclase phenocrysts are the principal crystals in the porphyritic variety. Three distinct kinds of north striking nearly vertical dikes cut the quartz monzonite of this area. The oldest type is a fine-grained aplitic rock, the next

younger dike is a light gray distinctly porphyritic rock, and the youngest dikes are very dark, fine-grained diabase, which at many places cut both the older types.

Typical contact metamorphism occurs at the mouth of Red Canyon where a 10-foot dike of quartz monzonite porphyry cuts a massive limestone. The dike trends northwesterly and the metamorphosed area is about 100 feet wide, where the calcareous rocks are altered to epidote and calcite, with the introduction of quartz.

Recent and Pleistocene gravels occur in the area southeast of Gardnerville at an elevation generally between 6,000 and 6,200 feet above sea level. Placer gold in the Mount Siegel district occurs at an elevation of 7,100 feet in these gravels.

Three types of ore deposits are found in the three districts in the southern end of the Pine Nut. Contact-metamorphic deposits, largely copper bearing, occur at the contact of the quartz monzonite intrusive and the Mesozoic sediments. Gold-bearing quartz veins occur in the quartz monzonite and were among the earliest deposits worked in this area. Also associated with the intrusive quartz monzonite, are occasional replacement bodies in the sedimentary beds. To a lesser extent ore deposits occur in the Tertiary andesite.

The veins in the quartz monzonite area strike north or east about parallel to the jointing of the rock. In general, the north striking veins are nearly vertical, but in some cases they dip steeply to the west, while the east striking veins dip to the south. In general, the veins average from six to ten inches in width, while a few range from a fraction of an inch to two feet. In some places several, closely spaced, nearly parallel veins may be exposed in a single tunnel. These are, as a rule, not strongly mineralized, but small pockets of workable ore occur in most of these veins. White quartz and minor amounts of pyrite and specular hematite are the chief constituents of the veins. In the richer pockets, galena and chalcopyrite are associated with the pyrite.

HISTORY AND HIGHWAYS

Prospecting and mining development was stimulated in all the adjacent areas by the Comstock excitement of the '60's and '70's, so that every noticeable quartz outcrop was located and worked with generous development funds. Probably the first ore mined from the southern Pine Nut area was taken from the Longfellow vein, situated on the west slope near the summit and opposite to Red Canyon. This ore was extracted in 1862 and hauled to the

Comstock mills for treatment. Later the Winters ore body was discovered immediately north of Oreana Peak, in 1872, and for a time rich surface ores were mined. The Ruby Hill mine, located in 1908 by Mr. Walker, is situated in a south arm of Mill Canyon, three miles northeast of Bald Mountain. Hill (1915), states the Ruby Hill mine was shipping ore in the summer of 1912 and development was in progress at the Winters, Longfellow, and Lucky Bill groups in Red Canyon District. The Imperial and Mountain Gold mines were active in the Wellington District at this same time.

Several reduction works were erected in the county during the early mining activity. A small mill built in 1872 for the Longfellow mine was equipped with five 100-pound stamps and an amalgamation plate. The South Camp property formerly operated a small two-stamp mill in the Wellington district. Cyanide milling was introduced at the Winters property with a three-stamp battery and four leaching tanks capable of treating 25 tons of ore daily. Amalgamation and cyaniding practice were both introduced at the Pine Nut Consolidated property where the mill was equipped with crusher, rolls, amalgamation plates, vanners and two 50-ton leaching tanks.

In recent years the mining activity in this area has been intermittent, depending upon metal price fluctuation and the demand for metals. Just prior to 1931 tungsten ore was discovered by R. C. Washer in the Gardnerville district near the Ruby Hill copper mine in the tactite areas of contact-metamorphism on the west slope of the Pine Nut, with considerable subsequent production.

Andalusite and corundum were discovered in the Buckskin district and several former metal claims were relocated during August 1944. The locators, James S. Adams and Alex Castaing, of Yerington, and Judge Clark J. Guild of Carson City, did some preliminary surface prospecting and later interested the Federal Bureau of Mines in making beneficiation tests. According to Binyon (1946) the material is suitable for the preparation of high-alumina refractories, but to date no production has been made. The presence of peat in the Minden-Gardnerville area has been known for many years. A recent discovery was made in the course of excavation on the M Bar C Ranch when soil conservation ditches were blasted open late in 1946. It is reported to be three to ten feet in thickness and may prove of value.

U. S. Highway Route 50 approximately traverses the north and west border of Douglas County and U. S. Route 395 and State

Routes 3 and 37 serve the central portion of the county with good paved highways. Connecting with these routes are truck trails to all the established mining districts in this area. Minden, the county seat, is the southern terminus of the Virginia and Truckee Railroad, which connects the communities of Minden and Gardnerville with the mainline railways.

A high-tension electric power line cuts across the north boundary line of the county and extends south to Minden and Gardnerville. On the east boundary there is a transformer station between Buckskin and Wellington.

PRODUCTION

Official recorded mineral production for Douglas County, by districts, from 1881 to 1940, inclusive, as compiled by Couch (1943), and brought up to 1947, follows:

Districts	*Tons*	*Gross yield*
Buckskin	586	$81,035
Gardnerville (Eagle)	1,002	29,448
Mountain House (Holbrook)	1,360	31,767
Mount Siegel	57	3,510
Red Canyon	2,006	102,818
Wellington (Silver Glance)	67	6,099
Unknown	.....	64,495
		$319,172

MINING DISTRICTS

BUCKSKIN (Smith Valley)

The Buckskin district lies on the east slope of the Pine Nut Range near the east border of Douglas County. It is adjoined on the east by the Yerington district in Lyon County and on the southwest by the Mount Siegel placer district. The area encompassed by this district is roughly that included in T. 13 N., R. 23 E.

Geology. The Buckskin area is composed of Triassic sediments intruded by granitic rocks with the resulting intense metamorphism as exhibited on the Blue Metal group. Near the intrusives the alteration of the country rock is widespread with silicification and the development of sericitic and talcose rock. The principal deposits of the district are copper contacts with minor amounts of gold and silver occurring in the sulphide minerals. Andalusite and corundum occur on the Blue Metal group, and placer gold was derived from the erosion of the gold-bearing copper mineralization in the district.

Properties. The Buckskin mine for which the district is named was discovered in 1904 by a prospector by the name of Kennedy. He is reported to have named the discovery Buckskin in honor of

his buckskin-colored saddle animal. During the mining excitement that followed the discovery a townsite was laid out and the community boasted of a Chamber of Commerce. Mining of the deposit followed the custom of many early operations and was divided into 100-foot square block leases, which resulted in numerous shallow shafts and pits being developed. Deeper work in the principal working situated on the Red Top claim in about 1907 lead to the discovery of copper sulphide ore below the oxidized gold bearing zone. Mining was suspended due to the 1907 panic and a subsequent depressed metal market. As a result of this setback no appreciable production was recorded from Buckskin until 1916 when the International Smelting Company obtained an option on the property and sank the No. 1 shaft to a depth of 260 feet. At this time the company extended the 130-foot level and explored the deposit for several hundred feet along the lower level. Subsequently, in the early '30's, the Moore Mining Company of Jackson, California, extended the working in the oxide zone and built a flotation mill early in 1936. Poor recovery was experienced from the treatment of oxidized ores which lead to the development of sulphide ore on the 90-foot level situated just above the water table. The Moore Company was succeeded by the Ambassador Mines Company early in 1936, who enlarged the mill for a 50-ton daily capacity. Ore of a quarter ounce gold and three quarter percent copper content was milled for a 70 to 78 percent extraction of the values. Mining was continued until 1938 when operations were suspended. Later the property was sold for taxes and the mill and machinery removed. It is now owned by E. F. Schultz of Reno. It is stated that due to inadequate pumping equipment the mining operations of the latter companies did not reopen the mine below the 90-foot level.

At the Buckskin the areal relationship is one of Triassic sediments intruded by granitic rocks and overlain by Tertiary volcanics. Lamprophyre dikes cut the formation and the vein near the No. 1 Shaft. The vein, which strikes N 60 degrees W, and dips 65 degrees to the N. E., is a replacement filling along a shear zone in altered andesite. A production of $73,093 was reported by the Ambassador Gold Mines, Ltd., for the period of 1937, Couch (1943).

The Antelope group of 23 unpatented claims is located in the Buckskin district 16 miles west of Yerington. It was controlled by L. W. Trankle of Yerington, and according to Weed (1924) the mineralized area lies in a north trending belt of monzonite. This deposit in monzonite is 4,200 feet wide and 1½ miles in length,

and dips moderately to the east, with diorite in contact with it on the west and andesite on the east contact. The deposit is strongly kaolinized to a depth of 150 feet which is near the water table in this property. Scanty copper carbonates occur on the surface through the length and breadth of the deposit, and streak of copper sulphides occur near the footwall.

The Blue Metal deposit is a later discovery that contains alumina refractories. It is situated one and one half miles northwest of the Buckskin mine and is located in section 4, T. 13 N., R. 23 E.

This deposit was discovered in 1944 by the locators, James S. Adams, Alex Castaing, of Yerington, and Judge Clark J. Guild of Carson City. The andalusite and corundum was discovered in some of the older prospect workings originally opened in the search for gold and copper.

The alumina minerals are intimately associated in small aggregates through the several shear zones that traverse the altered andesite. These shear zones vary from 2 to 50 feet in width and are distinguished by abundant sericitic and talcose rock. The better grade of mineral is easily recognized by the distinctive dark-blue color imparted to the deposit by the mineral corundum.

The mine openings are limited to numerous surface cuts and pits, and to a 200-foot adit from which is driven a 23-foot crosscut to penetrate one of the larger shear zones. The underground development was contracted for in 1945 by the U. S. Bureau of Mines under the Strategic Minerals Act. Binyon (1946) states that beneficiation test conducted by the U. S. Bureau of Mines indicates the ore is composed of micaceous alteration products with andalusite, corundum, quartz, and rutile. Microscopic grid grain counts made on the minerals indicate that it contains from 7 to 9 percent corundum by weight and from 11 to 14 percent andalusite. It is further stated that the recoverable minerals would probably best be used for the preparation of high-alumina refractories. To date no production has been made from this property.

The Minnesota-Nevada Copper Mines Co., formerly known as the Wabuska Copper Mines Co., operated a group of 13 claims located in section 19, T. 14 N., R. 24 E. The company was active during the first World War and did some development in the early '20's.

Copper sulphide mineralization along a contact zone was explored to a depth of 500 feet and according to Weed (1918) the company developed a large iron-ore body during 1917 on the same

property. The property was again revived under the name of Strategic Minerals, Inc., and did some development in 1943 on the iron ore according to the State Mine Inspector's records.

GARDNERVILLE (Eagle)

The Gardnerville district is situated on the west slope of the Pine Nut Range in central Douglas County and approximately 14 miles southeast of Minden and Gardnerville. It is adjoined on the west by the Red Canyon district and on the southeast by the Wellington district. The Mount Siegel placer district lies to the north of Gardnerville district.

Geology. The principal country rocks are Tertiary andesite, which covers the summit areas of Gardnerville district and intrusive quartz monzonite which is, however, exposed by deep erosion in the southern and eastern portion of the district. Lake deposits and tuffs occur along the base of the west slope that are probably Pliocene in age. According to Hill (1915) the augite-andesite is cut by nearly vertical, north-trending fractures at the Pine Nut mine. These north fractures are traversed by another set of fractures striking N. 35 degrees E., and dipping steeply to the southeast. Gold is associated with altered and silicified wall rock in these fractured areas, with minor amounts of pyrite included in the mineralized zone.

Mesozoic sediments composed of shale and limestone, believed by Hill (1915) to be Triassic in age, have been metamorphosed as at the Nevada Tungsten Mine where they have been converted to tactite with the introduction of scheelite.

Organic deposits of recent origin have been known for many years, and a peat deposit was recently discovered in Carson Valley near Minden. These deposits probably were derived from the decomposition and subsequent burial of years of tule growth along an early channel of the Carson River. Possibly they were similar to the tule marsh that now exists along the river between Walley's Hot Springs and Genoa.

Metal production from the Gardnerville district has been mainly copper, gold, and silver, with more value derived from tungsten shipments in recent years, particularly during the war demand for critical minerals.

Properties. The Alpine Mining Company operated by A. L. Stewart, of San Rafael, California, purchased, late in 1945, the Nevada Tungsten mill approximately 11 miles southeast of Gardnerville. The Company added a rod mill, slime table, and

flotation cells to the gravity concentrator to treat their scheelite-molybdenite ore from the Hope Valley mine situated south of Lake Tahoe in Alpine County, California.

The B & C Tungsten was operated by Baker and Chessher who leased contiguous claims owned by C. Clarence Park of Minden, and Dave G. Wood of Markleeville. These claims are about 12 miles southeast from Gardnerville, and were located about the summer of 1943. The B & C Tungsten in turn sub-leased parts of the property to Henry Koocher, Joe A., and Sam Miller. The Koocher-Miller lease shipped ore valued at $8,862 during the remainder of 1943, and the B & C is credited by Couch (1947) with a production of $11,067 for the year 1944.

The deposit is similar to the Nevada Tungsten, being in an area of metamorphosed Triassic sediments with erratic dissemination of scheelite introduced into the tactite formation.

Carson Valley Tungsten developed and shipped some tungsten ore from claims located in the Pine Nut Range 11 miles southeast of Minden during the later part of 1943 and in 1944.

The Duval property is one of those discovered and prospected during the early days of the district. It is situated half a mile west of the Ruby Hill mine. The deposit is in a silicified zone in the andesite formation. The mineralized zone strikes N. 45 degrees E., and carries gold values, but no visible sulphides.

The Nevada Tungsten deposit was discovered in 1930 by R. C. Walker and Wm. Maus near the Ruby Hill copper mine. The discovery was exploited by Herb Walker and Hank Loufek who organized the Nevada Tungsten Company in 1935 which was financed principally by Franklin Farrell. The mine was developed to 160-foot depth and a modern tungsten gravity concentrating plant built in 1937. Under the supervision of Norman Annett the property produced and marketed 50 tons of 80 percent tungstic acid concentrate. The company ceased mining about 1940, and following that time the property was purchased by Ott Heizer who explored the deposit with a diamond drill. The scheelite occurs in lenses in a contact metamorphic deposit with a general strike to the northwest and a 35 degree dip to the southwest.

Pine Nut Consolidated claims are located in Buffalo Canyon on the west slope of the Pine Nut Range. This property was discovered in the early 1900's, and a small 5-stamp mill installed at the mine in 1907.

The country rock is augite andesite which is cut by numerous north striking fractures traversed by other fractures running

about N. 35 degrees E. The deposit is in this fractured zone where alteration and silicification of the wall rock has taken place. The ore consists of fragments of this altered rock, quartz, and calcite and carries a little gold, associated with minor amounts of pyrite. The deposit was developed by a 200-foot crosscut adit which intercepts two veins, one of each fracture system. The veins generally do not exceed one or two inches, but occasionally open to a width of two or three feet, according to Hill (1915).

The Ruby Hill mine was discovered in 1908 by the late R. C. Walker, who optioned the property to one of the large copper companies operating at Yerington. Later about 90 tons of copper ore were treated in a leaching plant, and in 1928 the Johnson Engineering Company again operated an acid leaching plant, with precipitate assaying about 75 percent copper.

At the Ruby Hill mine the Tertiary andesites are cut by two sets of fractures. The older fractures strike about N. 25 degrees E., and dip 45 degrees N. W. through a zone varying from 100 to 150 feet in width. Crossing this zone is a later series of north-trending slips in the andesite which seem to terminate the mineralization on the west. The andesite is altered and crushed in this zone where pockets of oxidized copper ore occur near the north trending fault. The mine was early developed by a 150-foot incline with short levels extending from the 60-foot and 100-foot levels.

The leaching plant proved unsuccessful due to the presence of carbonate matter in the ore, and in recent years the property has not been active.

The Strategic Minerals Company under the direction of W. L. Loring developed and shipped several carloads of tungsten ore from their claims located in the Pine Nut Range southeast of Gardnerville. This operation was active during the demand for strategic minerals in 1943.

Tungsten Hills Company headed by H. B. Chessher operated a group of claims under option and lease from George Montrose, trustee for the Walker-Maus Estate. The claims including the Badger, Fawn, Mayflower, and Tungsten Hills adjoin the Nevada Tungsten ground situated near the Ruby Hill Mine about 12 miles southeast of Gardnerville. Tungsten was discovered in this property by R. C. Walker and Wm. Maus in 1930. According to Stoddard (1943) the deposit occurs mainly on the east flank of an anticlinal ridge trending N. 35 degrees W. The Nevada Tungsten occupies the west flank of the anticline with the formation on both properties dipping at an angle of about 35 degrees.

Scheelite mineralization is confined to a single bed of metamorphosed limestone and occurs unevenly distributed in a haphazard pattern of narrow quartz veins cutting through the tactite bed. The values are erratic and hard to sample due to the almost barren horses of tactite formation which occur between the quartz veins.

Production from the Tungsten Hills totaled $13,946 for 1943 divided between Henry Koocher-Miller Bros. lease, $8,862, and George Griface, $5,084. Couch (1946) revised production for the district also credits the B & C Tungsten, Cope and Miller, Koocher and Miller with a total of $11,067 for 1944.

The Veta Grande deposit, as the name implies, is a large quartz vein. It was originally known as the Mammoth Lode, discovered in 1860, and was explored together with the Peck Lode for several years. The deposit was reopened as the Veta Grande in 1921 and has been worked intermittently since that time. According to Lincoln (1923) the vein occurs with an augite-andesite footwall and a lamprophyric dike hanging wall. Beyond this dike on the hanging wall side the country rock is composed of hornblende-andesite. Silver values in the vein occur as argentite and stephanite streaks in the quartz vein matter that carries minor amounts of gold.

GENOA

The Genoa district lies west of the town of Genoa and on the east slope of the Sierra Nevada.

Geology. Triassic sediments are the principal country rock of the districts into which Cretaceous granite has intruded to form both veins and replacement deposits. The ore occurs in erratic bunches or lenses of quartz, epidote, garnet, actinolite, and tourmaline as gangue minerals, with minor amounts of chalcopyrite associated with small values of gold and silver.

The relatively recent fault scarp situated near Genoa is of unusual interest. At Walley's Hot Springs on this fault, Lawson (1912) measured the displacement to be 44 feet. He considers this to represent a single movement which caused an earthquake of first magnitude at the time of this earth tremor. The displacement can be seen near the road between Walley's Hot Springs and Genoa, where the scarp cuts through the alluvium on a nearly horizontal line and has been mistaken for the undercut terrace of some ancient lake. The existence of this scarp as early as 1854 and apparently in its present condition has been verified by early residents of Genoa. However, the continued flow of hot water from several places along this fault and the marshy area

where the Carson River flows almost at the base of the scarp indicates comparatively recent movement along the fault. The position of the river channel with respect to the fault proves that a recent depression of the valley block has been in excess of the degradation of the river channel.

Properties. The Genoa district was organized in 1860 and vigorously prospected for several years without encouraging results until activity in the district died out about 1865. Interest was renewed in the district about 1921 when the Genoa Comstock Mines Co. was organized for the purpose of driving a long adit to cut the lode at depth on their four claims in the southern part of the district.

The Simon Extension Mining Co. was organized about the same time and conducted prospecting work during the early 1920's.

Both of the above-mentioned stock companies suspended work without recording any official production from their development work.

Vanderburg (1936) states that Tertiary gravel deposits occur in the district, but the placer gold associated with them is of doubtful economic importance. A small amount of gold was produced from prospecting work conducted on these gravel deposits in 1916. In recent years there has not been any placer activity in the district.

MOUNT SIEGEL

The Mount Siegel placer district lies on the north slope of Mount Siegel, situated in the Pine Nut Range, approximately 20 miles east of Minden.

Geology. The placer deposits occur as loose unassorted gravel resting in a depression in the granitic rock of the Pine Nut Range at an elevation of about 7,100 feet. Some of the gold is held above the true bedrock on layers of hard pan and pipe clay. The gold occurs both as fines and nuggets which are disseminated through the gravel and sand. A few large boulders occur in the deposit, but they are not in sufficient quantity to be an economic problem. The average fineness of the gold recovered from this deposit is 880, and the largest nugget found was valued at $250 at the old price of $20.67 per ounce, Vanderburg (1936).

Property. The placer originally known as the Buckeye Placer was discovered in 1891. Later most of the placer ground in the area was consolidated as the Ancient Gold Placer Mines Company. From the date of discovery the area has always been handicapped by a limited water supply. In an effort to overcome

this difficulty considerable money was expended in the 1890's to bring water by pipe line from a small lake to a reservoir located just above the deposit. When this reservoir was partially full in 1896 the company made a six-day run on the gravel. In that interval about 4,000 cu. yds. were removed, but only approximately 600 cu. yds. were worked through the sluices and cleaned. The resulting clean-up was, according to Vanderburg (1936), 75.14 ounces of gold, worth at that time $1,322.80. Recent operations have been confined chiefly to annual assessment work. G. W. Slater of Minden controls the property. Couch (1943) lists the official production from this property as $3,510.

MOUNTAIN HOUSE (Holbrook, Pine Nut)

The Mountain House district is situated in the southern portion of the Pine Nut Range southeast of Minden and adjacent to the California border.

Geology. The country rock east and south of Mountain House is quartz monzonite similar to the formation in the Gardnerville district. In the southwest section of the district toward Leviathan, Tertiary volcanics, principally andesites, prevail.

Properties. South of Holbrook near the junction of the Wellington route with Highway No. 395, O. Kittle, V. Kral, and J. Wells are developing a lead-zinc replacement deposit in limestone.

The Monitor mine situated near the California border was being prospected by Capt. W. M. Awbrey during 1946.

The Orpheus or Willard-McDonald mine was opened in 1879. It is reputed to have produced $125,000 according to Weed (1926), but this is not substantiated by State records. The mine remained idle from 1896 to 1921 when it was reopened by the Carson Valley Mining Co. This company also acquired two other properties in the district which are the Ventura and the Little Comstock, both old-time mines. The deposit at the Orpheus is developed by adits to a depth of 200 feet on an ore body reported to be 4–5 feet wide and 180 feet long.

RED CANYON (Silver Lake)

The Red Canyon is located in the southern part of the Pine Nut Range, principally on the east slope and in Red Canyon, which debouches on Smith Valley about seven miles north of Wellington. Red Canyon district is adjoined on the west by Gardnerville district and on the south by Wellington.

Geology. Hill (1915) considers the sediments of Red Canyon

to be Triassic in age. His section of the Red Canyon formations are as follows:

	Feet
Massive blue-gray limestone	1,500–2,000
Thin-bedded dark-gray to black argillite with some lenses of white quartzite	800–1,000
Thick-bedded white crystalline limestone	100– 300

These beds have been folded and metamorphosed particularly along the contact with intrusive granodiorite southwest of Oreana Peak. In the eastern part of Red Canyon the limestone section is folded into a tight anticline where the beds stand nearly vertical. The anticlinal structure strikes N. 80 degrees W., and can be seen where the stream cuts across it at an acute angle.

Contact metamorphism is well developed on the Red Canyon Claim where the limestones are cut by a 10-foot dike of intrusive quartz monzonite, which trends northwesterly. Along this dike the calcareous sediments have been altered to masses of dark-greenish rock principally composed of epidote, quartz, and calcite with associated pyrite and chalcopyrite. Primary mineralization of the district is associated with iron and copper sulphides which carry minor amounts of gold, and in some of the richer ores galena, carrying some silver, is associated with the pyrite and chalcopyrite. The deposits of the district are mainly copper bearing with gold and silver values.

Properties. According to Hill (1915) the first ore mined from the Pine Nut Range was taken from the Longfellow vein in 1862, which was transported to and milled in Virginia City. Later the Longfellow group of 12 claims was developed by the Longfellow Gold Mining and Milling Co., who was succeeded in 1922 by the Detroit Gold Mining Co. According to Weed (1924) the property was developed by a 265-foot shaft and 150-foot adit, with a total of 3,000 feet of underground workings.

The Longfellow deposit is situated on a vertical vein in quartz monzonite. This vein consists of white quartz with minor amounts of pyrite and some specular hematite as the chief metal-bearing constituents. Galena and chalcopyrite are associated with the pyrite in the richer lenses of ore. Practically all of the ore extracted from the Longfellow has been in the oxidized zone in which the ore shows rusty quartz, with some yellow staining from lead carbonate and green and blue from copper carbonate secondary ores. These stained areas are helpful as an indication of the better grade of ore found in the vein. Small lots of ore were treated in the company mill from 1923 to 1926, according

to Weed (1926). The property was equipped in 1923 with power hoist, air compressor, air drills, and a 50-ton amalgamation and concentrating mill. Couch (1943) credits the Longfellow and the Winters mines with a combined production of $102,818 between 1881 and 1936.

The Winters mine is located on the north slope of Oreana Peak about 18 miles easterly from Minden. The deposit was opened in 1872 by John B. Winters and, according to Thompson and West (1881), made a production of $8,000 prior to 1881. The original discovery was patented as the Silver Lake Lode and it, together with five unpatented claims, is now held by Chris Christofferson of Minden.

The ore deposit is a series of replacements in lenses of calcareous argillite intruded by quartz monzonite. This deposit is developed by three tunnels to a vertical depth of approximately 250 feet and for a horizontal length of nearly 1,000 feet. The replacement has a vein-like structure that strikes N. 10 degrees E., and dips steeply to the west. The ore is completely oxidized to a depth of 150 feet; below that depth occasional bunches of sulphide minerals are encountered. As previously listed above the combined production of the Winters and the Longfellow properties is over $100,000.

The Lucky Bill property is situated in the north fork of Red Canyon in an area of fractured quartzite in which a replacement deposit contains considerable disseminated pyrite. The principal fracturing in this body strikes east-southeast and is nearly parallel to the axis of the Red Canyon anticlinal folding. Small pockety occurrences of silver-bearing galena and stibnite follow the fracture zone and are associated with minor amounts of pyrite and chalcopyrite. According to Hill (1915) the galena is in part altered to the lead carbonate cerusite, and the stibnite has changed to the orthorhombic form occurring as yellowish-gray, silky fibers of valentinite.

The Defiance Mines Co. made a small shipment of silver-bearing lead ore from its claim during 1923. The formation is similar to the other replacements in the district.

The Washoe claim is situated near the summit of the range between the south fork of Red Canyon and Mill Canyon on the west slope. According to Hill (1915) this deposit is a slightly mineralized series of eastward striking veins.

The Red Canyon claims lie near the mouth of the Canyon by that name and constitute a typical contact-metamorphic deposit.

On this property the limestone formations are cut by a 10-foot dike of quartz monzonite that strikes northwest and dips moderately to the northeast. The sediments are metamorphosed for about 100 feet southwest of the contact and composed mainly of epidote, quartz, and calcite, with varying amounts of pyrite, chalcopyrite, and pyrrhotite. The ore minerals are principally confined to the limestone formation and the intercalated argillite members are practically barren. Sulphides occurred at the surface, but copper carbonate and sulphur were encountered at a depth of about 75 feet. The Red Canyon property was operated by the Douglas Mining and Reduction Co.

The Iron Boy claim is situated near the Winters property, and its ore body is a lens of contact minerals with magnetite, pyrite, and some chalcopyrite disseminated in a black calcareous shale according to Hill (1915).

The Wyandotte Mining Company, of Minden, was conducting surface development work on a group of nine claims situated about 12 miles southeast of Gardnerville during 1946. The mineralization carries gold and silver values in oxidized quartz. A small amount of shaft work was reported but there was no active development in progress during the early part of 1947.

WELLINGTON (Silver Glance)

The Wellington district lies near the town bearing that name and in the southeastern portion of Pine Nut Mountains. It is about 30 miles southeast of Minden, the nearest railroad shipping point.

Geology. Quartz monzonite predominates as the country rock in this area. It is considered by Gianella (1945) as Cretaceous in age, with limited outcrops of Triassic sediments. Quartz veins occur in the monzonite formation and are of two patterns, one striking northward with nearly vertical dips and the other an easterly trending set of veins which dip steeply to the south. Most of the veins are narrow and not highly mineralized, but consist principally of white quartz and minor amounts of pyrite. Occasionally richer pockets or lenses occur in the veins in which galena and chalcopyrite were the primary minerals, now oxidized to secondary minerals of lead and copper with their characteristic yellow, blue, and green stains.

The production of the district has been mainly in gold and silver values, with some copper. In recent years some tungsten ore has been developed in the area.

Properties. The Bovard claim situated in T. 9 N. 2, R. 24 E., about 38 miles south of Yerington, is held by F. V. Bovard. This deposit is a high temperature quartz mineralization occurring in granodiorite formation.

The Gold Mint mine, developed by the late Peter Fox, is situated in T. 9 N., R. 23 E., about 15 miles south of Wellington. Associated with this mineralization is an unusual occurrence of bismuth telluride and free gold, determined by Palmer (1947) as tetradymite.

The High Jinks claims, owned by H. E. Fulstone, are situated four and one-half miles southwest of Wellington in T. 10 N., R 22 E. The deposit is a contact metamorphic mineralization in which scheelite is irregularly disseminated in tactite.

The Imperial claims were located in the early day mining activity of the district. They are located in the southern portion of the Pine Nut Range about six miles west of Wellington near the north end of Antelope Valley. The deposit consists of a series of north-bearing veins. Some of the veins are nearly vertical, while others dip westerly, according to Hill (1915). Mineralization in this area is mainly iron-stained quartz with some specular hematite and occasional bunches of sulphides. When the sulphides occur pyrite is common with occassional pockets of galena.

The Lindsey-Barry claims are located about five miles east of Coleville, California, in T. 9 N., R. 23 E. The property is held by Roy R. Mighels. The mineralization is lead-zinc replacements in a broken, altered limestone formation.

The Poco Tiempo Mining Company was mining in the district, and in 1908 they were operating a five-stamp mill, according to Lincoln (1923).

Victor Prajer claims are located in T. 9 N., R. 24 E., about six miles east and twelve miles north of Topaz road junction with magnesite occurring in fissures in quartz porphyry.

The Ski Hi property, held by W. C. Brown, is located in T. 9 N., R. 23 E., about 10 miles east of the Topaz road junction. The deposit is an irregular distribution of scheelite in tactite formation.

The South Camp mines is another property that was active in the early 1900's. It is situated in the southern Pine Nut Range about six miles northwest of Wellington and in the quartz monzonite area. The deposit was originally opened by three adits, now caved, and several shallow shafts on a series of north-bearing veins. The mineralized area is near intrusive quartz monzonite and andesite dikes that cut the older monzonite rock.

The Yankee Girl or Taylor Hill mine is one of the early producers of the district. This deposit is situated low on the east

slope of the Pine Nut Range approximately two miles northwest of Wellington. Ores from this mine were extracted and treated in an arrastra on the West Walker River during the 1880's. Lincoln (1923) states the mine was active in 1915 when a five-stamp mill was in operation. In recent years the Yankee Girl mine has been inactive.

The deposit covers two nearly vertical veins on the north slope of Taylor Hill, which strike approximately N. 50 degrees E. Several shallow shafts and tunnels expose about 18 inches of iron-stained quartz. Hill (1915) states the vein is frozen to the footwall and has a thin fault gouge parting next to the hanging wall. A few sulphides associated with copper carbonate and limonite can be seen in a part of the vein left in the mine openings.

ORMSBY COUNTY

Ormsby County, the smallest county in the State, lies on the western border of Nevada between Douglas and Washoe Counties. It extends east from Lake Tahoe about 22 miles to a common border with Lyon County along Eldorado Canyon.

LOCATION AND TOPOGRAPHY

Ormsby County is composed of three land masses, two mountain areas divided by a central valley. In the western portion the topography rises abruptly from Lake Tahoe to Marlette basin at an elevation of 8,000 feet. About a mile farther east the Sierra Nevada summit culminates near Marlette and Snow Valley Peaks whose elevations are 8,845 and 9,274 feet, respectively. From this crest the land slopes more gently eastward where Ash, Kings, and Clear Creeks flow into Eagle Valley at an elevation of about 4,700 feet. Carson City is situated near the western edge of this small valley, and Empire lies three miles eastward on the east edge of the valley, where the Carson River begins to increase its grade in the canyon thus affording excellent power sites for the multitude of early-day reduction works which were built along its course. The eastern portion of Ormsby County is occupied by the Pine Nut Range. The northern portion of this desert range rises immediately east of the Carson River and reaches an elevation of 7,500 feet along the southern border of the county near Bismark Peak. Eastward from the ridge the topography slopes steeply to Eldorado Canyon, which drains northward. The west slope is broken by Brunswick Canyon whose drainage pattern flows northerly to join the Carson River about three-quarters of a mile east of Empire. The whole northern end of this range has developed a peculiarly irregular and rugged topography due to deep erosion by the numerous tributaries of the Carson River. Probably the major part of this erosion occurred during Pleistocene time when precipitation was more abundant than at the present time. The runoff now is limited to that due to a few inches of rain and snow fall during winter storms, which results in a shortage of water for mining purposes.

In the western half of the county conditions are more favorable and the winter precipitation is sufficient to normally supply the communities in Eagle Valley with ample water. Water from Marlette Lake is conducted through the Lakeview inverted siphon to supply the communities of Virginia City, Gold Hill, and Silver

City. Construction of this siphon, considered a notable engineering feat in 1873, revolutionized the milling practice on the Comstock by supplying water direct to the mining properties where it was utilized both as a milling agent and for power.

GEOLOGY AND ORE DEPOSITS

The areal geology of Ormsby County is similar to that of Douglas County, with large sections of granodiorite exposed in the Sierra Nevada Range and smaller amounts of intermediate flow rocks covering the summit areas of the Sierras. Metamorphosed Triassic sediments flank the base of the east slope of these mountains where the intrusive granodiorite has produced contact type of mineralization. Typical exposures of these contact deposits can be seen in the Voltaire district and to a lesser extent along the railroad cuts south from Lakeview summit. Some remnant outcrops of these meta-sediments are exposed east of Lakeview in the granitized area. Limited tungsten mineralization has been found in this area, and the same granitized area extends south and east from the Washoe Mountains to Prison Hill.

Igneous flow rocks dominate the northern Pine Nut Range and are composed mainly of andesites. In Eldorado Canyon, there are hills of gently folded gravels which are almost entirely derived from these same andesites. Lower in the canyon are exposed water-laid breccia and tuffs overlain by thin slaggy white lava deposits. In a few places the gravels are covered by thin sheets of basalt that flowed over the area after the development of the present topography, according to Spurr (1903).

Underlying the lavas in Eldorado Canyon are limestone beds of a dark blue color, sometimes siliceous and changing to shaly and carbonaceous material. These beds are intensely sheared and appear to be standing nearly vertical where they are exposed. The younger hardened and well-stratified gravel and clays found on the plane south of Dayton and which terminate in obscure benches at an elevation of about 6,000 feet are, according to Spurr (1903), Pliocene lake deposits. Other sediments occur in Eagle Valley at the Prison quarry in the form of hardened sandstone or granitic arkose. Smith (1912) believes this sandstone deposit is the result of cementation of alluvial and aeolian sand by hot springs deposits during late Pliocene or early Pleistocene time. Reed (1904) holds the opinion these beds were formed in an ancient lake.

In Brunswick Canyon the andesites are cut by numerous quartz veins in which gold and silver values are associated with iron

and copper sulphides. These deposits show typical Tertiary hydrothermal mineralization, with considerable alteration of the wall rocks near the fissures. Iron ore in the form of hematite occurs at the Bessemer property in the Delaware district. The mineralization in the western part of the county is of an older period and associated with intrusive granite and granodiorite probably of Cretaceous age. Intense metamorphism along the contact of these intrusives with the Triassic sediments now exposed on the eastern slope of the Sierra Nevada has developed low grade copper mineralization. This contact belt extends south from Lakeview to Jacks Valley along which numerous copper showings exist, but there is no official production recorded for the area. Many of the mineralized zones are small remnants of meta-sediments surrounded by granitic rocks which preclude the possibility of large deposits. Some scheelite has been found in small areas of tactite east of Lakeview in the granitized area.

In the intensely metamorphosed area near the Voltaire district intrusive basalt has converted carbonaceous shales to graphitic schist such as are developed on the Chedic and Voltaire properties. This graphite deposit is quite extensive and has been producing for many years. Arsenopyrite occurs on the nearby Raffetto property, being a lenticular deposit in graphitic schist. Originally the Voltaire deposit was developed for the values in a silver-bearing quartz vein which occurs on the property.

HISTORY, MILLS, AND HIGHWAYS

From the earliest Comstock excitement Ormsby County was more favorably endowed with water and timber resources than with metal deposits. However, under the stimulus of the rich discoveries made in Storey County and the resulting influx of fortune seekers all of the surrounding area was intensely prospected and numerous mining districts organized. Included in these districts were the Eagle, now known as the Voltaire; the Clear Creek; the Argentine, situated north of Carson City and now included in the Carson district; and the Sullivan, usually now known as the Delaware district, situated east of the Carson River. It is interesting to note that all of these districts were diligently prospected and in several instances extensive development work was done, but the bullion tax records show a production of only $625 from 37 tons, which was recorded in 1940. Other production is known to have originated within the county, however, in the earlier years operators were lax in reporting production to the State.

The abundant water power offered by the Carson River and the smaller streams flowing into Eagle Valley were a prime requisite for the development and recovery of the wealth discovered in the mines in 1859. Immediately, construction was started on several reduction works along the Carson River with the first one completed in the spring of 1860. According to Thompson and West (1881) the construction of milling facilities continued to expand unabated, reaching a maximum with the construction of the Virginia and Truckee Railroad from Virginia City to the Carson River in 1869. This new transportation system greatly augmented the milling of Comstock ores as its route passed through Empire and along the river, allowing carloads of ore to be delivered easily to the half dozen mills between Empire and Dayton of 200 stamps and about 400 ton capacity.

In 1861 a small stamp mill was built and operated by water power in the Clear Creek district. In the same year a mill was built by Alexander Ashe in the canyon west of Carson City and now known as Ash Canyon. This mill was destroyed by a flood in the winter of 1861–1862. Childs and Hunt built a mill on the same creek soon after the destruction of Ashe's mill. It was driven by water power and carried 10 stamps capable of crushing about eight to ten tons of ore per day.

In 1862 an original mill situated near Empire was enlarged and was then generally known as the Mexican Mill. It was described in Kelly's Directory of Nevada in 1863 as follows:

> The mill is driven by water acting on a breast wheel twenty-eight feet in diameter, and an outside breadth of twenty-six feet, being the largest water wheel on the Pacific Coast, furnishing about two hundred horsepower. The fall of water is twenty-two feet. There are now forty-four stamps working, running with an average speed of seventy-five blows per minute, and the amount of rock crushed averages from seventy to seventy-five tons daily—this being more than double the amount crushed by any other mill in the Territory. Twenty-eight of these stamps are employed constantly on ore from the Mexican mine, from which place the ore is shipped in sacks. The remainder of the mill is employed on custom work.

This Mexican Mill was probably the most completely equipped reduction works treating Comstock ore at that time. The method used according to Thompson and West (1881), was a combination of amalgamation and the barrel process, in which the ore was ground wet to a finely divided pulp and forced through

Mitchell amalgamators by copper screws. The pulp then passed into thickeners to settle out any finely divided amalgam and quicksilver along with the sulphides, which were then dried, salt added, and reground before being introduced into the furnaces. After roasting the ore was cooled and conveyed to the dust room located above the barrels. The barrel room contained twenty barrels, each capable of treating from two to two and one-half tons of ore per day. Each barrel was charged with a quantity of ore, water, iron, and quicksilver and then made to revolve to convert the silver to a chloride and amalgamate it. Finally the pulp was washed from the barrels into settlers to recover the amalgam for retorting. The mill was provided with a complete assay office with adequate means for experimenting with and testing custom ores. A further innovation was in the manner of delivering fuel to the mill, as the cordwood was cut from a wood lot situated near the head of the power canal and floated to the mill.

The active construction of quartz mills naturally stimulated and created a demand for lumber mills as a necessary adjunct to the mining development of that day. As a result numerous sawmills were built in the well-wooded slopes of the Sierra Nevada. Thompson and West (1881) state the first sawmill constructed in Ormsby County was built by Mr. Gregory in the fall of 1859, on Mill Creek (Ash Canyon), three miles west of Carson. This was the first steam-power mill built in the State of Nevada and was a major undertaking to transport such heavy machinery over the mountains. Soon afterwards Alexander Ashe built a sawmill near Gregory's mill, which was powered with water from the creek. Thompson and Treadwell erected a second steam-power mill about one mile north of Gregory's. This mill was capable of cutting 15,000 board feet per day and included a shingle and planing machine which prepared large quantities of building material.

By 1861 three additional sawmills had been built on Clear Creek with an aggregate capacity of 50,000 board feet per day. The Lake Bigler Lumber Company, organized by Messrs. Barrett, Pray, and Winters installed a large mill on Lake Bigler (Tahoe) in 1862 and sent its products to Carson and Virginia City over the newly established King's Canyon toll road. Other mills continued to be built as a result of the continued demand for lumber and mine timbers.

In 1863 a large sawmill was built at Empire, which was supplied with timber from the Sierra Nevada by rafting the logs down the Carson River. The introduction of the V-flume about

1865 was the ultimate development in rapid transportation of lumber and mine timbers from distant mills down to transshipping points along established transportation routes.

The transportation methods used during the early development of Ormsby County have mainly been replaced by modern highways and motor transport. Federal Route 50 traverses southwesterly through the county and Route 395 trends southerly through Carson City with secondary roads connecting all active parts of the county. Electrical power is available from the Sierra Pacific Power Company's distribution system which runs through the central portion of the county.

PRODUCTION

According to Couch (1943) there are no bullion-tax records of mineral production for Ormsby County. The production of the early mills was credited to the Comstock area as being the source of the ore. Small producers evidently failed to report production. A mistaken idea has often prevailed that if no profit was made no report is necessary.

MINING DISTRICTS

CARSON CITY

The Carson City district includes the southern slope of Washoe Mountains and the State Prison sandstone quarry in Eagle Valley.

Geology. North of Carson City, in the Washoe Hills, deep erosion has exposed granitic rocks with occasional remnants of meta-sediments included within the granitized area. Erratic contact copper mineralization is associated with the metamorphic rocks and scheelite in small tactite bunches has been prospected during the demand for strategic minerals in recent years.

A considerable amount of stone was quarried from the Prison deposit early in the State's history for the construction of the Capitol and other State buildings, and is being quarried today for new buildings at the State Prison. The material is an endurated and cemented sandstone derived from disintegrated granite. It has a yellowish gray color, is heavily bedded and lies nearly horizontal.

Properties. Andy Carrigan's gold prospect is situated in the granitic area north of Carson City.

The North Carson mine, an early day stock company, is reported by Thompson and West (1881) to have actively prospected their property two and one half miles north of Carson City. The property was equipped with $15,000 worth of hoisting machinery in 1876 and abandoned a short time thereafter. Mineral Resources (1925) reports the sale of a small lot of copper-lead-silver ore from this property during 1925.

The Argentine district, located in the summer of 1859, is occasionally referred to as including a portion of Eagle Valley, but was principally the antecedent of the Jumbo district situated east of Washoe Valley.

The Carson River itself, although not a source of primary mineral, has commanded attention as a potential producer because of the immense wealth of Comstock tailings, quicksilver, and amalgam discharged into the Carson River from the numerous reduction works established along its course from Empire to Dayton. These tailing losses have been estimated to be in the millions of dollars, and have not been subsequently recovered due to dilution of these values with quantities of worthless river detritus.

Although many attempts have been made to recover these values by the use of dredge, caisson and pumps, none have been economically successful. Outstanding among the fruitless efforts to recover the wealth lost in the Carson was that of the Carson River Placer Mining and Dredge Company. This company, a West Virginia corporation, was organized in 1890 by Peter Forester, with a capital stock of $2,000,000. The company erected a dredge which was operated near Dayton during 1895, and the Engineering and Mining Journal (June 1902) announced the expiration of the company by a sheriff's sale held in New York, where the office assets were purchased for $82.

Interest in the Comstock tailings was revived in 1914 when preliminary tests were made with caissons sunk in the river near Dayton. Later the same year the Comstock Development Company diverted the river from its channel just below the old Santiago Mill where it was expected large quantities of quicksilver and amalgam had lodged.

A sixty-foot dredge was completed in May 1914 to operate between Dayton and Empire, according to the Engineering and Mining Journal. It proved to be a failure but some real recoveries were made and several small lots of bullion are recorded between 1923 and 1932 from the clean-up of the Brunswick and Morgan mill sites and from tailings that were impounded above the river level.

DELAWARE (Sullivan, Brunswick)

The Delaware district lies east of the Carson River, mainly in Brunswick Canyon, and was formerly referred to as the Sullivan district. This area can be reached by driving east from Carson

City on Highway 50 to Empire, thence southeast on secondary road into Brunswick Canyon.

Geology. Numerous Tertiary volcanics, mainly andesite flows, predominate in this area. Mineralization is associated with quartz veins which cut the andesites and carry limited gold and silver values. Copper and iron sulphides occur with the quartz mineralization, and barite is associated with the mineral on the Yerington property in Brunswick Canyon.

Properties. The Bessemer mine, situated in Brunswick Canyon, contains a deposit of iron ore. Trial shipments were made from the property in 1907, and in 1919–1920 shipments of ore were made to San Francisco.

The Bunker Hill group of eight claims with a gold-copper showing was being developed by W. J. Loring in 1944.

The Comstock Extension Mining Company was incorporated in Nevada in 1921 by A. F. Eske. The company controlled 12 mineral claims in Brunswick Canyon on which occur fissures in andesite carrying gold and silver values. The property was developed by two shafts and a tunnel. This property was sold in 1932 to the Comstock Gold Mining Company, Ltd., headed by Charles Manker and Mr. Beales. The Yorston-Sullivan lease operated the Eske property during 1944 developing gold-bearing ore until March 1945 when the operation ceased.

The Smith Brothers property is situated about six miles east of Carson City in the Pine Nut Range. The property was discovered in the 1920's and by frugal development John and George Smith and Andrew Foote of Carson City, equipped the property with a 5-stamp mill in 1930. This mill was erected near Hot Springs a short distance south of McTarnahan bridge, where it is reported several lots of ore were treated. The ore carries gold values with a trace of silver.

The Tactite Thursday claim controlled by L. W. Little and A. F. Eske is located about 15 miles southeast of Carson City in section 9, T. 14 N., R. 21 E. The mineral scheelite occurs in a small tactite area near a granite-limestone contact.

The United Mining Co. was incorporated in Nevada during 1905 with a capitalization of $3,000,000. The company controlled 34 claims located about 12 miles southeast of Carson City. Development consisted of two shafts 100 and 450 feet deep and numerous surface pits and shallow adits. According to Weed (1918) the country rock is granite, cutting sedimentary and volcanic rocks. A strong iron gossan up to 200 feet wide caps four fissures in andesite. The veins vary greatly in width, with the

main ore body averaging from 7 to 12 feet wide. Surface development work shows azurite and malachite with some copper oxides which are succeeded at a shallow depth by sulphide mineralization. The mine was abandoned in 1915 and the shareholders given stock in the Boston American Mining Company.

Valley View Tungsten controlled by Frank Garavanta, Vern Cunningham, F. and R. Fulstone, and John R. Ross is situated about eight miles southeast of Carson City near the site of the old Mexican Mill dam. R. Rysch of Fallon is reported to have optioned six of the original fourteen claims late in 1941. The terms of this option called for the erection of a 25-ton concentrator which did not materialize. Subsequently the property was leased by Joe Vesco of Carson City, who shipped a carload of tungsten ore to Metals Reserve depot in Salt Lake City early in 1944.

The Yerington Mine located in Brunswick Canyon contains an occurrence of iron ore in the form of hematite, and barite is found on the same property.

VOLTAIRE (Eagle Valley, Washoe)

The Voltaire district is situated on the east slope of the Sierra Nevada Mountains west and southwest of Carson City.

Geology. The region is mainly composed of sediments intruded by granodiorite of Cretaceous age. Silver-bearing quartz occurs in the granodiorite, arsenopyrite is found in lenticular pockets in the schist formation and amorphous graphite occurs in the intensely metamorphosed shale that has been intruded by basalt. A colorful but meager contact copper mineralization is exposed along this zone of metamorphosed sedimentary rocks.

Properties. The Athens mine was opened in 1865, and some ore was treated in a quartz mill situated in Carson City during 1866. This mine was again active in 1910–1911 when several test runs of ore were treated in a three-stamp mill. Development work on this property was reported to Mineral Resources for the year 1936.

The Carson Black Lead or Chedic Graphite mine, four miles southwest of Carson City, was opened in 1903 by Walter Chedic. It is the only steadily producing mine in the county, and for years has shipped a limited tonnage to the Pacific Graphite Works of Richmond, California, of which it is a subsidiary company. The products manufactured from the Chedic graphite include paint, foundry facings, and lubricants.

The deposit occurs in a graphitic shale in which the better

grade material is about 35 feet wide. It is mined from an open pit after the overburden is first removed. According to Lincoln (1923) the deposit is associated with intrusive basalt which he considers is responsible for the intense graphitized formation.

The Carson Free Gold Mining and Milling Co., controlled the Lucky Strike claims one and one-half miles west of Carson City, situated in Muldoon Canyon. The company was developing the property through an 80-foot shaft in July 1919 at which time they reported 18 inches of gold and silver ore. According to Weed (1931) the operation was abandoned about 1926.

The Crystal claims, located five miles southwest of Carson City are reported by Mineral Resources (1923) to have produced a shipment containing 75 ounces of silver, a little gold, and 19 percent zinc.

The Golden Eagle Mine situated in the Voltaire district was reported by Mineral Rosources (1931) to have treated 150 tons of ore in a small stamp mill on the property. This ore was extracted from 150 feet of new development work opened during 1931. Development work was continued during the following year but no production reported.

The Ohio claim situated southwest of Carson City and developed by an 87-foot inclined shaft, is stated by Mineral Resources for 1923 to have produced a small quantity of silver-gold ore for that year.

The Panama Canal Mining Co., a Washington corporation organized in 1917, controlled 12 mineral claims in the Voltaire district, which were developed by a 550-foot adit on a silver-bearing quartz vein in granodiorite. Weed (1920) reports that the company received an income of $3,300 from 150 tons of ore in 1918. Subsequent shipments were reported for 1919, but the company was defunct in 1924.

The Premier Mine, formerly the Henry Quill property, was optioned to Walter J. Bracking of Reno, who reported making the final payment in 1930. Several small mills have been erected on this contact copper mineralization, which is now controlled by T. G. Bracking of Carson City.

The Rafetto property, situated in Kings Canyon west of Carson City, contains lenticular bodies of arsenopyrite in schist.

The Voltaire claim, an early day silver-bearing property, was in operation in 1880 and again reported to be under development in 1927, from which work a shipment of 8 tons of silver-gold-copper ore was extracted according to Mineral Resources (1927).

WASHOE COUNTY

Washoe County occupies the northwest border section of Nevada, extending south from the Oregon boundary approximately 200 miles to Lakeview Summit on the Reno to Carson City highway. The northern portion of Washoe averages 35 miles in width and attains its greatest width of 44 miles, about six miles north of Wadsworth. From this point the county tapers southward to a common border with Ormsby County to terminate upon the northeast embayment of Lake Tahoe.

LOCATION AND TOPOGRAPHY

The physical features of this county are varied and present both youthful and mature topographic forms. Probably the most striking feature of this region is the continuous succession of valleys, which were in the past a series of lakes separated by low divides. Situated on the western edge of the Great Basin these valleys are in a position to receive more water from the high Sierra Nevada mountains than is common to most of this basin region. Long Valley, in the northern end of Washoe Valley, still retains numerous lakes and playas in a table land of comparatively low relief. Here the main land mass lies between 6,000 and 7,000 feet in elevation. The drainage is poorly developed, appearing youthful as the streams flow short distances to their sinks.

South of this volcanic tableland is a desert basin including Smoke Creek Desert, Mud Lake, and Granite Creek Desert, all a part of the ancient Lake Lahontan basin. Pyramid and Winnemucca Lakes, separated by the Lake Range, occupy the lowest portion of Lahontan Basin. Their existence as the major body of water in Nevada is due to the quantity of fresh water that originally flowed into them from the Truckee River.

South of Pyramid Lake from the Virginia Mountains to Peavine Peak the intervening valleys and ranges trend northwest, contrary to the usual north or northeast basin structure. Adjoining this area on the south is the Truckee Meadows, another ancient lake basin which was drained by the Truckee River cutting its canyon eastward through the Virginia Range.

From Reno southward the Sierra Nevada dominates the western portion of the county, and spurs from the Virginia Range traverse across this area to meet the Sierra Nevadas at Washoe

and Lakeview summits. These low hills separate and enclose Washoe, Pleasant, and Steamboat valleys. At this point the erosion has developed more mature forms in the granitic hills east of these valleys. Near the old site of Ophir in Washoe Valley two ages of glacial moraines can be seen on the valley floor. The older moraines are distinguished by the greater degree of rock decay and weathering.

GEOLOGY AND ORE DEPOSITS

Since the results of the Fortieth Parallel Survey were published in 1876 very little field work has been done on the geology of Washoe County, and consequently literature covering the geology of this area is very limited. The Fortieth Parallel Survey extended west to the 120th meridian and covered an area from 39 degrees 30 minutes north latitude, which is about two miles south of Reno's railway depot, to the forty-first parallel a distance of 107 miles northward. Practically no mapping has been done north of this area, and few reports are available beyond one on the cinnabar occurrence in the Lone Pine district and a private report on the Leadville mine.

The maps prepared by the Fortieth Parallel Survey are an admirable work accomplished under adverse circumstances, but occasional errors were made in designating the age of formations such as the intensely metamorphosed Mesozoic sediments exposed at the northern end of Fox Mountains and in the Peavine district, which were mistakenly classified as Archaean in age.

To supplement the meager geological information assembled on northern Washoe County, Director Jay A. Carpenter, accompanied by Byron Hardie, made a reconnaissance survey of this area during May of 1946. They reported that favorable igneous and sedimentary rocks for mineral deposits are not visibly exposed north of the Leadville district and that the area is mainly covered with comparatively recent lavas, tuffs, and lake sediments, in which normal deposits of common metals are not likely to occur. What may lie buried beneath these recent formations is of great interest to the prospector, but the present deep exploration methods are too costly to make such an investigation a practical venture.

Briefly, the mineralized areas in southern Washoe County are similar in character to those in Ormsby. Small areas of remnant Mesozoic and Paleozoic sediments remaining at Galena and Peavine districts contain base metal deposits carrying some gold and silver values. Eastward from Washoe Lake in diorite formation,

deep erosion has exposed quartz veins carrying precious metal values. Extending northward along the first basin range, Tertiary eruptives are the prevalent formations in which vein deposits containing gold and silver occur at Wedekind and Olinghouse, while in Pyramid district the ores contained silver-bearing copper minerals, and at Leadville lead-silver values predominated.

The greater portion of the wealth taken from Washoe County has been mined from the above-mentioned metal deposits, however, a variety of other economic minerals have been produced from the following localities. Adjacent to Pyramid Lake, chara marl deposits have recently been developed, which contain high-grade calcium carbonate suitable for use as a soil amendment. Intercalated with these marl deposits and often overlying them to a depth of five or six feet are hydrous silica deposits of impure diatomite. Both products were accumulated in Lake Lahontan time together with the salt and sodium sulphate beds that occur near Buffalo Springs on the west edge of this old lake basin. Sulphur, cinnabar, silica, and clays have been produced in limited quantities from the hydrothermal deposits and alteration products of Steamboat Springs.

In early years placer gold was mined from former Tertiary river channels situated in Little Valley, southwest of Franktown, and from placer workings in recent alluvium on the northeast slope of Peavine Peak. The hearsay high production figures cannot now be substantiated.

HISTORY AND HIGHWAYS

The mineral wealth of the region now known as Nevada was not readily discovered, partially because of the hostile attitude of the Indians that inhabited the area, and mainly due to the forbidding nature of the Great Basin deserts. Both early explorers and emigrants hurried through the arid stretches of Nevada with a minimum of delay. Consequently, with the exception of the Humboldt River Valley, which was the main travel route, this inland basin was the last area in the United States to be accurately mapped. Amusing as it may seem today, Bidwell in 1841 and Fremont in 1844 expected to find the mythical Buenaventura River flowing westward from Great Salt Lake through the Sierras to the Pacific Coast.

The exploration party of Captain John C. Fremont entered Nevada from Oregon and traversed southward through Washoe County to "Big Bend" (Wadsworth) on the Truckee River. He observed extensive areas in northern Washoe covered by black

volcanic rock, and sandy soil covered with saline effloresence on the margin of the many lakes and playas. The unpalatable nature of the brackish lakes and thermal springs encountered here by Fremont was a source of concern to the party searching for fresh water. He discovered, on January 6, 1844, the boiling hot springs of Gerlach that he described so carefully, and on January 10 "a sheet of green water set like a gem in the mountains" that he named Pyramid Lake. His party was further confounded by the massive calcareous deposits of tufa on the granitic rocks around Pyramid Lake, which they concluded could not have been

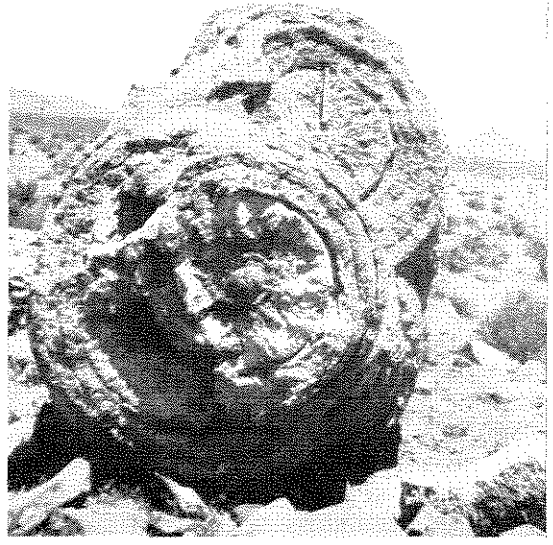

Figure 13—Concentric Tufa at Pyramid Lake.

deposited from water. These striking remnants of Lake Lahonton can be seen from all along the road on the east and south side of the lake. Evidently metallic minerals were not observed or recognized for none are mentioned in the report. (Figures 13 and 14.)

This region remained an obscure part of Alta California until it was acquired from Mexico in 1848. Subsequently it was organized as a part of Utah Territory in September 1850, and by an Act of Congress approved March 2, 1861, became Nevada Territory. Most of the area remained practically unexplored until placer gold was discovered in California by John Marshall in

1848, which precipitated a rush to the West. Most of the fortune seekers followed the overland route along the Humboldt River to Lassen Meadows, now inundated by the Rye Patch Reservoir. At this point the emigrant trail divided, the southern route continuing along the Humboldt River and crossing the Forty-mile Desert to Fort Churchill, and through what is now Ormsby and Douglas Counties to West Carson Canyon and Placerville. The northern or Lassen and Applegate trails continued westward through Rabbithole Springs and crossed the Black Rock Desert. The Lassen Trail crossed Washoe County about on the present Western Pacific route, while the Applegate Trail lead to Oregon

Figure 14—Tufa Covered Hill at Pyramid Lake.

up through Highrock Canyon and past Massacre Lake to reach the Klamath region.

Discovery of the Comstock in 1859 intensified interest in mining, and other discoveries quickly followed in nearby districts which developed in the aurora of the great silver camp. Jumbo and Galena, in southern Washoe County were opened in this manner about 1860, and soon declined after the preliminary excitement. A lead smelter was erected at Galena, which failed to function properly mainly due to the arsenic and zinc content of the ores. Subsequently the mines were abandoned and the communities of southern Washoe County turned their attention to lumbering and furnishing timber to the Virginia City mines.

A period of rapid expansion in mining accompanied the development of communications in Nevada, beginning with the Pony Express and culminating in the building of the railroads. The early enterprises stationed personnel along their route who prospected and explored the adjacent areas for mineral and the railroads made possible the shipment of ores and concentrates to various smelters. In fact Vanderburg (1936) states the first rail shipment from Nevada to Sacramento consisted of ore from the Peavine district.

It is interesting to Washoe County people that the Annual

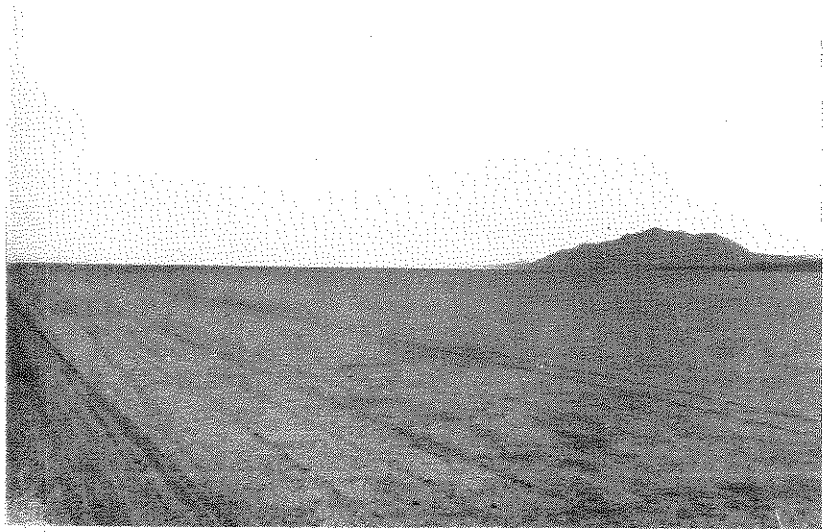

Figure 4—A Dry Lake Road on the Black Rock Desert.

Report of the State Mineralogist for 1866 states concerning the Peavine District:

> Assays from thirty-four mines in this district made by W. F. Rickard, F.C.S., show an average yield in gold of 1 oz. 1 dwt. 3 grs., and in silver of 4 oz. 9 dwt. 19 grs. per ton, giving a value of about $25.
>
> And of the Galena District:
>
> Considerable work has been done on one of the lodes (probably that of the Commonwealth Mine now operated by the Union Lead Company) an adit being driven to the lode, from which an incline has been sunk on the vein.
>
> Considerable ore has been extracted from the mine, and Galena Creek, only a few yards from the mouth of the adit, affords ample facilities for dressing the ore, and the vicinity of the pine forests of the Sierra Nevada

reduces the cost of wood at the mine to about three dollars per cord.

Of the Crystal Peak District the report states:

> It has chiefly attracted attention as having produced the best coal which has hitherto been found in the State. It is a black lustrous lignite, retaining strongly the original structure of the wood.

And of the Truckee River:

> This river affords the most valuable water power in

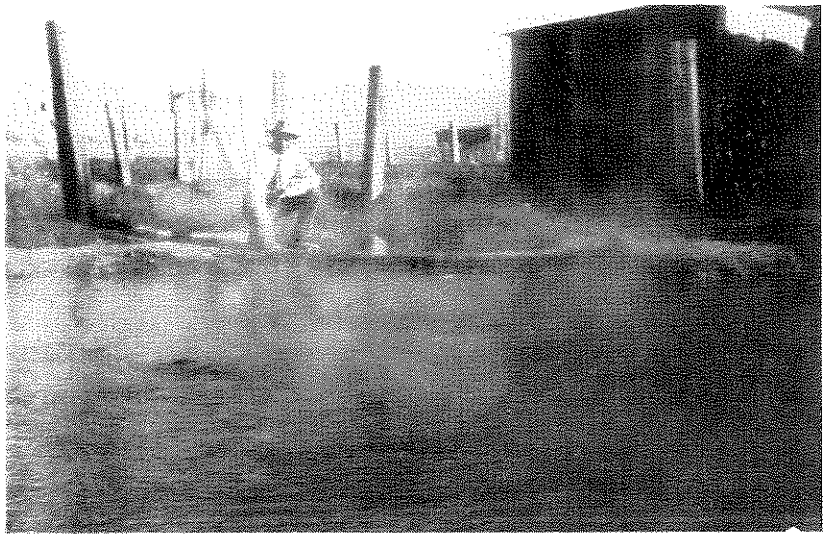

Figure 5—The Gerlach Hot Springs.

> the State. With a fall varying from thirty to forty feet per mile, a large volume of water, and freedom from serious floods, it possesses unrivaled qualifications. There is no doubt but that on the completion of railroad communication between it and the surrounding mining districts, many mills will be erected along the stream, which will not only be able to compete with those in the immediate vicinity of the mines, but will beneficiate ores yielding no more than twelve dollars per ton, at a profit both to mill and mine.
>
> The only foreign incorporation is the Washoe United Consolidated Mining Company, who have a good twenty-stamp mill on the Truckee River, at present lying idle, having been built before the mines, which were to furnish the material for crushing, had been proved of value.

A few months ago a man came into Director Jay A. Carpenter's

office asking if it was possible for him to locate the mill site on the Truckee that his father constructed in the '60's, and who later sank the deep 3,000-foot shaft at Gold Hill named after him as the Osbiston shaft.

The Southern Pacific and the Virginia and Truckee traverse southern Washoe County to serve that area, while the Western Pacific Railroad crosses the south-central portion of the county. In addition, the Fernley-Lassen branch of the Southern Pacific System runs northwest from Wadsworth, along the west side of

Figure 6—The Gerlach Swimming Pool at the Springs.

Pyramid Lake, to Flanigan, where it crosses the Western Pacific and continues into northern California.

U. S. Highway 40 crosses the southern end of Washoe County from Verdi, through Reno to Wadsworth and U S 395 crosses into the county at a few miles northwest of Reno, thence to Reno and south to Lake View summit toward Carson City, with branches to Lake Tahoe and to Virginia City.

A secondary road, Nevada Highway No. 34, runs northward from Wadsworth through Nixon to Gerlach. From here it goes almost due north for thirty-six miles and then northwest for approximately forty-five miles to Vya near the western boundary of the county where it intersects the Cedarville, California, to Denio, Oregon, road, Nevada Highway 8A, that crosses the north end of the county. From Vya, Highway No. 34 continues north past the west side of the Sheldon Antelope Refuge to the Oregon line.

From Gerlach also another road, Nevada Highway No. 81, runs almost due northwest for fifty miles, passing a branch road to the Mountain View mine, and along Duck Flat to the county line, and then leading on to Eagleville and Cedarville. At about nine miles out on this road from Gerlach a branch turns southwest then south, roughly paralleling the Western Pacific railroad which it crosses at Sand Pass and continues down the western side of Pyramid Lake to south of Sutcliffe, where branches lead either to Reno or Wadsworth. Many small branch roads run to mining

Figure 7—The Reservoir Fountain north of Gerlach.

properties over the county and various short cuts through the Smoke Creek Desert and other playas are similar to vast pavements in dry weather, but impassable after storms and during the winter months.

A description of the roads in the northern end of the county follows, based upon the notes of Messrs. Carpenter and Hardie.

The road from Nixon to Gerlach skirts the old eastern shore line of Winnemucca Lake, which is practically dry, and at about 15 miles south of Gerlach the gypsum quarry and crushing plant of the Pacific Portland Cement Company can be seen to the east where it lies just over the Washoe County line in Pershing county.

The road north of Gerlach at 0.8 miles passes the Double Hot Springs whose boiling water is apparently used to dip chickens in for picking feathers, and where local people swim in the warm pool below the spring, or take mud baths close by in adjacent spring areas. Mrs. Thrasher, the Gerlach postmistress, states

she has many inquiries concerning the springs. (Figures 5 and 6.)

Farther on the road follows a flat valley, or "dry lake," for several miles that in summer is as smooth as a race track and offering surprising mirages ahead of the traveler. (Figure 4.) At about 24 miles out on this road, and 0.3 miles to the east, is a spouting fountain that can be seen from the road. A side road leads to an area of hot pools, springs, and coarse grass, where this fountain of a 20-foot base and ten foot height coated by nature in red, green, blue, and buff colors, intermittently spouts water and steam.

Director Carpenter believes it may be of comparatively recent

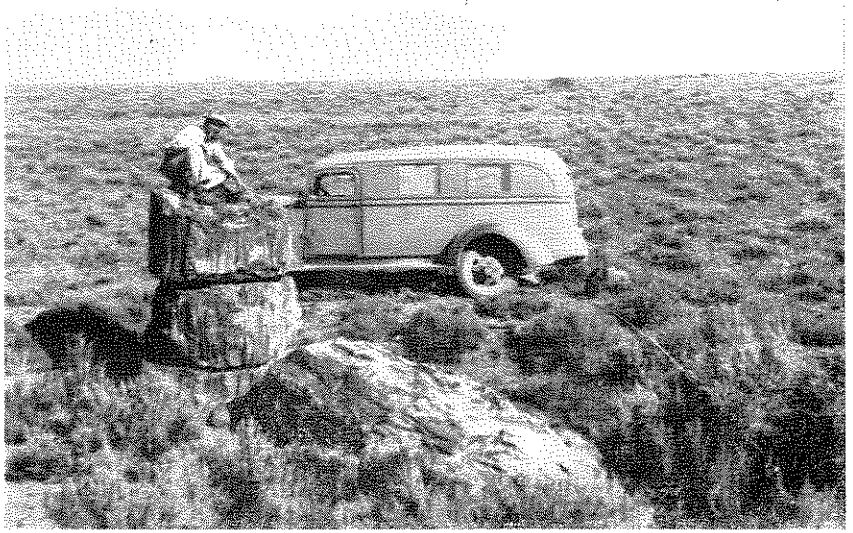

Figure 8—Petrified Tree Trunk north of Gerlach.

growth by deposition of carbonates, possibly around a drill pipe and watering trough as indicated by the growth around another drill pipe not far away. Mr. Moore of the Pacific Portland Cement Company states that the cone has built up two or three feet in the last six to ten years. Being near a reservoir, the name of Reservoir Fountain is appropriate. (Figure 7.)

At about 45 miles out on this road the Leadville mine can be seen to the left. Here a branch road runs to it up a ravine, while a second road farther on avoids the ravine.

At about 52 miles on the west side amid the sagebrush a stump of a petrified tree looms up about nine feet in height and five

feet in diameter, and in the vicinity many more stumps are to be found. (Figures 8 and 9.)

On the road on to Vya many round pebbles of dense black obsidian are in evidence and they continue out on the road 8A past the striking Painted Peak (elevation of 6,378 feet) to the Massacre Lake area. Messrs. Carpenter and Hardie camped at this lake and tried to locate the source of this obsidian in a flow formation, but came to the conclusion that they were probably inclusions in overlying formation now weathered away. Messrs. L. A. McCully and Bill Grabe when interviewed in Cedarville stated that obsidian boulders of larger size are to be found

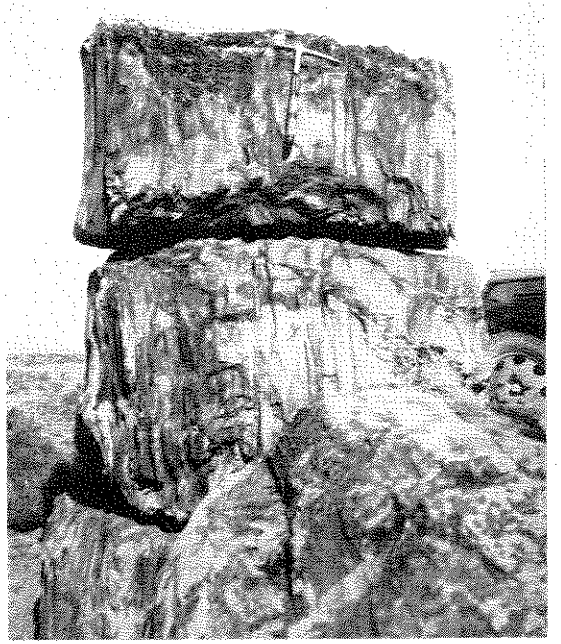

Figure 9—Petrified Tree Trunk Prepared for Shipment.

south of Massacre Lake toward High Rock Canyon, and in the canyon area are fossil shells, clay stones, and petrified wood. At Eagleville, Pete Hurd stated that petrified tree stumps occur to the northeast of Duck Flat. These three men have large interesting collections and are well acquainted with northern Washoe County.

On the Eagleville to Gerlach road on Duck Flat there is a large area covered with growths of tufa, saucer to wash basin in size

Figure 10—Painted Peak, Nine Miles East of Vya.

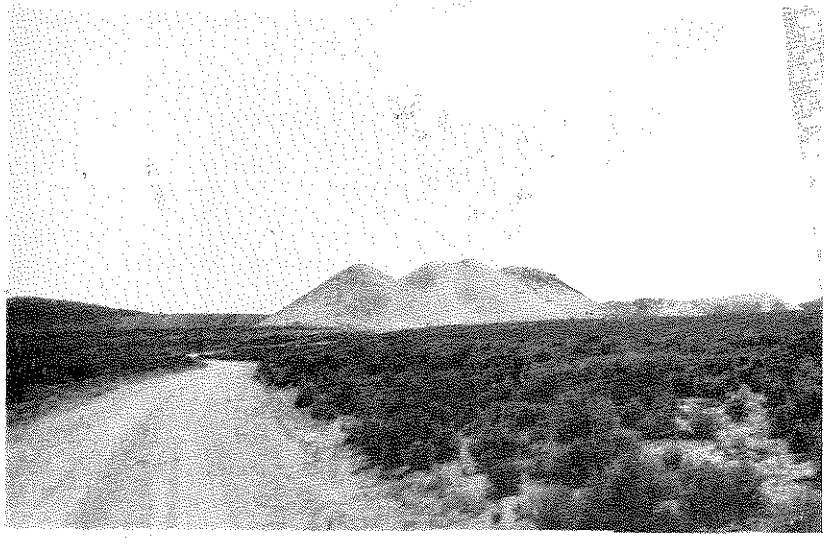

Figure 11—Gravel Piles at Sand Pass.

and shape, starting from a stem in the ground. This was the point at which calcareous waters issued from the ground and apparently the deposition of the tufa formed a basin, gradually building up as the tufa deposited on the overflow edge. This is similar to the condition at Reservoir Fountain. Mr. Hurd stated that a tonnage of these odd growths of tufa had at one time been burned in a kiln for local lime.

One of the common geological sights all over northern Washoe County is that of softer flat-lying tufa beds overlain by basaltic flows of harder protective rocks. One of the striking examples is that of Painted Peak nine miles east of Vya, that rises seven hundred feet above the level sagebrush land. It derives its name from the red, buff, yellow, and white colors of the rocks. The

Figure 12—Gravel Pit at Sand Pass.

contact of the top glassy cap rock with the tufa below is marked by a belt of red-burned pebbly rock telling of molten volcanic flows of ages ago. (Figure 10.)

Coming south from Sheephead Station toward Pyramid Lake, a huge pile of gravel at Sand Pass could at first easily be taken for a hill. Close by is the pit area from which the Western Pacific took gravel to make a firm foundation for its tracks up the Smoke Creek Desert to Gerlach. (Figures 11 and 12.)

From Sand Pass to Sutcliffe, there are three branch roads leading to deposits of marl, spotted when being worked on windy days by clouds of white dust. (Figure 1.)

Southern Washoe is adequately served with power furnished by the Sierra Pacific Power Company from a series of hydroelectric generating stations located on the Truckee River and a tie-in service with the Pacific Gas and Electric Company of California. Areas north of Reno are dependent upon either gas or diesel engine power.

PRODUCTION

The official recorded mineral production for Washoe County, by years, districts, and producers from 1881 to 1940, inclusive, as compiled by Couch (1945) and brought up to 1947, follows:

DISTRICT SUMMARY

	Tons	Gross yield
GALENA (Washoe)	15,468	$233,296
DEEPHOLE (Granite Range)	5,325	69,497
JUMBO (West Comstock)	1,200	5,000
LEADVILLE	3,719	541,671
PEAVINE (Reno, Crystal Peak)	30,530	160,128
PYRAMID	2,634	87,100
STEAMBOAT SPRINGS	.....	13,010
WEDEKIND (Glendale)	2,350	73,126
OLINGHOUSE (White Horse)	12,251	577,079
UNKNOWN	.....	36,300
	74,468	$1,796,207

With $300,000 of this since 1940.

PRODUCTION OF PROPERTIES REPORTING TOTAL OF $5,000 BY DISTRICTS

Districts	Period	Tons	Gross yield
GALENA (Washoe)—			
Union Lead Mining and Smelting Co.	1943–45	14,624	$232,820
DEEPHOLE (Granite Range)—			
Burm Ball Mining Co.	1939–40	5,325	69,497
JUMBO (West Comstock)—			
Bargo Mining and Milling Co.	1909	1,200	5,000
LEADVILLE—			
Leadville Mines Company	1911–25	3,024	462,336
Tohoqua Mines Company	1910–16	649	73,611
PEAVINE (Reno, Crystal Peak)—			
T. A. Larke, Agt. for Golden Fleece and others	1872–74	29,580	148,464
Red Metals Company	1912–13	793	11,381
PYRAMID—			
Franco-American Mine and Leasers	1881–89	2,634	87,100
STEAMBOAT SPRINGS—			
Reno Press Brick Co.	1943–44	.....	8,340

PRODUCTION OF PROPERTIES—*Continued*

Districts	Period	Tons	Gross yield
WEDEKIND (Glendale)—			
Desert King	1902–03	333	$6,569
Reno Star	1901	326	15,628
Wedekind	1901–03	994	36,354
OLINGHOUSE (White Horse)—			
Cabanne, Emile	1941–42	58	5,054
Cabin No. 2	1902–04	1,710	20,050
Clemons, Ray	1936–45	1,930	13,568
Dallimore, Dallimore & Dallimore	1941–45	66	12,006
Dallimore, George	1939–40	122	6,047
Effrick & Carothers	1926	182	21,676
Gold Center Mine	1901–04	513	12,726
Gold Ledge Mine	1901–04	955	7,958
Huskey and Springer	1901–02	182	14,105
Juniper	1901–03	598	9,615
Keystone Mining Company	1910	856	10,682
Tourseu, A. E.	1941	451	15,148
Valmadre and Mangini	1941–44	52	13,798

MINING DISTRICTS

BUFFALO

Buffalo Springs district is situated on the west side of Smoke Creek Desert near the mouth of Buffalo Canyon. It lies about 25 miles southwest of Gerlach on the Western Pacific Railroad.

Geology. This area is principally composed of Quaternary sediments and mud flats which are impregnated with saline matter derived from the dessication of Lake Lahontan. The area immediately west of the ancient playas is capped with Tertiary basalt flows. Post-Pleistocene faulting occurs on the west side of the desert, along which thermal springs can be observed. The water from these springs and that which debouches on the mud flats from nearby surface drainages is soon transformed to a brine by the addition of salt from the lake sediments.

The Buffalo Springs Salt Works, established here about 1879, produced about 250 tons annually for a short time prior to 1885. The crude salt was used mainly for the chloridizing of silver ores, and the purer grade salt segregated for domestic use. The production of salt was accomplished by pumping brine from shallow wells to surface vats where it evaporated and the resultant crust was collected for shipment. In addition to the sodium chloride, a bed of sodium sulphate approximately eight feet thick occurs near the old salt works, Lincoln (1923). This deposit has neither been thoroughly explored nor worked commercially

and none of the saline deposits in the district have been exploited in recent years.

The United States Geological Survey in Bulletin 669 mentions beds of sodium sulphate several feet thick in several places, and gives an analysis of brine, mainly sodium chloride, with a 0.311 percent potassium sulphate content.

Director Carpenter states that Mr. Cornell, a rancher living close to Sheephead Station, 38 miles from Gerlach, knows the location of the old Buffalo salt works close by, and that W. D. Parker of Gerlach, Nevada, who owns several ranches along the Smoke Creek Desert, owns the land or that nearby, and also that Bert Ithurburn at Sheephead Station said that a fullers earth deposit 25 miles to the southwest of there had once been drilled by an oil company.

COTTONWOOD

The Cottonwood district is situated in the Fox Mountains (northern Lake Range) and about 15 miles southwesterly from Gerlach.

Geology. The mountains of this region are mainly granite flanked on the north and east by Mesozoic sediments with scattered basalt flows covering a portion of both east and west slopes. Extensive fault movements have occurred along the east base of the Fox Mountains. Some contact metamorphism exists in the marginal sediments, and quartz veins carrying silver, lead, and copper minerals have been prospected. Antimonial minerals also occur in the mineralized areas, which include small amounts of stibnite and tetrahedrite (gray copper).

Hill (1915) reports that claims in the Cottonwood district were worked in the seventies, and by 1882 nearly 100 claims were held in the district. A five-stamp mill was erected to treat the ores, but the scarcity of water was given as the reason for the unsuccessful operation of this mill. The early activity in the district ceased about 1900.

Properties. The Wild Horse Mine, operated by the Washoe Lassen Mining Company during 1912, was equipped with a five-stamp mill, in which gold and silver values were recovered by amalgamation from ocherous quartz ores.

The vein strikes northwest and has a rather flat northeast dip. The wall rock is softened by alteration and has a porphyritic texture, which Hill (1915) believes is a porphyritic quartz monzonite or an altered andesite. The vein averages about three feet wide and consists mainly of altered wall rock cut by stringers of iron-stained quartz. The yellow ocherous ore is low grade,

but pans very fine colors, while the narrow siliceous streaks are higher grade ore in which flaky gold up to one-sixteenth of an inch across occurs.

The Sano Consolidated Mines Company represented by W. E. Pruett of Reno was the only active property in the district during the period of 1922–1923.

In Rodero Canyon a 14-inch quartz vein strikes northwest through the granitic rock and is said to contain silver values carried by pockets of galena in the quartz.

The northern boundary of the Pyramid Lake Indian Reservation lies approximately two miles south of Pah-rum Peak; consequently the southern portion of this district lies within the reservation, and is not open to location. Mineral discoveries within the reservation may be leased with the consent of the Bureau of Indian Affairs.

DEEPHOLE (Granite Range)

The Deephole district derived its name from a unique thermal spring, situated north of the Smoke Creek Desert and about ten miles northwesterly from Gerlach. Nearby portions of Granite Range is included in this district.

Geology. That portion of the district which lies east of Squaw Creek is dominated by the intrusive rocks of the Granite Range and the west portion of the district is covered mainly by Tertiary basalt and Quaternary alluvium. Limited quantities of gold ore were discovered in the district in 1908 and the district became active again in 1938 when the Mountain View property was discovered.

Property. The Mountain View Mine is situated on the west slope of the Granite Range about 21 miles northwest of Gerlach. This property was discovered and opened by L. E. Donner and W. H. Swank during 1938. During that year it was reported that low grade values of gold and silver existed in a wide calcareous shale formation which extended across the claims, and that they shipped from the main vein 838 tons of ore which contained 340 ounces of gold and 1,844 ounces of silver. The Anaconda Copper Mining Company did the first development work on the property. Later the Burm-Ball Mining Company optioned the Mountain View from Donner and Swank and extended the development work on the main lower tunnel level. Some good ore was developed in a winze sunk below the main adit and water level was reached. The Burm-Ball production from 1939 to 1940, inclusive, is given by Couch (1943) as 5,325 tons with a

gross value of $69,497. Metallurgical tests of the ore indicated poor extraction by either cyanidation or flotation due both to oxidation and to an arsenic content.

Charles Nash's tungsten claim adjoins the Mountain View property on the south and is approximately 20 miles northwest of Gerlach. This property is on a contact zone of granitic intrusives and a series of metamorphosed sediments. Scheelite is associated with the metamorphosed rocks, according to Gianella (1942), but the development work was insufficiently advanced to make a conclusive evaluation of the property.

The Silver Bell, also adjacent to the Mountain View and Nash claim is approximately 20 miles northwest of Gerlach on the west slope of the Granite Range.

The Silver Bell vein trends northeasterly, cutting through metamorphosed calcareous rocks which are largely converted to garnet, epidote, tremolite, and zoisite, as reported by Gianella (1942). The mountain front here trends about north while the large area of metamorphosed limestone strikes north 70 degrees east and dips 80 degrees to the south. This general trend of the metasediments is nearly at right angles to that of the Granite Range. It is probable that more thorough prospecting might reveal sufficient tungsten ore to be of commercial value, but the exposures open in 1942 were not very encouraging.

DONNELLY

Donnelly district was originally listed by Lincoln (1923) under the mining districts in Washoe County, but apparently it is situated on the southwest flank of Division Peak about three miles inside the Humboldt County border. See Vanderburg, W. O., Reconnaissance of mining districts in Humboldt County, Nevada; United States Bureau of Mines Information Circular 6995: 20, 1938. Mr. J. J. Thrasher of Gerlach owns property in the district and is the best authority on it.

FLANIGAN

The Flanigan district is four miles northwest of the "Needles" at the north end of Pyramid Lake and six miles east of Flanigan station on the Fernley-Lassen branch of the Southern Pacific Railroad.

Geology. Deposits of marl occur near Zenobia, Sand Pass, and Sutcliffe, and a clay deposit is situated at Dusty Point northeast of Astor station on the Southern Pacific Railroad. The marl or bog lime deposits occur as calcareous beds composed mainly of chara stems, a form of alga, and numerous gastropod shells, along with

clay and diatomite as impurities. It accumulated in shallow embayments of the ancient Lake Lahontan. Humphrey (1945) found the marl deposits were nearly all situated approximately 100 feet above the present level of Pyramid Lake and in valleys adjacent to that body of water. Some deposits have been deeply eroded since being exposed. The marl varies from seven to eleven feet in thickness and is intercalated with beds of hydrous silica in the form of diatomite. Both products are white and the silica must be carefully stripped from the lime to avoid dilution. The marl is noticeably heavier than the diatomite and can be recognized by the numerous small tube-like carbonate remnants of the chara plants which are contained in the deposit. Another means of distinguishing the marl is to apply dilute hydrochloric acid to a sample, which will cause the carbonate content of marl to effervesce while the silica remains inert.

The marl can be mined to contain averages 55 to 65 percent available calcium carbonate, and its mining due to its softness breaks it down to a powder thus not requiring crushing or grinding. Due to the organic origin of the Lahontan marl, its calcium carbonate content is readily available by rapid disintegration and solution in the soil, consequently it is a desirable neutralizer and soil conditioner.

Properties. The first bog lime deposits were discovered and located by Paul Butler in 1919, who sold claims to the Agriculture Lime and Compost Company in 1922. This company shipped about 1,500 tons of marl during a six-months operation in 1922.

In 1945, the Lodi Fertilizer Company, a subsidiary of the Sanguinetti Fruit Company of Lodi, California, is reported to control 400 acres under lease from the Bureau of Indian Affairs and to hold in private ownership 470 acres in the Sand Pass area. Large shipments were made from these deposits to California and Arizona during 1945 and 1946 and the company is now active.

The Double Check Products Company produces marl from its deposits located at Astor Pass. The deposit is worked by an open-pit operation.

The Nevada Lime Company shipped in 1945 and 1946 many thousands of tons from the Rivermott Placer Claims in Section 29, T. 27 N., R. 20 E., at the north end of Pyramid Lake just off the Indian Reservation. A report on this property by Humphrey (1945) of the Nevada Bureau of Mines is on open file at our office. This deposit was taken over in 1947 by the Pacific Fertilizer Company, Inc.

The Dusty Point Clay Deposit is owned by Bennett Wilcox and is situated in sections 11, 12, and 13 of T. 27 N., R. 19 E. This deposit consists of three flat zones of hydrothermally altered lava, which contain approximately 250,000 tons of 30 percent alumina.

GALENA

The Galena district is situated adjacent to Galena Creek in Pleasant Valley approximately 14 miles south of Reno.

Geology. Situated low on the east flank of the Sierra Nevada Range the Galena district is a mineralized area of hard fine-grained hornfels, which area was originally shale with some interbedded dolomite or limestone. Humphrey (1945) states the metamorphism and probably the mineralization of the district were caused by a granodiorite intrusion, a portion of which is exposed on the north slope of the spur leading down from the Sierras. The ore zone contains lead, silver, and zinc values with accessory minerals of arsenopyrite, pyrite, and chalcopyrite. The vein on the Commonwealth property strikes about north 80 degrees east and is divided into an "east" and "west" zone, because an andesite flow covers the middle portion for a distance of about 1,000 feet. Probably the two zones are on the same fracture system, but development to date has not proved this point.

The outcrops of the mineralized areas show lead as both sulphide and carbonate associated with yellow iron sulphate and iron and manganese oxides. Most of the copper and zinc has been leached from the surface, due to the heavy oxidation. Galena, sphalerite, chalcopyrite, arsenopyrite, and pyrite were the minerals encountered in the primary ore when the Union Lead adit was again opened in 1939.

Auriferous arsenopyrite occurs on the west side of Pleasant Valley at the Rocky Hill Mine. The formations here are similar to the Commonwealth area and consist mainly of hornfels.

Properties. Numerous companies or operators have controlled or operated the mines of Galena. The camp was started by A. J. and R. S. Hatch who organized the district in 1860. A smelter and a mill were erected in the district soon after the lead-silver ores were discovered. Both of these plants failed to function properly and mining was subsequently abandoned in favor of lumbering. Interest was renewed in the district when the Nevada Commonwealth Mining and Milling Company built and operated a gravity concentrating plant in 1906 and 1907. The present lower adit was driven at this time and considerable other development completed. The mine and plant is generally known as the

Commonwealth Mine, and is in plain view of the Reno to Carson City highway, being situated on the west side of Pleasant Valley.

In 1911 the property was purchased from the Commonwealth organization by the Washoe Consolidated Mining Company which was headed by C. N. Miller of San Francisco.

Next the Ford Lead-Silver Company leased the property and shipped lead-silver ore to a Utah smelter during 1924 and 1926. Al McCoy of Sparks directed the mining operation and later leased the property in November 1929 and rehabilitated the old working to open the downward extension of a rich silver-lead shoot which he found outcropping on the claims. McCoy continued to work his lease until the end of 1930 when the ground was taken over for a short time by the Allied Mines and Exploration Co.

Late in 1926 T. F. O'Brien and H. L. Parker obtained a bond and lease on the Commonwealth property at which time they made metallurgical tests on the ore, but failed to agree with the owners on terms for working the mine.

W. H. Blackburn obtained a lease and option on the claims for the Treadwell Yukon Company in June 1931, and commenced active exploration work. It is reported Blackburn concluded that no money could be made working this complex ore body under the terms and economic conditions that prevailed at the time.

An ill-advised attempt to work the Commonwealth ore by an air-separation process was tried and failed in 1933.

John H. Somers reopened the property in 1939 under the name of Union Lead Mining & Smelter Company and shipped 14,624 tons of ore during 1943 to 1945, inclusive, with a gross value totaling approximately $232,000. A flotation plant is planned for the property.

According to Director Carpenter the mineralization at this mine is apparently confined to a single fissure vein having a N. 60 degree E. strike with a S. 60 E. dip, with a width of ore from 5 feet to 15 feet. The main working adit, the lowest of several, is about 1,400 feet long, encountering sulphide ore in the last 400 feet. This ore contains the valuable minerals of argentite, galena, and marmatite (the sulphide of both zinc and iron).

The vein is in a metamorphosed volcanic tuff. This tuff is partly overlain on the surface by a late andesite flow, tongues of which appear in the tuff in the lower adit, and the better mineralization in the vein occurs on cross fractures.

At 1,150 feet from the portal, a winze encountered water level at 100 feet depth, and with promising ore on this level. In the first half of 1947, the United States Bureau of Mines diamond

drilled from a hanging wall crosscut on this level, which the mine owner states proved that good milling ore persists with depth below water level.

The Rocky Hill property, situated on the east side of Pleasant Valley, produced and milled some gold from arsenopyrite ore during 1907. This property remained idle until 1924 when 66 tons of arsenical ore was shipped to the National Chemical Company at Pittsburgh, California, where the ore was roasted and converted to calcium arsenate.

The Galena Hill mine includes one patented claim and the Steamboat group of seven mining locations, which are situated about three miles southwest of Steamboat Springs. The property has been developed by a 900-foot adit and some open cuts, from which two thirty-ton cars of ore were shipped to the Western Ore Purchasing Company at Hazen, Nevada, during May 1929. The mineralization consists of lead-zinc ores which occur in shear zones cutting the hornfels and in part overlain by Tertiary andesites.

JUMBO (West Comstock)

The Jumbo mining district is situated on the west flank of Mount Davidson in the Virginia Range and east of Washoe Valley.

Geology. The country rock at Jumbo consists of Tertiary volcanics and hornfels which are intruded by diorite. The mineralization is mainly gold and silver values which occur in fissures in the andesite and diorite.

Although the district adjoined the Comstock on the opposite slope of Mount Davidson and was probably prospected during the Comstock excitement, it was not developed until the early 1900's. Stuart (1909) credits the Wild Goose, Pandora, and Red Top Mines with an appreciable production in gold and silver. He further lists the Fink and Mahoney, Londons, the Golden Gate, and Gopher mines as engaged in development work on favorable locations. The Selby Consolidated Mining and Milling Company was reported mining and operating a 5-stamp mill. The Comstock Extension Mines, adjoining the Selby property, had driven a crosscut adit 305 feet, with 100 feet remaining to cut the London vein.

Fink and Mahoney, according to the Mineral Resources (1911) produced 266 tons of gold and silver ore from which they recovered $9.63 per ton by amalgamation in a 5-stamp mill.

The Last Chance, in 1914, produced a small amount of precious metal ore and a year later Mineral Resources reported that the

Washington Nevada Development Company constructed a ten-stamp mill on their property with the testing of several lots of ore. In 1928, The West Comstock Gold Mining Company was developing the Bargo claims. The shaft of 235 feet depth struck a heavy flow of water on the 180 foot level, and a long tunnel was driven to drain off the water. Some milling ore was produced.

LEADVILLE

The Leadville district is situated 38 miles north of Gerlach, which is a freight division point on the Western Pacific Railway. The Leadville mine is located on the east flank of Mt. Fox in the Granite Range.

Geology. According to Burgess (1926) the country rock is Tertiary andesite overlain by tuffs and breccias. The andesite has been intruded by large dikes of prophyritic diorite containing large crystals of fluorite. The mineralization is in fissures in which a silver-lead-zinc sulphide ore occurs with a small amount of gold.

The occurrence of niter salts along cliffs of rhyolite west of Leadville is regarded by Gale (1912) as unimportant accumulations of organic matter.

Properties. Leadville Mine. A. A. Codd acquired control of the Leadville property in 1919 and after exploring the ground organized the Leadville Mines Company in January 1920 to develop the property. Prior to this the property was originally owned by John Harnan, who turned the property over to the Tohoqua Mining Company who made an official production of 649 tons of a value of $73,611 from 1910 to 1916, and it had developed the property by two shafts and the "1,700-foot Floyd Tunnel" with a winze from it to 300 feet in depth. The head of this winze is 250 feet below the outcrop of the vein.

The Leadville Company erected a 25-ton gravity concentrator employing jigs and tables. In time the mill was increased to 60 tons a day with flotation units added, giving a reported 90 percent recovery of the metal contents at a 6:1 concentration ratio. The mill was destroyed by fire in September 1925, and was not rebuilt. The company reported through 1925 a gross production of $462,336 from 3,024 tons of concentrate and ore. The mine operation was then turned over to leasers who mined selectively and shipped out small tonnages, mainly from the 700-foot level in the winze until the mine was closed by the Mine Inspector's orders in 1928, and has since lain idle. Two of the last leasers, Ogle Swingle and Ben Cassidy, now live in the vicinity of Gerlach.

The vein of the Leadville mine is in an andesite formation and strikes about east and west with a 70 degree dip to the north. To the west a prominent wide diorite dike cuts across the strike of the vein and farther on a tuff formation overlies the older rocks.

The vein walls and the values across the vein are irregular. The stopes varied from 3 to 6 feet wide and were stulled, and the drifts were timbered. The valuable minerals in the vein from close to the surface were the sulphides of lead, zinc, copper, and silver, accompanied by abundant pyrite, and with a gangue of quartz and calcite. From assays it appears that the ratio of silver to lead in the ore was from 4 to 8 ounces for one percent of lead, and that the zinc content somewhat exceeded that of the lead, and with but a minor amount of copper.

The main adit encountered ore in the last 800 feet which apparently was quite continuous on this level and on the succeeding winze levels, including the 700-foot level. The rake of the ore shoot is to the west or away from the winze, and a drift on the 800, the bottom level, was reported to be in ore when the mine closed down. This level is approximately 1,050 feet below the outcrop.

The vein apparently "terminates" against or is "cut off" to the west by a "crushed zone" or a "fault" or by the "diorite dike," yet one newspaper account reported good ore was found "west of the crushed zone on the 500 level." Only a small flow of water needed to be pumped from the winze. Water now at the tunnel mouth indicates that the winze timbers may be fairly well preserved under water even if the ground may be caved at the winze station.

A very reputable engineer examined the mine in 1926, and although unable to reach the western faces, recommending development work to the west, and the sinking of the winze deeper, based upon the wonderfully consistent ore shoot along the strike of the vein and to the 700-foot level in the winze. He also recommended crosscuts into the walls due to presence of parallel fissures on the surface.

Director Carpenter reported after his trip to the mine in 1946 that caved sets in both the main adit and the connecting Harnan shaft prevented underground inspection of the vein, and he expressed his surprise at the weak outcrop of the vein and the absence of stopes coming to the surface, all in contrast to the ore shoot at depth. The same was true of the outcrop of the Swingle vein to the south in which shallow tunnels have encountered some ore. In his opinion the area merits more exploration work.

Of the seven patented claims, Mr. David Pennick of San Francisco now owns two and Ogle Swingle of Gerlach owns three, these five covering the mine workings and the old camp.

LITTLE VALLEY

The Little Valley, in which profitable placer gold deposits were mined, is situated in southwestern Washoe County and immediately west of Washoe Valley. The deposits are in the south end of a narrow trough or down thrown block on the east slope of the Sierras.

Geology. The gravels are a portion of a Tertiary river channel which has been traced from a point near Incline on the northeast shore of Lake Tahoe through the south end of Little Valley, thence easterly into the Virginia Range where its course is obscured by overlying andesite flows. A major portion of the channel to the west of Little Valley is also overlain by andesite and rhyolite flows. It is displaced by numerous faults as shown by Reid (1908), which complicated the mining problems of the early-day operation. The reported production is given by Vanderburg (1936) as $100,000, of this amount $60,000 is reported to have been taken from a single pocket. The Little Valley deposits and most of the remainder of the channel is located on ground controlled by the Hobart Estate.

LONE PINE

The Lone Pine district is in northwestern Washoe County near the southern boundary of the Sheldon National Game Refuge, but outside the fenced area. It is approximately nine miles north of Massacre Lake.

Geology. The rocks of this district are mainly Tertiary lava flows and associated tuffs that appear to belong to two periods of volcanic activity. The lower unit consists of a red to nearly black, fine-grained andesite. Interbedded with and underlying this andesite is a light-colored tuff intercalated with bands of conglomerate. These rocks generally dip eastward. Near the southern border of this mineralized area, the andesitic rocks are unconformably overlain by a basalt flow, varying from 20 to 50 feet in thickness, and which display an attitude of gentle southern dip, Ross (1941).

The cinnabar mineralization of this area occurs in fractured, kaolinized, and to some extent locally silicified and iron-stained andesite. The cinnabar is accompanied by pyrite which is mostly oxidized in the limited exposures of the shallow development opened in 1941. The most prominent fracturing trends northwestward and dips from 55 degrees northeast to nearly vertical.

Properties. The Antelope property is the principal prospect in this area. Some old prospect pits are within the Game Refuge, but that area is now closed to prospectors. This district was originally prospected for gold, but the search for that metal was discouraging and the area remained practically unnoticed until the more recent discovery of cinnabar. The Antelope group of 18 claims was located by Curtis Mathews and W. S. Miller in December 1929, and a number of shallow trenches and shafts were dug on the property, most of this work being on Antelope Number 10 claim. Late in 1939 the Colton Log and Lumber Company of Portland, Oregon, acquired a bond on this property and explored it by cutting numerous trenches with a tractor powered bulldozer. According to Ross (1941) the workings on Antelope Number 10 claim show considerable pulverant cinnabar, commonly called "paint" along some of the fractures. The average mining content is low with the best 10-inch seam of 0.70 percent containing 0.12 percent as mercuric chloride.

The Harry Woods prospect includes a group of claims located over the ground originally prospected for gold by earlier prospectors. They lie just west of the Antelope group and are in a similar formation with mineralized fractures. The development consists of a few small surface pits.

OLINGHOUSE (White Horse)

The Olinghouse district is situated on the east slope of the Pah Rah Range in southeastern Washoe County. The principal mines in the district are situated in Olinghouse Canyon nine miles west of Wadsworth and about five miles north of Derby in the Truckee River Canyon. A railroad siding is available just north of Wadsworth on the Fernley-Lassen branch of the Southern Pacific Company.

Geology. The region surrounding Olinghouse is mainly underlain by older Tertiary andesite flows, and a small isolated area of prevolcanic rocks, with Quaternary alluvials in the valleys and deep canyons. The mineralized area is an eroded depression from which the original basalt capping has been removed to expose the older andesite. Porphyritic rhyolite and younger andesites intrude this thick series of older andesite flows as both sills and dikes. The rhyolite intrusions are generally confined to the area north and east of the town of Olinghouse, while the later andesite intrusives are widely distributed over the district, but most abundant north of town on Green Hill. The productive mineralization occurs in the form of quartz veins and intensely altered

wall rocks. The later andesite intrusions appear to have had a marked effect on the older rocks and to be the source of most of the ore bodies. Where the younger intrusive has cut the older andesite and rhyolite the normal color of the rocks is usually leached to a white or grey-green earthy appearance. In some places the silicification of veins and of wall rocks has been sufficient to resist erosion and thus form slightly elevated zones. Some ore occurs in veins, but it is more common to find values in zones of altered and silicified country rock adjacent to the intrusives. Free gold and a little silver chloride are the economic minerals. Accessory minerals include chalcopyrite, pyrite, calcite, and quartz. Hill (1910) states tellurium was present in the high-grade ore from the Buster property and an unusual rich ore from the Gus Schave property contained a mixture of petzite and coloradoite, according to the records of W. S. Palmer, Director of the State Analytical Laboratory. The former mineral is a silver-gold telluride and coloradoite is a mercury telluride.

Prior to 1900 placer deposits situated in several ravines tributary to Olinghouse Canyon were extensively worked by Wadsworth residents. These deposits were composed of unassorted subangular gravel, 90 percent of which is less than one inch in size. Vanderburg (1936) states the gold found in these placer gravels averaged 680 fine, and the largest nugget found in this district weighed one and one half ounces. The placer gold is similar to and probably derived from that of the vein deposits in Green Hill.

Properties. This area was prospected in 1860 (Hill 1910) and the first locations made in Fort Defiance Canyon in 1864. In 1874 Frank Free located the Green Mountain mines in Olinghouse Canyon, where most of the subsequent production was made. Mining activity and metal production reached a maximum during 1900 and 1902, which averaged nearly $100,000 annually.

An ambitious but ill-advised mining project was instituted in 1906, when, according to mining news, construction was started on a standard gage railroad from Wadsworth to Olinghouse to haul ores from the Buster mines in Olinghouse to a 50-stamp mill located near the Truckee River. This mill ran for a period of approximately three months and then ceased operation. The old concrete foundations can still be observed just north of Highway 40 about two miles west of Wadsworth.

Renewed interest in Olinghouse developed in 1935 when John J. Raskob and the late Key Pittman organized the Gold Horn Mining Company to acquire and explore the Myra group of five

claims and an additional group of seven Sunbeam claims, all located by Gus Schave. F. J. LeLongchamps, of Reno, directed the exploration work and mined some high-grade ore from the property. The option was relinquished after a few months had been spent in exploring the ground.

Leo DeTray, of Chicago, acquired the placer ground in Olinghouse in 1937, and after constructing a washing plant and installing a 12,000-foot pipe line to carry water to the plant the project was abandoned.

The lode mines have been consistently worked by lessees since the major company operations ceased. Attorney William M. Kearney, of Reno, acting as agent for many of the Olinghouse mines is conversant with the properties and the recent leasing operations in this mining camp. Approximately a couple dozen claims or properties have been actively operated by lessees in recent years in the Olinghouse district.

The Big Mouth property, situated 21 miles north of Wadsworth on the Pyramid Lake Road and five miles up Big Mouth Canyon, is owned by Cowles and Howes. This property was located about 1860 and has been worked intermittently since to produce a few small shipments of selected ore.

York (1935) states the gold occurs in small veins of quartz in fractured diorite. Four parallel veins occur in a width of 200 feet in the sheared diorite. Hot water alteration of the country rock is apparent over most of the property. Development consists of three shallow shafts sunk on the vein structure, and a short adit driven in the east slope of Big Mouth Canyon. A half mile below the above working another adit has been driven, but at the time of York's examination this work had not exposed the vein structure.

Derby-Tungsten. John M. Heizer found tungsten in a highway cut five miles west of Wadsworth early in 1940 and the property was developed by the Rare Metals Corporation. Its location is on section 13, T. 20 N., R. 23 E., in the Truckee River Canyon immediately south of Olinghouse district. It is reported this tungsten-bearing rock was used for ballast by the Central Pacific Railroad in the summer of 1868 and had lain undetected until Heizer checked the favorable appearance of this metamorphic strata with a violet-ray light to confirm the scheelite content in the outcrop.

The Rare Metals Corporation developed the deposit through an adit driven north under the highway. A small amount of tungsten ore was reported taken from the development work.

A gold prospect, situated adjacent to the tungsten and occurring in the overlying volcanic rocks, was explored many years ago under the name of Rainbow Canyon Mines.

South of Olinghouse, deposits of diatomite occur along the north side of the Truckee River between Sparks and Wadsworth. Closer to Sparks there is a rhyolitic tuff from which an excellent light-weight building stone has been quarried for use in Sparks and Reno, according to Humphrey (1945).

North of Olinghouse, in the Nixon area, deposits of shells and of limestone occur from which shipments have been made. A small lime kiln was operated for a short time in the early '40's at Nixon, the limestone coming from a deposit of limestone near the railroad loading point of Numana.

PEAVINE (Crystal Peak, Granite Mountain, Reno)

The Peavine mining district is centered around the peak by that name, which is situated 10 miles northwest of Reno. The area generally considered within this district lies parallel to and reaches about eight miles north of the Truckee River, and extends from the California border eastward twelve miles where it is adjoined by the Wedekind district.

Geology. The formations include Mesozoic and probably Paleozoic sediments which have in part been intruded and metamorphosed by Cretaceous quartz monzonite. Gianella (1942) judges these older stratified rocks to belong in the Paleozoic series because of their marked resemblance and similarity to the tuffaceous sediments of the Feather River region. In addition these rocks have suffered a greater degree of metamorphism than the nearby middle Mesozoic sediments which are exposed in a small area on the north shoulder of Peavine Mountain. These older formations are flanked on the east and south by at least three Tertiary andesite flows. The flow rocks are in turn flanked by sediments commonly referred to as "Truckee" formation, which are probably of Pliocene age. They are exposed in the terraced foothills sloping from Peavine to the river. Interbedded with the basalt sediments of this formation are gravels derived from the earlier andesite flows and concurrent tuffs, grading upward into shaly sands and diatomaceous earth with minor beds of impure lignite exposed in the area northeast of Verdi. Curious pieces of slag and rock with a roasted appearance have been found near this outcrop, which indicate to Gianella (1942) that in the past these beds have been ignited.

In both Truckee Meadows and Lemon Valley alluvial sands and

fine silts cover the floor of these depressions to obscure any older formations underlying the valleys.

The stratified rocks on Peavine generally strike N. 60 degrees E., and dip steeply southeast or stand nearly vertical, however, the beds exposed on the northwest slope show rather flat dips. These rocks have a characteristic green-gray to dark gray color, due to the development of epidote and chlorite in most of the members, which nearly all weather to a dull red-brown color.

The intrusive rock has a coarse granular texture with a porphyritic phase exposed in numerous dikes in the schist areas beyond the contact. A massive tongue of quartz monzonite covering most of the west slope extends from a broad base westward to terminate in a triangular apex just east of the summit and about one-half mile west of Poeville, situated in the schist area.

Approximately two and one-half miles eastward from Peavine summit a north trending contact marks the boundary between the schist and the eastern mass of quartz monzonite. Veering from a quarter to one and one-half miles east of this contact the intrusive body is overlain by andesite flows with the exception of a small boss of monzonite exposed near Fulton's quarry.

The oldest of the flow rocks is a hornblende andesite which is not widely exposed. Succeeding this flow is a dark, fine-grained augite andesite, which is widely distributed in the eastern portion of this district and may readily be mistaken for a basalt because of its dark color and vesicular structure. It usually weathers to a rusty brown color except where is has been altered by hot solutions, in which case it may vary from a light green to a bleached white or maybe stained a brilliant red by ferric iron oxides. The younger flow consists of a porphyritic hornblende andesite in which the Fulton quarry was opened about two miles north of Reno. Rock from this quarry can be observed where it was used for the trim on Lincoln Hall and the Old Gymnasium building on the University campus.

Apparently a long period of erosion preceded the extrusion of the first andesite flows, for deep weathering of the monzonite has been observed beneath the andesite contact by Hill (1915). Following, or possibly preceding, this volcanism, faulting began and deformation of the region resulted, as can be observed by the marked scarp on the northeast side of Peavine. This fault has a strike of N. 45 degrees W., which is unusual in this area. It does, however, turn southward along the east slope of Peavine and divide into shear zones which conform to the usual fault pattern. These fault zones can be observed near the highway

just north of Reno where they traverse the highly altered areas of andesite. Other zones of brecciation trend eastward across the low andesite hills to the Wedekind district. These zones can be observed as conglomerate-like masses of bleached and altered rock in which progressive alteration by hot solutions attack the exposed edges of angular brecciated rock to reduce them to well-rounded nodules of andesite in a kaolinized residue. Two types of alteration occur, one, which is confined mainly to the augite andesite, softens and leaches the rock and is accompanied by abundant dissemination of pyrite. The other type is common silicification with some bleaching of the dark minerals so that the resulting product resembles a rhyolite formation.

Mineralization in the eastern portion of Peavine is confined to these altered areas, and Hill (1915) states the greater amount of values are associated with the propylitic or softening type of alteration, in which silver sulphide occurs with minor amounts of galena and sphalerite in a gangue of sericite, calcite, and quartz.

Mineralization in the west portion of Peavine is of two distinct types and of different ages. The earlier copper-gold deposition occurs in the stratified rocks and adjacent intrusives as quartz veins and lenses carrying auriferous pyrite and chalcopyrite. Generally these veins conform to the schistosity of the enclosing formations, as observed at the Red Metals property. The later deposits are replacement zones in the quartz monzonite and resemble the altered areas of andesite previously described in the eastern extension of this district. The Nevada Central deposit exemplifies this mode of mineral occurrence, in which the intrusive rock is altered to sericite, calcite, and quartz containing an abundance of fine-grained pyrite. Traversing this altered zone is a network of innumerable veinlets consisting of about 95 percent pyrite and 5 percent quartz. This type of deposit is cut by the ravine in which the Nevada Industrial placer was found, and Hill (1915) concludes that sufficient gold accompanied this thermal alteration to account for the placer by erosion concentration from the noncommercial veinlets.

Properties. The Black Panther Mining Company was active in 1920 on a group of six copper-bearing claims three and one half miles north of Reno. According to Weed (1920) C. H. Duborg organized the company and was president until succeeded by J. M. Molina. Development of the property is by a 200-foot vertical shaft, in which chalcocite was exposed at a depth of 135 feet. The formation continued in andesite to a depth of 150 feet. The

mineralization is said to exist in a zone between andesite and monzonite, where some 12 percent copper with fair silver values is reported to have been mined on the 165-foot level.

The Molina Mining Company in 1923 continued development work in the mine. In 1925 they reported to Weed that some ore was being mined from the 300-foot level that netted the company $32 above transportation and treatment charges; however, the organization was dormant by 1931.

The Black Panther Extension, organized in February 1920, consisted of five unpatented claims situated three and one half miles north of Reno and claimed to be the extension of the Black Panther vein. This company, headed by Col. Carson, was reported dormant by Weed in 1927.

Copperfield Mining Company, successor to Nixon-Nevada Copper Corporation (1928) controls 1,400 acres of mineral land near Copperfield on the Western Pacific Railroad. The ground consists of 72 claims, forty of them patented. Mines Register (1937) reports the property was developed by a 40-foot and a 300-foot shaft together with a 460-foot adit in which are exposed four veins.

The Emma was an old property situated on the divide between Lemon Valley and Reno and approximately five miles north of the latter. The mineralization is associated with east-striking veins in quartz monzonite. The abandoned shaft is reported to have been 300 feet deep. The ore is said to have carried gold and silver values associated with pyrite in a siliceous gangue.

The Fravel-Paymaster mine, situated at Poeville, is approximately six miles northwest of Reno. The gold-silver-copper mineralization occurred in veins enclosed by schist and intrusive quartz monzonite dikes. The claims adjoin the Standard Metals property and the development work includes a 400-foot shaft and 2,000 feet of lateral workings, according to Weed (1922).

The Gold Bond mining claims are situated about 10 miles northwest of Reno, on a copper fissure vein in meta-andesite. Mineral Resources reports several small copper-silver ore shipments from the Gold Bond from 1923 to 1930, and the several lots of this ore were treated by the Mason Valley Smelter. It was reported that this property was operated in conjunction with the Golden Fleece early in 1944, but the workings are not accessible according to current United States Bureau of Mines data.

The Golden Fleece mine, an early day producer, is situated on the northeast slope of Peavine Mountain, and about 10 miles northwest of Reno. It was considered by Whitehill (1875) as

the chief location in the district, but its ores were considered at that time very base. The claims are located on the Poe ledge system. Large sums of money were expended by the Consolidated Poe Mining Company for the development of the Poe ledge and for hoisting and reduction equipment, according to Whitehill (1873).

John Waldes and associates leased the property in 1936 and shipped several small lots of ore to the Utah smelters which were reported by the local press to have assayed about $16 per ton. Lew Hymers and Sol Lockman controlled the property in 1941 and granted a lease to W. E. Shirley. Couch (1943) gives the production for the Golden Fleece and others as $148,464 from 29,580 tons of ore. The property was inactive in 1947.

The Mazy or Updike property, is an old claim situated about two miles north of Reno in a crushed and pyritized zone in andesite which strikes N. 10 degrees W., and dips 60 degrees to the east. Two short adits and a shallow shaft expose a few veinlets of quartz with pyrite, galena, and sphalerite. This mineralization is reported by Hill (1915) to carry 0.09 ounces of gold and about 6 ounces of silver per ton. This property has been dormant for many years.

The Nevada Carbon Company controls the ground in which impure lignite occurs northeast of Verdi. Numerous samples were analyzed for the Croxdale organization in 1943 by William I. Smyth in the State Analytical Laboratory, along with a sample run for Judge Frank H. Norcross in 1942. The analyses are as follows:

	Norcross (1942)	Croxdale (1943)
Moisture	12.8%	27.1%
Volatile	38.4%	29.0%
Fixed carbon	25.2%	23.3%
Ash content	23.6%	20.6%

The sample analyzed for Norcross had been exposed to the air for several years and thus differed from the fresh Croxdale sample.

The Nevada Central property is located about four miles west of Reno on the south slope of Peavine Mountain. The mineralization there is a mass of hydrothermally altered quartz monzonite about 1,500 feet wide and one-half mile in length, in which pyrite and a little chalcopyrite occur. This zone is interlaced by stringers of pure pyrite and a little quartz. The property was developed by a 600-foot crosscut adit and an abandoned shaft of unknown depth.

The Nevada Industrial or Kirman placer is on the northeast slope of Peavine in the southwest quarter of section 16, T. 20 N., R. 18 E. The pay gravels occurred in a narrow ravine about 1,500 feet in length and from two to four feet in depth. They were mined between 1876 and 1881. Apparently the placer gold was derived from weathered auriferous pyrite in the altered quartz monzonite cut by the upper end of the drainage.

Nixon-Nevada Mining Company in 1915 to 1920 operated the Granite Hill mine situated about 14 miles northwest of Reno. The claims included 840 acres on Peavine and also 50 acres at Big Mouth Canyon near the Pyramid Lake road north of Wadsworth. The Granite Hill mine has a 300-foot vertical shaft sunk on the Number One vein and a 120-foot crosscut to the second vein, according to Weed (1920), who reported in 1924, a small production of 30 percent copper and $12 in gold and silver values mined prior to 1920. The ground was held in 1928 by the Copperfield Mining Company according to the Mines Register (1937).

The Peavine Silver Corporation was organized in April 1921 to reopen the old Paymaster mine under option to the company. The property consists of two unpatented mining claims which are located approximately six miles northwest of Reno at Poeville. The corporation sank a 160-foot shaft on the property, and an old shaft, 150 feet deep with 250 feet of lateral workings is also included in the development work which exposes a flat dipping fracture zone 20 feet wide.

The Reno Mizpah, an inactive claim, is located about two miles north-northwest of Reno in a north trending silicified zone in andesite. These zones contain a little pyrite which Hill (1915) states carries a little gold value. The property was developed by a few surface pits and a 600-foot crosscut adit, which was driven to cut under the largest outcrop. The heading of the adit is caved and probably did not reach the silicified zone, judging from the material found on the dump.

The Reno May is an old property located between the Mazy and the Reno Mizpah. The vein on this property strikes N. 10 degrees E., and dips about 60 degrees to the east. The old development consisted of a few surface pits.

The Reno Rule, also an old location, is situated about three miles northeast of Reno and two miles east of Fulton's quarry. Hill (1915) states this property was developed by a 400-foot shaft sunk in altered andesite. No production is reported from this property.

The Red Metals Company controlled 16 unpatented claims

located about 15 miles by road northwest of Reno and approximately two and one-half miles northwest of Peavine summit. The property was first opened in 1866 for silver ore, and the Red Metals Company in 1910 developed the property through a 1,200-foot adit. In 1915 Charles B. Bills, of Pioneer Fruit Company in Sacramento, California, acquired control of the property and planned to install a copper leaching plant which did not materialize. Hill (1915) states the ore occurs in overlapping lenses of crushed quartz and wall rock, which lie parallel to the schistosity of the inclosing meta-volcanics. The development adit is driven S. 34 degrees E. for 600 feet, at which point a fifty-foot raise intersects the above-mentioned ore. Oxide minerals predominate which show occasional kernels of bornite more or less altered to chalcocite. Hill (1915) reported the occurrence of some light blue copper phosphate as a film of radial grouped needle-like crystals. Possibly these are either cornetite or pseudo-malachite. The production for this property is given by Couch (1943) as $11,381, extracted from 793 tons of ore mined in 1912 and 1913.

The "Rokada" diatomaceous earth deposit is a dense endurated buff-colored diatomite, which is situated about one mile northeast of Verdi. The color and quality of this rock is probably due to volcanic action. The Rock Products Company, organized by Mr. Walmsley and Judge Frank H. Norcross, in 1926, produced magnesite flooring and interior finishing products, using this buff diatomite as a filler and pigment. The resulting product had a pleasing color and obtained resiliant strength, but failed due to pitting caused by differential wearing away of the softer diatomaceous earth aggregate.

The Standard Metals Company from 1916 to 1922 carried on operations on 240 acres of patented claims situated near Poeville which is about eight miles northwest of Reno. These claims were worked as far back as 1867.

The mineralization occurs in veins cutting the schist formation which is in turn traversed by porphyritic quartz monzonite dikes. The ore is pyritic, carrying gold, silver, and copper values, with a little lead and zinc. The company developed the mine by an inclined shaft to a vertical depth of 300 feet, and built a concentrating plant in 1920, which employed both Wilfley tables and flotation units. Weed (1922) reports about 160 tons of concentrate was shipped having a gross value of $125 per ton.

The Washoe Copper Company in 1917 controlled 695 acres of mineral land adjacent to the Nixon-Nevada holdings at Copperfield, situated on the northeast slope of Peavine Mountain. This

company was later merged with the Nixon-Nevada Copper Corporation.

The Homestake and Mars claims are right on the State line about three miles north of where the highway north of Reno crosses this line. According to Erich J. Schrader (1947) they were worked by Boston capital in about 1900. A 150-foot shaft was sunk on a narrow gold vein and a Huntington mill installed. Over 20 years later a lower adit was driven by another company.

In about 1904 L. T. Brockbank located an adjoining claim from which he states he took out several thousand dollars in gold ore.

Several metal reduction plants were constructed in early years in or near Reno to treat ore from the Pyramid and Peavine districts. The site of one of these plants can be observed northeast of Reno's rodeo grounds near Highway No. 35 where the soil is still red from the English mill tailings, which mill was situated in the town of "Auburn." The old town is shown on a map prepared in 1867 by Andrew J. Hatch. This map, now in the Mackay School of Mines Museum, also shows the location of a smelter in Laughtons Valley near the south quarter corner of section 33, T. 21 N., R. 18 E., and another small smelter was built at Poeville.

The Reno Smelting Mill and Reduction Works was located on the Truckee River about one-half mile below the present gravel pit of the Ready Mix Concrete plant. H. H. Beck, A. H. Manning, Archie Farrington, John Howell, and M. Carey organized the company in 1866 and built the plant consisting of a 10-stamp mill for free milling ores, a Howell chloridizing-furnace for silver ore, and a complete thirty-ton capacity water-jacketed lead smelter. The Engineering and Mining Journal for November 1886 reports the following schedule paid for ores by this plant, which are interesting for the tenor of ores listed:

> Base milling ore up to 300 ounces per ton value, pay for 90 percent of the assay value of the gold and silver.
>
> Base milling ore 300–500 oz./ton, pay for 93 percent of the gold and silver.
>
> Base milling ore over 500 oz./ton, pay 95 percent of the gold and silver.
>
> A charge of $14 per ton was made for all milling.
>
> Lead smelting ore up to 55 percent lead, pay for 90 percent of the lead, gold and silver and charge $14 per ton.
>
> Lead smelting ore over 55 percent lead, pay for 90 percent of the lead, gold, and silver and charge $10 per ton.

This plant was soon idle for lack of ore. It was leased in 1905, but no production reported.

PYRAMID

The Pyramid district is situated 32 miles north of Reno in Mullen's Pass, which is a low divide in the Virginia Range between Pyramid Lake and Warm Springs Valley on the south. The Fernley-Lassen Branch of the Southern Pacific Railroad is located about five miles northeast of the district.

Geology. The mineralization of this district occurs in veins in Tertiary volcanics and usually the older andesite formation incloses the more productive areas. The ores originally worked in this region contained silver-bearing copper minerals with a trace of gold. In more recent years several small properties have been opened in this district which show gold, silver, copper, antimony, manganese, and tungsten minerals, some of which have been shipped to the smelters.

Claims were located in the district as early as 1863 and the district was officially organized April 12, 1866. Whitehill (1876) reports that about ten distinct veins were discovered and locations made upon them. He states the principal work had been done on the Monarch, Buckeye, Infant, Gamble, Gregory, Auburn, Venetian, and Walker. All of the veins trend northwesterly and vary greatly in size. By 1878 the two important properties were the Jones and Kincaid Mining Company and the Monarch, according to Whitehill. Some low-grade copper ores were developed on the Kincaid through a 1,000-foot adit from which a 300-foot raise connected with the surface.

The Blondin mine later known as the Franco-American property is credited with a production of $87,000, from 1881 to 1889. Hardy (1947) states this property was equipped with a small mill in which oxidized copper ores carrying silver and a little gold were treated. Arsenical pyrite also occurred in this ore to complicate the milling.

The Parry property was once equipped with a small mill that was destroyed by fire. The claims are on a copper-gold fissure or shear zone in the older andesite, similar to the Olinghouse formation.

The old Antelope mine was reopened in 1945 by F. E. Horton, Jr., and William Van Der Heggen. This property is situated near State Line Peak northwest of Pyramid district and about 30 miles north of Reno, where a mill was built on the ground by a Boston company in the 1890's. Recent investigation by the United States Bureau of Mines is reported to disclose some ore along the strike of the two parallel Mars and Homestake veins.

SAND PASS

The Sand Pass district is situated on a plateau 500 feet above the west edge of Smoke Creek Desert and about 20 miles north of Sand Pass on the Western Pacific Railroad.

Geology. A deposit of fuller's earth or bleaching clay is indicated over an area of approximately 2,100 by 3,300 feet and of about 60 feet in thickness. The deposit is overlain in part by lime-cemented rock and gravel. The upper surface of the fuller's earth has probably been subject to erosion as indicated by the uneven contour which resembles a series of cones. Lincoln (1923) states the Standard Oil Company prospected the deposit by trenches, pits, and borings. He gives the following analyses of the material:

Silica	60.22%	Magnesia	1.11%
Alumina	15.55%	Ferric oxide	6.55%
Lime	2.69%	Combined water	13.78%

STEAMBOAT SPRINGS

The Steamboat Springs district is situated at the hot springs nine miles south of Reno and is traversed by both the Reno-Carson City highway and the Virginia and Truckee Railway.

Geology. The formations here are similar to the stratified rocks on Peavine Mountain and are probably both Mesozoic and Paleozoic in age. They are intruded by granodiorite and capped by late Tertiary basalt. The springs issue from a fissure that is related to the comparatively recent faulting along the east flank of the Sierra Nevada.

Intense alteration of the adjacent rocks has been effected by the hot mineral water, and numerous metal sulphide minerals are precipitated near the surface in small quantity and deposited in the huge siliceous sinter bench built up of quartz, opal chalcedony, and clay minerals. This bench along the highway, the smell of hydrogen sulphide, the spouting steam, so visible for miles in winter weather, and the delightful swimming pool, all add to the local interest.

The results of an investigation now in progress by Don White (1946), geologist for the United States Geological Survey and Vincent P. Gianella (1946), head of the department of geology at the Mackay School of Mines, will be of much interest to those interested in the deposition of minerals by thermal waters. A preliminary report by White and Gianella disclosed that heavy precipitation and barometric pressure changes influence the discharge of these springs. Cinnabar, stibnite, pyrite, and sulphur

are commonly deposited by the spring water. Siliceous muds in small quantity are occasionally deposited by the springs which contain gold and antimony values that are equivalent to commercial ores.

The hot springs were located by Felix Monet in 1860 who transferred his location to Dr. Ellis. Cameron, another locator sold his title to the same ground to a Mr. Cullins, who finally obtained title to the springs through litigation. He expanded the baths and built a hospital which was later managed by Dr. H. Rozsas. Under this influence the Steamboat Springs area has gained considerable attention for both the medicinal value of the water as well as its mineral deposits. It has proved to be a most interesting and valuable laboratory for geologists to study active mineral deposition from magmatic waters.

The deposits of sulphur and cinnabar were first opened up in 1876 by Tom Wheeler. Numerous attempts have been made to exploit these deposits, one of the outstanding being the one started by Balfour Guthrie & Company in 1929 and 1930. This company obtained a 10-year lease on property to the southwest of the springs and expended a considerable sum of money for equipment and plant to produce a pure silica for the glass industry by removing the impurities, including cinnabar. A portion of the deposit is now mined for clay by the Reno Press Brick Company and used in their products.

A related deposit containing low grade cinnabar was discovered by John Poe in 1875 on what is known as the Wheeler Ranch located north of Steamboat Springs and about seven miles south of Reno. It is probably on the same thermal belt as Steamboat and Moana Springs.

WEDEKIND

The Wedekind district, often considered a part of the Peavine district, is an eastern extension of that district, two miles north of Sparks.

Geology. The exposed formations are all Tertiary volcanics, mainly andesite, as described in the Peavine area. Mineralization in this area occurs in crushed and altered areas of andesite. The productive zones are irregular, but generally trend northwest and dip gently to the southwest. Due to intense alteration by thermal solutions this originally angular brecciated rock has been changed to resemble a ferruginous cemented conglomerate.

The surface ores contained rich silver chloride with some free gold along with lead sulphate and carbonate. Gypsum is abundant in the outcrop and in the upper level ores, apparently derived

from the alteration of pyrite and lime-feldspar present in the andesite formation.

According to records in the possession of Joseph Martin, in Sparks, the major production at Wedekind was made from smelter shipments during the period 1901–1903 which amounted to $229,621. These records show the shipments varied from a few ton to carload lots and the value varied from $11,600 to $77 per ton. Unfortunately this production cannot be verified due to the early producers lax methods of reporting production data for tax purposes. The official record credits the Wedekind district with the following:

Mine	Year	Tons	Yield
Desert King	1902–1903	333	$6,569
Reno Star	1901	326	15,628
Wedekind	1901–1903	994	36,354
Other small producers (of less than $5,000)			14,575
Total			$73,126

Properties. George H. Wedekind discovered the Wedekind mine in 1896 by tracing float from the Reno-Spanish Springs Valley road to its nearby source. He is reported to have made a substantial production from the mine and then turned it to John Sparks, then Governor of Nevada. The main properties included both the Wedekind and the Anna Bell. The latter was on a desert land entry, from which a reported $80,000 was taken before an injunction was sustained in favor of the Wedekind. Sparks purchased both the Bell property and the Reno Star, thus acquiring what ever adverse title the Bell had to the Wedekind deposit.

The early milling practice was reported to be unsuccessful because the circuit was designed to treat surface oxide ores and the mine was soon developed below the water table where sulphide ores were encountered. Tailings from this early milling effort were successfully cyanided in 1911–1913. Hot acid water was encountered in the Wedekind shaft in 1903, at a depth of 213 feet where the workings passed from unaltered andesite through a "gray mud." This flow carried quantities of silt into the sump and consequently through the pumps. This mud, together with the acidified water, corroded the piston pumps which proved inadequate to handle the flow. They were replaced with a three-stage 150-gallon-per-minute capacity centrifugal pump which was able to hold the flow of water at the 100-foot level. It is said that this heavy flow of water and the poor mill recoveries, together with litigation, combined to make the mine an unprofitable venture

for the original investors. Two small companies each tried to work the mine in the early '20's, and in 1930 a Mr. Miller, acting for the Southwest Mines Investment Company, obtained a bond and lease on the Wedekind and Arkell properties for the purpose of testing the ground at depth by churn drilling. Three test holes were drilled, the results of which were favorable according to numerous publicity reports issued to local newspapers. The first hole failed at a depth of 142 feet due to a collapsed casing. Miller reported sphalerite was encountered in the second hole at a depth of 210 feet, and that some values continued down from 212 feet to the bottom of this hole at 317 feet, and that the third test hole drilled through lead-silver-zinc sulphide minerals in "lime formation" below a depth of 400 feet. On the evidence of these sludge samples the Southwest Mines Investment Company planned to deepen the Dennison shaft and drift under the mineral cut by the drill holes; however, the property was again embroiled in litigation and the development curtailed.

Joseph Martin, of Sparks, resides on the property and holds the controlling interest in the property, which he states is now free of any legal entanglements.

The Arkell mine was first incorporated as the Solid Metals Mining and Leasing Company by Edwin Arkell. The property included six claims which lie east of the Wedekind mine. The development work of several companies consisted of a 975-foot adit and five shafts, with one to a depth of 160 feet. Weed (1926) reports the silver-lead-zinc ore from this property varied in value from $3.25 to $26 per ton.

OTHER DISTRICTS

In listing the mining districts of Washoe County the United States Geological Survey Bulletin 507, and both Lincoln's and Gianella's bulletins include a Sheephead district "15 miles W of Renard on the Western Pacific R. R." This would place it about 20 miles northeast of Sand Pass at the Lassen County line. The only reference to be found on this district is in the Mineral Resources of 1907, Part 1, stating "The Washoe Lassen Mining Company is the only mine reporting progress from this point."

The United States General Land Office map of mining districts in Nevada show an Astor Pass district that checks closely with the presently known Sand Pass district, and shows also an unorganized district south of Gerlach on the county line adjoining the Hooker District in Pershing County, in which lies the gypsum deposit of the Pacific Portland Cement Company.

This unorganized district might well be termed the Gerlach

district. In it are several good prospects, but the promising Stormy Day tungsten mine of John Thrasher's in Township R. 24 E. apparently is just over in Pershing County. Likewise there are likely prospects in the Nightingale Mountains of Washoe County adjoining or in the Nightingale mining district.

The described boundaries of mining districts close to county lines like the Hooker, Donnelly, and Nightingale districts probably often cross county lines. As location certificates are required to be filed also in the County Recorder's office, errors may occur.

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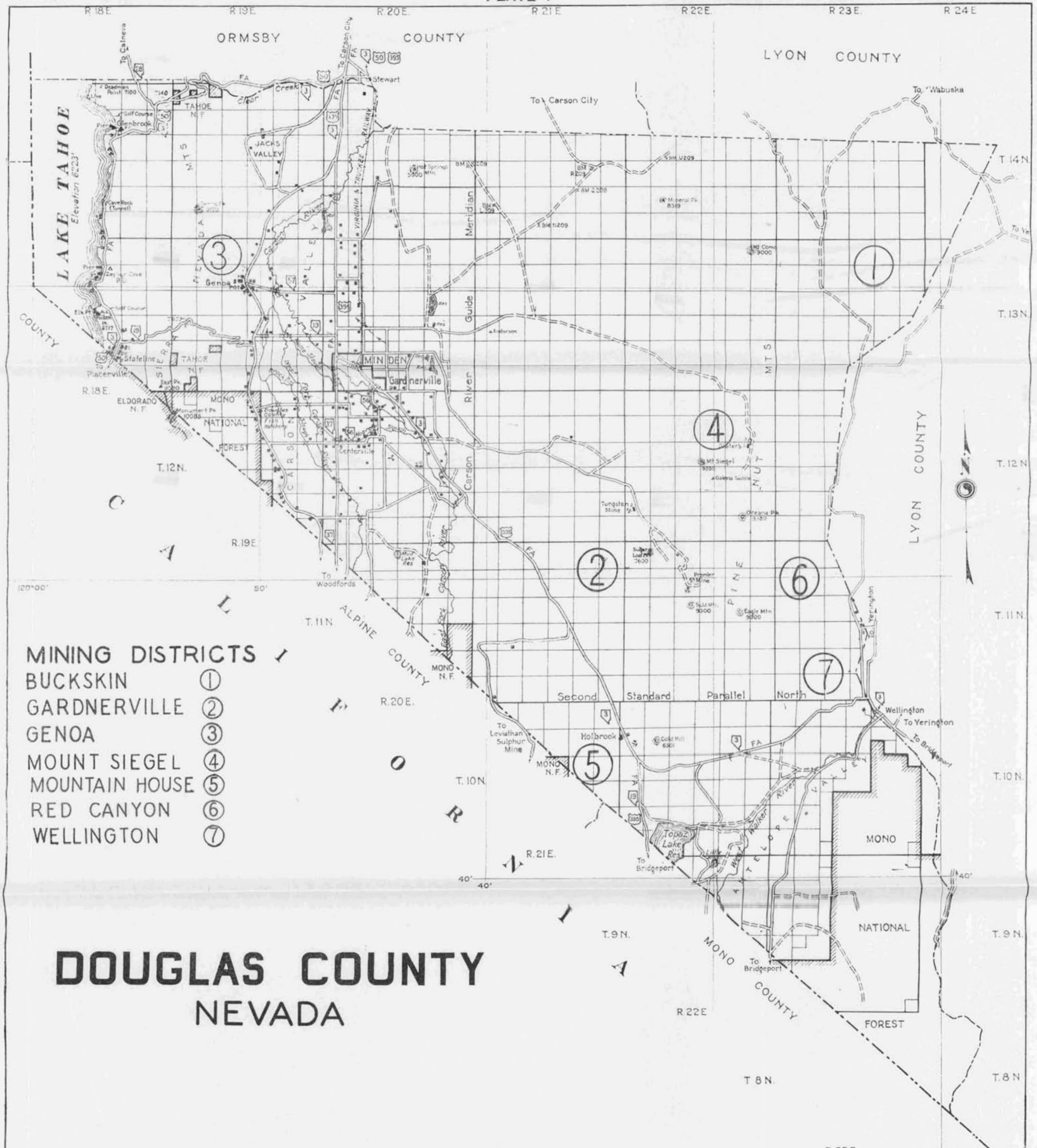
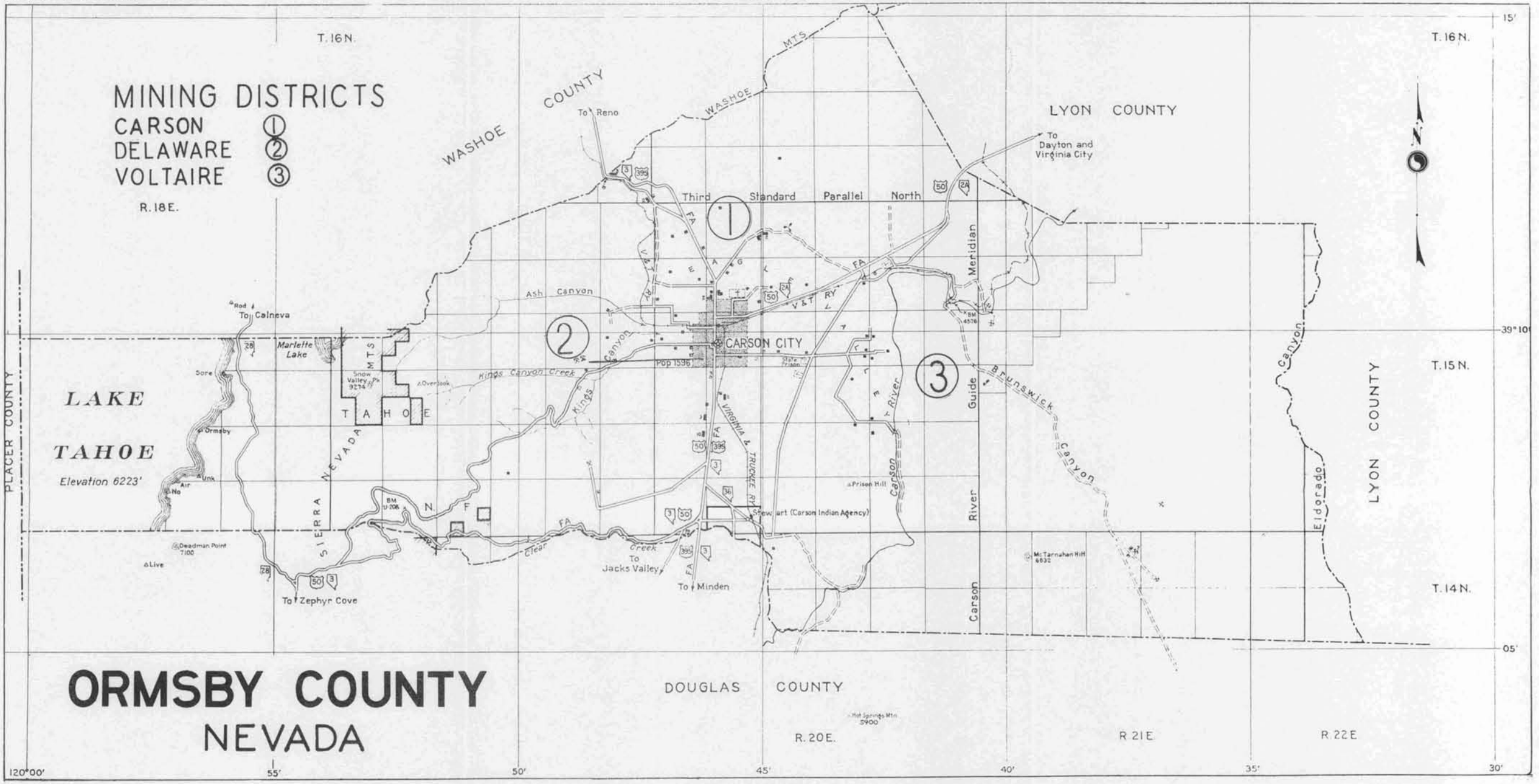


MINING DISTRICTS

1. BUCKSKIN
2. GARDNERVILLE
3. GENOA
4. MOUNT SIEGEL
5. MOUNTAIN HOUSE
6. RED CANYON
7. WELLINGTON

DOUGLAS COUNTY
NEVADA



ORMSBY COUNTY
NEVADA

WASHOE COUNTY
NEVADA

MINING DISTRICTS

GALENA	①
JUMBO	②
LITTLE VALLEY	③
NIGHTINGALE	④
OLINGHOUSE	⑤
PEAVINE	⑥
PYRAMID	⑦
STEAMBOAT	⑧
WEDEKIND	⑨

KEY TO SHEETS

WASHOE COUNTY NEVADA

MINING DISTRICTS

1. BUFFALO SPRINGS
2. COTTONWOOD
3. DEEP HOLE
4. FLANIGAN
5. GERLACH
6. SAND PASS

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