NEVADA MINING AND YOU
DID YOU KNOW?

THAT today the United States, with only 5% of the world's population and 7% of its land area, consumes about one fourth of all the minerals produced worldwide.

THAT every year in the United States alone, we consume 40,000 pounds of new mineral products for every man, woman, and child.

THAT there are only two basic industries that produce raw materials—mining and agriculture. If it can't be grown, it has to be mined.

THAT all other industries are dependent on the production of minerals. Even the food we eat requires mineral products to plant, fertilize, harvest, and distribute.

THAT surface mining is practiced in all 50 states, and despite extensive exploration, over 99% of the land surface has never been worked by a miner's pick.

THAT the various transportation systems now established in the United States require approximately 10 times more land than mining requires.

THAT some of our most critical minerals are imported from foreign countries. For example, approximately 95% of the platinum used in the United States for such things as electronic equipment is imported from the Soviet Union or South Africa.

THAT only one out of nine exploratory oil wells drilled encounters any petroleum at all, and only one in a thousand stands a chance of becoming a major producer (capable of supplying the United States for five days or more). Each exploratory well costs an average of $1,000,000 to drill.

THAT drilling oil wells, digging coal, manufacturing turbines, stringing transmission wires, collecting solar heat, and cutting firewood with a saw all require minerals.

THAT Nevada, as of 1984, ranks number 1 in the domestic production of gold (48%), magnesite (100%), mercury (99%), and barite (85%). Nevada is the second largest producer of lithium, diatomite, and gemstones, and the third largest producer of silver.

THAT five of the last seven major gold discoveries have been made in Nevada.

THAT in the last fifty years, the mining industry, in its search for and production of mineral resources, has disturbed only a small portion of the land in Nevada. Much of this land has been reclaimed by the industry.

THAT in 1984 over 1,900,000 barrels of oil were produced in Nevada. The oil is recovered from five major oil fields located in Nye and Eureka Counties.

THAT Nevada has great potential for geothermal resources development.
NEVADA MINING AND YOU

A resource guide,
with sections on historical mining camps,
modern mining methods,
and an overview of some
mineral-producing areas in the state

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INTRODUCTION

Natural resources are a fundamental part of today’s society and their importance deserves much attention. There are two types of natural resources, renewable and nonrenewable. The food we eat, much of the clothing we wear, the books, magazines, and newspapers we read, many of the homes we live in, and to some extent, the warmth in our homes, are products of renewable resources. Renewable resources are those commodities that can be replenished as they are used. Nonrenewable resources, on the other hand, are those materials that cannot be replenished. Minerals (gold, mercury, barite, and magnesite, to name a few) and energy (natural gas, oil) are examples of nonrenewable resources. Recycling allows many nonrenewable resources, such as minerals, to be used over and over again. Conservation of nonrenewable resources also adds to their availability in the future. There are some materials, however, that are so scarce or in such demand that they will eventually be completely used. The alternatives are to perfect recycling of these scarcer materials or learn to substitute more common or abundant materials for them.

Minerals are the one natural resource that, more than any other, have had the most profound impact on our civilization and society, and upon which we are most reliant. History abounds with the stories of empires and countries won and lost because of their quests to control the mineral holdings of the world.

Minerals can be divided into two categories, metals and nonmetals; industrial minerals are generally nonmetals that have economic value. Metals such as gold and silver are precious metals; lead, zinc, and copper are base metals. Diatomite and gypsum are examples of nonmetals or industrial minerals. Metals are vital to industry and transportation of goods; nonmetals are important in agriculture and construction. Minerals are also just as important to art and science as they are to technology. The stone used in the great cathedrals of the world, the pigments in the oil paintings, and the marble in the sculptures of the great masters owe their existence to minerals. And finally, rocks, which are simply an aggregate of one or more minerals, are the only record we have of the geological processes that shaped our planet and how those processes work today.

Nevada is a great source for many resources, and for over 100 years, the mineral industry has served as a strong component of Nevada’s economy. Nevada is an important producer of barite, diatomite, gemstones, gold, lithium, magnesite, mercury, and silver. There has been a substantial increase in the production of oil in the state. In 1984, over 1,900,000 barrels of oil were produced, and Nevada has become a prime target for new exploration by major oil and gas companies. The geothermal industry has made significant progress during the past years. Innovative projects such as the Elko County School District’s geothermal system clearly demonstrate the possible benefits of this “homegrown” resource.

Today, as in the Comstock era, the mineral industry plays a tremendous role in our state’s economic well-being, and we must continue to support the development and production of our mineral resources. A brief history of mining and some early mining camps, an overview of mining methods and recovery processes, and descriptions of several modern mining areas and the commodities produced at them are just some of the sections included in this resource guide. We have also included a glossary of terms that appear in italics, as well as other terms you are likely to encounter while reading articles or books that deal with geology. We hope that the information in this guide will enhance your understanding of the importance of mining and the production of minerals in Nevada.
The earliest locations of mining activity in Nevada were in the southern tip of the state. Local legend has it that the Spanish mined in the El Dorado district on the Colorado River south of Las Vegas in the 1700's and that Indians mined there before that. The old Spanish Trail between Santa Fe, New Mexico and Los Angeles, California passed by this area, and mining by the Spanish could well have been possible. An early route established by Mormons between Utah and San Bernardino in southern California also passed through Las Vegas. Two separate discoveries near there are credited to Mormons who were traveling the route. The silver-gold camp of Wahmonie, located in southern Nye County north of Las Vegas, was established in 1847. A large piece of rock from a fireplace in an old cabin near Wahmonie bears an 1847 inscription. The lead deposits at Potosi, southwest of Las Vegas, were discovered in 1856, the year production was first recorded there.

In the north, gold placer deposits were discovered in 1850 in Gold Canyon, downslope from the Comstock Lode, and were mined during the early 1850's, leading to the eventual discovery of the Comstock silver-gold deposits in 1859. The Comstock discovery and resulting developments set into motion a period of general prospecting activity in the state and in the entire west that is only now being approached in intensity by a similar activity, the search for disseminated gold. The Comstock discovery has been compared, by analogy, to a stone tossed into a quiet pool, the ripples created being the waves of prospectors scrambling in all directions seeking other bonanza discoveries. Many of Nevada's famous mining camps were established within a few years after 1859, and most of them, at least the precious-metal camps, were known and worked prior to the turn of the century.

The study of Nevada history is, to a large extent, the study of Nevada's mines. Mineral discoveries created a reason for settlement; agriculture and other industries were established in the outlying areas to serve the mining population. To illustrate the nature of early mining activity in Nevada and to place this mining activity into perspective in the overall development of the state, historical sketches of six mining camps are included in this resource guide. These camps are located in diverse areas of the state and range in size from the Comstock at $400,000,000 in production to Unionville at $3,000,000 in production. Two of these districts, Unionville and Hamilton, are direct results of Comstock-era prospecting. Discoveries at Unionville were made in 1861, and Hamilton, or White Pine, was established in 1865. Delamar and Searchlight, both desert camps in southern Nevada, were established in 1892 and 1897, a generally quiet period in Nevada mining. Wonder, in the Carson Sink area east of Fallon, was established in 1906 and was a product of the Tonopah-Goldfield era of mining excitement.

Special Note: The dollar amounts used throughout this resource guide reflect the actual value at the time of production.
COMSTOCK

The Comstock mining district, originally known as Washoe, includes several mining areas situated along the length of the Comstock Lode, a mineralized vein system that extends for over 6 miles along the lower slopes of the Virginia Range northeast of Carson City. The Virginia City and Gold Hill mines in Storey County, the Silver City or Gold Canyon mines in Lyon County, and the Flowery area of Storey County are all commonly included within the Comstock district.

The story of the Comstock began on a May morning in 1850 when a wagon train from Salt Lake City, bound for California, stopped for a rest on the banks of the Carson River near the site of the present-day town of Dayton. William Prouse, one of the passengers on the train, tried his hand at panning in a small stream nearby. He found a few colors of gold in his pan but placed no importance on the discovery and went on his way. Others returned to the site, later named Gold Canyon, and followed the stream up to the general area of Silver City, where small-scale placer gold mining was carried on for the next few years. Other prospectors, many of them disappointed gold-seekers returning from California, explored the nearby ravines and, in 1857, gold was also found in Six Mile Canyon several miles to the northeast of the original placer discovery. The Comstock Lode was “discovered” in March or April of 1859 by placer miners in Gold Canyon. At their diggings at Gold Hill, the miners found a broken reddish quartz vein that carried significant amounts of gold but little silver. To the north, placer mining was also being done near the head of Six Mile Canyon. In June of 1859 two placer miners, Peter O’Riley and Patrick McLaughlin, were in the process of digging a deeper hole to collect more water for their rockers. They found, much to their surprise, the bottom of their rockers covered with black sand and pale yellow gold. Henry Comstock happened along, and when he saw the gold exclaimed the now-famous words, “You have struck it boys.” Comstock received an interest in the discovery for his good fortune in being in the right place at the right time. He soon sold out for a few thousand dollars and went on his way, leaving only his name on the lode as his legacy. Meanwhile, the two placer miners, who were only interested in gold, were annoyed by some heavy “blue stuff” that clogged their rockers, although it too contained some gold. When the material was assayed, it was found to be almost three-quarters silver and was worth $3,876 per ton. O’Riley and McLaughlin had accidentally uncovered the top of what was later called the Ophir.

Savage Mine hoisting works at Virginia City in 1869. Ore was loaded and unloaded by hand. Nevada Historical Society photo.

The “Rush to Washoe” got off to a rather slow start considering the high-grade silver values that were reported by the early mining claimants. California was suffering a period of depression, its gold placers were playing out, and the deep lodes there were not yet being developed. The Californians who rushed to Washoe found only silver, however, not the placer gold they were seeking, and many left quickly when the winter of 1859 approached.

Work steadily advanced on the Ophir and Gold Hill discoveries, and in late 1860, bonanza ore was found on the 160 level of the Ophir. The Ophir ore body was so soft and unstable that in 1860 an innovative new method of reinforcing the soft rock, square-set stopping, was developed. As a block of ore was mined, a framework in the shape of a square box approximately 5 feet wide was constructed out of timbers. The mined area became a network of interlocking boxes, which when filled with waste rock, supported the heavy ground. Developments in silver metallurgy followed, and Virginia City and the Comstock were on their way into prominence and carried the rest of Nevada with them. Production of the Comstock mines grew to $12,400,000 in 1863, the first major production year. Development continued into the 1870’s resulting in discoveries of bonanza ore bodies along the lode. The 1873 Consolidated Virginia discovery, the Big Bonanza, yielded $105,000,000. The peak production years of the Comstock were during the early 1870’s. Beginning in the late
1870's, depletion of the rich bonanza ores, coupled with water and heat problems encountered as the mines became deeper, led to a gradual decline of the Comstock district. Total recorded production for the Comstock district (both Storey and Lyon counties) is over $400,000,000 in silver and gold. An interesting point here is, while known mainly for its silver production, the Comstock Lode produced over 8,000,000 ounces of gold and is also one of Nevada's major gold districts.

The importance of the Comstock mines to both Nevada and the nation seems overstated at times but this is far from the actual case. Comstock silver drew a population to an otherwise empty region, resulting in the formation of the state of Nevada. Riches made in the Comstock mines built San Francisco and aided in financing the Civil War in the east. Owners of the Bank of California, using Comstock-generated money, built the Virginia and Truckee Railroad and Central Pacific Railroad. John Mackay founded his fortune on the Consolidated Virginia bonanza and went on to form what became AT&T. His heirs later provided funds to build the Mackay School of Mines on the University of Nevada campus at Reno. Engineering and metallurgical developments originating at the Comstock mines are too numerous to list but went out to benefit the mining industry all over the world. Square-set stoping is still used where the ore is rich enough to pay for the high cost of timber and labor. The first general use of Nobel's nitroglycerine-based dynamite was in the Comstock mines, as was the use of the compressed-air drill and diamond drill. Comstock's miners' wages set standards for pay throughout the west, and miners' unions were a powerful force in the district.

Some large-scale underground and surface mining has been attempted at Virginia City over the years since the main activity ceased. In the 1920's, a large cyanide mill was constructed in American Flat, southwest of Virginia City, and mining of low-grade underground ores and old stope fill was done. In the 1930's and early 1940's, open-pit mining was done on the Belcher and Ophir outcrops, and in the late 1970's another attempt was made to mine low-grade surface ores in the Yellow Jacket-Belcher area. The surface pits are now inactive but prospecting is again being done underground at the Savage, and there are reports of new discoveries in Silver City—very near the site of the 1850 discovery that started it all.

Savage Mine and part of Virginia City. This photo, probably taken in the late 1870's, shows a general lack of activity in Virginia City and at the mill. Nevada Historical Society photo.
DELAMAR

Delamar, within the Delamar or Ferguson mining district, is located on the western slopes of the northern Delamar Mountains in Lincoln County. The original strike was made near Monkey Wrench Wash, north of the main district, in 1891. Claims were located at the Magnolia Mine about 1 mile south of Monkey Wrench Wash in March 1892, and the Delamar-April Fool area was staked about 1 month later. The district was originally named for its discoverers, John and Alvin Ferguson, who were farmers from Pahranagat Valley. In 1893, most of the claims in the district were acquired by Captain J. R. De Lamar, a prominent mining promoter of that day who brought the major mines into production. His name, slightly Americanized to Delamar, was given to one of the largest mines and eventually was applied to the entire district. The mining camp grew rapidly. Most of the original settlers and merchants moved to Delamar from Pioche, which was then experiencing a slump, and many of the original buildings were moved intact to Delamar from Pioche. Water was brought in by pipeline from Meadow Valley Wash, 12 miles distant. Between 1894 and 1895, Delamar had acquired a newspaper, a post office, a hospital, a school, and two churches. In 1899, Delamar boasted of the Max Schaefer Grand Opera House, then the most elegant theater in southern Nevada, and the town had its own brass band.

The gold at Delamar occurred in quartzite, a very hard rock composed mostly of silica. Water was scarce in the camp at first, and mining and milling was done dry. Grinding the quartzite ore to free the gold created clouds of silica dust. This unfortunate characteristic of the ore earned Delamar its other name, "Maker of Widows", as silicosis, a disease of the lungs, took a terrible toll.
During the 5 years following De Lamar's entry into the district, while mining activity was negligible in other parts of Nevada, Delamar produced more than half of the state's gold ore. In 1894, the Delamar district was the primary producer of gold in Nevada, and until 1902, the Delamar mines produced $9,500,000 in gold and silver. In the spring of 1906, most of the town was destroyed by fire. The town was quickly rebuilt and, that same year, Delamar was still producing more ore than the boomtowns of Manhattan and Bullfrog and was surpassed only by Tonopah and Goldfield. De Lamar sold his interest to a group of eastern investors in 1902, and the new group operated from 1903 until 1909; by then the boom was over and the mines closed permanently. In 1932, re-treatment of old tailings began and some additional production was recorded. By 1938 all mining activity at Delamar had ceased and the district has not been active since. Total recorded production of the district is about $15,000,000 in gold, silver, and minor lead and copper.

Today, only ruins of rock-rubble cabins, the mill, and some headframes remain. The camp is easily accessible from main highways, and many weekend prospectors and ghost town buffs spend time in the area. As with most Nevada precious-metal camps, serious prospecting activity rises and falls, and someday Delamar may see renewed mineral production.
HAMILTON

The Hamilton, or White Pine, mining district is located along Pogonip Ridge on the crest of the White Pine Range in southwestern White Pine County. The first discoveries in this area were made in 1865, on the west side of White Pine Mountain. It was not until January of 1867, however, that rich silver-chloride ores on Treasure Hill were discovered. This discovery, made by A. J. Leathers on what was later to become the Hidden Treasure Mine, set off the “Rush to White Pine” that drew prospectors from all corners of the state.

Hamilton was at first called Cave City, after some caves that early miners used for shelter. Several small springs nearby furnished water, and the area was a natural staging area for Treasure Hill, 2 miles to the north, where there was no water at all. The townsite was laid out on May 16, 1868, and given the name of one of its founders, W. H. Hamilton. It was incorporated in 1869 after the rush began. The population grew so quickly during the rush that houses were made of every conceivable substance including sagebrush, metal from tin cans, and blankets, as well as the more standard wood and stone.

The elevation of Hamilton townsite is 8,005 feet and the mines on Treasure Hill are at 9,000 feet. In the early days, pneumonia claimed many lives due to exposure, inadequate food and shelter, and the terrible “pogonip” (freezing fog that clings to trees, sagebrush, buildings, even people and animals).

There were no roads at first and early travelers walked or rode horses on trails to Austin, the nearest community, or to Elko, the nearest railhead. Frederick Arthur Farnsworth (1898–1981), White Pine resident, related that when he and his father hauled freight into Hamilton and other early-day towns in eastern Nevada, one of the first things they did every morning was to look ahead and decide where they would camp that evening. Usually they could see across the Nevada valleys to the end of their day’s journey.
As the mines in Hamilton boomed, so did the town of Hamilton and the nearby communities of Treasure City, Sherman town, Monte Cristo, Seligman, Swansea, Eberhardt, Keystone City, and Belmont. In 1869, Hamilton was selected by the State Legislature as the first county seat of White Pine County. Some historians have stated that as many as 30,000 people populated this district, if all the outlying areas are counted, but surely this is an exaggerated figure. Although the district is generally credited with having a population of 20,000 in 1869, the Census of 1870 recorded only about 6,800 people in the entire district. The population declined rapidly, however, as the blush of boom wore off and stories of other mining booms in warmer climates became known, which drew away even more of those remaining.

The beginning of the end came for Hamilton in 1873 when a cigar-store owner set fire to his store in an endeavor to collect fire insurance. Much of the town was destroyed by the fire. Another fire in 1885 burned the courthouse and all the county records leaving a tangle of property records, some of which are still not straightened out. The courthouse fire signaled the end of Hamilton as a county seat, and Ely was designated county seat in 1887. Mining continued until the late 1800's, and production reports range from approximately $11,000,000 to $20,000,000. While the district is considered primarily a silver producer (one of the top nine silver districts in Nevada), it has also produced moderate amounts of lead, zinc, and copper, along with small quantities of gold and tungsten.

The Hamilton mining area is still believed to contain a great deal of silver, and recent drilling on the Hidden Treasure claim, site of the original discovery has revealed some high-grade and low-grade ore. The population varies with mining activity, and in 1978, for example, the population was zero. During the summer of 1980, 50 people were in the camp. By the summer of 1984, only three people were in the camp. Many of the old mining camps, ghost towns today, hold the potential of revival, and so if it is true that history repeats itself, perhaps Hamilton will once again be a prosperous place of activity.

Hamilton, 1892. Young woman is Jean Muir, granddaughter-in-law of Alex Muir. Alex Muir was the “mine captain” of the Eberhardt Mine, which produced some of the richest silver ore ever mined. Nevada Historical Society photo.
SEARCHLIGHT

The town of Searchlight, in the Searchlight mining district, is located in the southern Opal Mountains in Clark County about 55 miles south of Las Vegas. The area was first prospected in the early 1890’s, and the first gold discovery was made by G. F. Colton in 1897. Ore was found on the Searchlight claim of what later became the Duplex Mine in 1898, and the Searchlight mining district was organized in July of that same year. The population grew after a rush during the following winter. At first, ore from the district was shipped by wagon to Manvel, California for rail delivery to a smelter at Needles. In 1900, the Quartette Co. built a 20-stamp mill on the Colorado River, and in 1902 a narrow-gauge railway began transporting ore between the mine and mill. In 1903, a mill was built at Searchlight and from that point on, milling of the ore was done on site. Initially gold was mined from surface outcrops of high-grade ore, but later mining gave way to silver as the rich surface ores were exhausted.

The discoveries at Searchlight signaled the start of a period of activity in the desert districts of southern Nevada that lasted until the financial panic of 1907 or, in some cases, up through the World War I boom. The nearby camps of Sunset, Sandy, and Plativa, in Nevada, and Kingston and Hart, in California, were staked during this time. Older camps, such as Potosi, Goodsprings, and Eldorado, had renewed activity at the same time. The Searchlight boom peaked in early 1907, and the camp supported two newspapers, stores, over a dozen saloons, and a reported population of 5,000. The financial panic of 1907, which followed the 1906 earthquake and fire in San Francisco (the source of mining development money for most of the west), hit Searchlight hard. High-grade surface ores had been worked out by this time, and money was needed to search for and develop deeper ore. Production fell drastically, and the district never returned to its pre-1907 level of activity. There has been only intermittent, moderate activity up to the present. The Searchlight district has a recorded production of about $7,000,000, mainly in gold, some silver, and minor copper, lead, and zinc.
The present-day town of Searchlight is a mixture of old and new, and the area now appears to have somewhat of a retirement-recreation economy with only small-scale mining activity. Residence sites are now located side-by-side with former mine sites. Mining may continue to play some role in the local economy as, in 1983, a small-scale gold-silver leach operation was under development west of Searchlight.

The Duplex Mine 10-stamp mill at Searchlight, circa 1910, was typical of the mills at the smaller mines. To take advantage of gravity, ore was loaded at the top of the building (upper left). Nevada Historical Society photo.
UNIONVILLE

The town of Unionville, historic business center for the Buena Vista mining district, is located on the east side of the Humboldt Range in Pershing County. The canyon within which Unionville lies has been described as one of the most beautiful areas of the state, with cold springs that feed a perennial millstream that flows through a broad and fertile valley. The discovery of silver is credited to Paiute Indians who brought rich specimens of ore from Buena Vista Canyon to Virginia City in the spring of 1861. Prospecting parties set out for the “Humboldt,” as the new area was known, and the Buena Vista mining district was organized in May of that year. By November, the town had grown to the point that it was selected as county seat for newly created Humboldt County.

Among the notables answering the call to the Humboldt was Mark Twain, who set out to pick up what he described as “masses of silver lying all about the ground... glittering in the sun on the mountain summit.” Discouraged at their lack of success in finding their fortune, Twain and his friends left after only three weeks, but others were more persistent. Production peaked in 1864, but gradually decreased until the arrival 3 years later of the transcontinental railroad, which passed nearby on the west side of the Humboldt Range. In the early 1870’s three 10-stamp mills that treated ores from the Arizona and nearby properties were operating in the canyon. The rich ores soon became depleted, however, and the camp began its decline.

The county seat was moved to Winnemucca in 1873, signaling the beginning of the end for Unionville. Some mining activity continued into the 1880’s, but there has been very little production since that time. Total recorded production of silver from the Unionville mines totals about $3,000,000 but may be as much as $6,000,000. The Arizona Mine, largest in the district, produced $2,600,000. At times since the end of the silver rush to Unionville, prospecting activity has been heavy in the Buena Vista district. Small amounts of antimony were also produced from deposits in nearby canyons. In 1919, tungsten was discovered at the old Arizona Mine and a small amount was produced. Most recently, the entire Humboldt Range is being heavily prospected for gold, and disseminated deposits are being found in settings similar to that at Unionville.
Unionville, looking west up Buena Vista Canyon, late 1860's. *Nevada Historical Society* photo.
WONDER

The Wonder mining district is located on the lower west slopes of the Clan Alpine Mountains near the south end of Dixie Valley. The district is centered around the old camp of Wonder, which is located downslope from the outcrops of the principal mine, the Nevada Wonder. The Wonder townsite is about 15 miles north of U.S. Highway 50 at a point some 40 miles east of Fallon in Churchill County.

The first mineral discovery in the district was made on March 18, 1906, by Tom L. Stroud, a lone prospector working out of the nearby camp of Fairview. Attracted by the conspicuous light coloration of the rock outcrops, Stroud obtained samples that assayed up to $1,200 per ton in gold and silver. When news of the strike leaked out, a stampede to Wonder began and the entire area was blanketed with claims. A townsite was laid out in June and active trading in claims began, although very little development work was done until the next year. The Nevada Wonder Mining Co. was organized in the fall of 1906 and became the nucleus and life of the district. The town of Wonder was built in 1907 and the principal boom occurred that year. In May of 1907, the district had a population of 1,200, one fourth of which were at work in the mines and prospects. In July and August, the effects of the financial panic of 1907 hit the district and operations of the Nevada Wonder Mining Co. halted. A 200-ton cyanide mill was constructed in 1911, and the Nevada Wonder Mining Co. resumed work and operated continuously from then until December 1, 1919, when the company suspended operations permanently. In its 8 years of production, the Nevada Wonder Mine was almost the sole support of the district. The company constructed a private 10-mile-long pipeline to supply water for the mine, mill, and domestic uses, and arranged for electric power to be brought in from a power plant near Bodie, California, 130 miles to the southwest.
Recorded production for the Wonder district is $6,350,000 in silver and gold. Of this amount, over $6,000,000 is credited to the Nevada Wonder Mine, which paid over $1,500,000 of that in dividends to its stockholders.

The Wonder district has seen very little activity since 1919, and only a trace of the old townsite can be seen today. In 1983, however, a small open pit was reported to be operating at Wonder. The ore body consisted of lower grade material left in the walls of the original high-grade mine. As has been the case in many other Nevada districts, changes in mining technology and improvements in metal prices has brought new life into an old camp.
MINING LAW OF 1872

Through the efforts of the U.S. Senator from Nevada, William M. Stewart, and others, Congress passed a law titled "An Act to Promote the Development of the Mining Resources of the United States." Until passage of the law in 1872 (with the exception of some laws passed in 1866), miners had no legal rights to prospect for and work their claims. More importantly, the law gave any citizen or someone who intended to become a citizen the right to explore for, develop, and produce mineral resources from the unappropriated public domain. Additional laws have been passed since, but this basic law is still used in the United States today.

The law specifies four types of mining claims: lode claims, placer claims, mill site claims, and tunnel right claims. Claims are located by posting a conspicuous notice on the discovery itself. The claim notice should identify the locator, contain the name of the claim, the date of discovery, and a description of the boundaries of the claim. A lode claim cannot be longer than 1,500 feet nor wider than 600 feet. Several claims may be located for holding large deposits. A placer claim can be no larger than 20 acres for an individual claimant. A claim owner must diligently work any claim toward the development of a productive mine, and at least $100 worth of "assessment work" must be performed on each claim each year.

These are just a few of the items contained in the law. For more information about mining claims in Nevada, see "Mining Claim Procedures" published by the Nevada Bureau of Mines and Geology, or contact the Bureau of Land Management.
MINING METHODS

The geological setting of each mineral deposit dictates which method of mining would be the most economical. Different methods for mining ore bodies have been developed depending on their size, shape, and depth. This resource guide describes four different mining methods in use today: placer mining, underground mining, open-pit mining, and solution mining. Placer mining is the oldest type of mining. Panning, dredging, and hydraulicking are examples of placer mining. Narrow or deep ore bodies are mined using underground mining methods. Open-pit mining is used to economically mine ore bodies that contain large tonnages and that are located relatively near the surface. Solution mining involves drilling a well and pumping out mineral-bearing solutions.

PLACER MINING

Placer mining can be traced back to prehistoric time when man searched the river bottoms for the heavy flints used in making stone tools. Egyptian hieroglyphics from about 3400 B.C. show the placer origin of their gold. In Medieval Europe, placer mining was used extensively, and some of the devices used then are still used today and have not been improved upon to any great extent.

The word "placer" is derived from a Spanish word meaning a gravelly place in a stream bed or by the side of a stream where gold occurred. Placer deposits are the result of erosion of mineral-bearing rock and transportation of the rock debris, usually by water. The heavier minerals, such as gold or cassiterite (a tin mineral), settle out in the sand and gravel along stream or river bottoms or along the inside curves of streams, where the water moves more slowly. The minerals can also be trapped in natural rilles made of resistant rock or in pot holes along the stream bottom. This process of settling out of heavier minerals is called mechanical or gravity concentration. A few placer deposits occur where erosion has exposed and eroded the mineralized rock or a vein, but lack of running water to carry the rock material away leaves the minerals concentrated in place or downhill.

There are several methods used to mine placer deposits. Panning for gold is the method with which most people are probably familiar, but this is slow and relatively uneconomical, especially for large-scale operations. Panning is used mainly to prospect for gold or certain other minerals. Other methods include sluicing, in which sand and gravel is washed in a box called a sluice; rilles on the floor of the sluice trap the heavier minerals. In hydraulic mining, or hydraulicking, powerful jets of water are used to blast and wash away the mineral-bearing sand and gravel, which is then run through a sluice box. Dredging is used to inex- pensively mine large, low-grade deposits. The dredge is a large floating machine that scoops up the sand and gravel from the edges of man-made lagoons and small ponds dug near active streams or in areas where streams were known to exist.

Gold nuggets are the most common product of placer deposits, but other heavy minerals including gemstones, platinum, and rutile (a titanium mineral) are also found. Placer mining has taken place in many areas of Nevada, including Battle Mountain, Manhattenn, Osceola, Rabbit Hole, and Round Mountain.
UNDERGROUND MINING

Underground mining has been an important method of extracting minerals for over 2,000 years. It played a major role in the settlement of the American West during the second half of the 19th century, with underground mines and the ever-present headframe a common sight in many western towns.

Underground mining methods have improved greatly in the 20th century and particularly since World War II. Today's underground mining bears little resemblance to that of 100 years ago, as it is still frequently depicted in television and in movies. Over the years, as rich ore bodies were mined out and as the technology was developed to mine large, low-grade deposits, the number of underground mines began to decline. Today only a very small portion of all major producing mines in the United States are underground operations, and these produce only 8% of the total tonnage of ore mined. This does not mean that underground mining has lost its importance, however. On the contrary, there are certain aspects of underground mining which insures that it will always have a place in the industry. Underground mining allows recovery at great depth and has some additional advantages in that the effect of extreme weather and problems with access in high, rugged areas are less. The amount of surface disturbance, an important consideration in environmentally sensitive areas, is also usually less with an underground mine. Underground mines presently are making significant contributions to the production of many important minerals in the United States. Although tonnages are relatively small compared with open-pit mines, several commodities, such as fluor spar, lead, silver, and zinc, are still produced primarily from underground mines.

OPEN-PIT MINING

Open-pit mining methods have been employed in some form for extracting minerals for several centuries. Open-pit mining as we know it, however, really came into its own following the Industrial Revolution in the late 1800's. During the early part of the 20th century, the concept of mining large tonnages of low-grade ore was developed and proven. Through the years, larger and more complex equipment was introduced, which continued to increase the tonnages mined were able to produce. As a result, today's open-pit mine is a model of manpower efficiency and safety. Many mines represent a monumental achievement in earth-moving, as entire mountains have sometimes been moved in order to mine the ore. As large as many open-pit mines are however, they are responsible for disturbing only a very small fraction of 1% of the total land area in the United States.

The most important factor that dictates the selection of an open-pit method of mining is economics. Ore bodies that are located relatively near the surface and that contain large tonnages are ideally suited to open-pit mining. Typically lower operating costs for open-pit mines enable the companies to operate at a profit where they could not do so if the mines were underground. Open-pit mining lends itself well to the processing of large tonnages of ore on a daily basis because, among other factors, the number of working areas are less restricted than with underground mining. This allows open-pit mines to better take advantage of the principle of "economy of scale." This principle states that the operating cost per ton or per unit of product decreases as the quantity of material processed or product produced increases. This principle has been responsible for the development of equipment of gigantic proportions in order to mine and process the massive quantities of ore.

Open-pit mines are generally worked by first removing the overburden, which covers the rock in the area of the mineral deposit. Enough rock is then removed so that the ore can be mined. Mining proceeds downward with a bench established with each new level. Benches are dirt roads arranged as spirals or as levels with connecting ramps to provide access to and from the lower parts of the pit. As the pit gets deeper, more rock has to be removed in order to mine a ton of ore. The tons of waste rock that have to be removed in order to mine 1 ton of ore is called the stripping ratio and is an important consideration in determining the economics of an open-pit mine. The higher the stripping ratio, the greater the cost to mine a ton of ore. Mining the ore is generally done by drilling holes in the rock using mobile drilling machines, filling these holes with high-explosives, and blasting. The ore is picked up by front-end loaders or scrapers, loaded into trucks or trains, then transported to the mill. The waste rock is deposited far enough away from the mine so that it does not have to be moved a second time.

Open-pit mining's importance as a source of much-needed minerals continues to increase. Open-pit operations produce virtually all of the aluminum and iron ore mined in the country together with significant amounts of gold, copper, mercury, molybdenum, uranium, and coal. In addition, barite, diatomaceous earth, and many other important industrial minerals are mined primarily by open-pit methods. Ways in which to improve productivity and efficiency are constantly being sought in an effort to keep the United States' mining industry competitive in the world marketplace.

SOLUTION MINING

Solution mining systems generally involve drilling wells to pump out the mineral-bearing solutions, to inject chemicals for the purpose of dissolving the minerals, or both. Brining is a long-established method of extracting halite (salt) from underground salt beds. The salt water or brine created when additional water is pumped down to the salt bed to dissolve the salt is pumped back out through wells. Lithium is extracted in a similar way. Another type of solution mining system is hydrometallurgical leaching or chemical mining. It is similar to the leaching that is used to treat stacks of crushed ore on the surface. Acidic solutions or ammonium carbonate solutions are allowed to trickle down into the fractured rock, dissolving certain minerals. The solution is pumped out and further treated to remove and concentrate the desired minerals. Some copper and uranium is mined using chemical mining methods.
RECOVERY PROCESSES

Once the ore is mined, whether it is an underground or open-pit mine, it must be processed into a salable product. This may be in the form of a refined metal or concentrates containing one or more minerals or metals. Processing of ore is referred to as milling, and the method employed greatly depends on the particular characteristics of the ore and the mineral or mineral product being recovered. Generally, most milling processes involve crushing and sometimes grinding in order to reduce the size of the ore so that the desired mineral may be extracted. Once this is accomplished, separation of the mineral product from the waste is done by a method or a combination of methods which take advantage of the mineral's particular physical or chemical properties. An example of a physical property which may allow a mineral to be separated from the ore would be its relative weight, while an example of a chemical property would be the ability to be selectively dissolved in a particular chemical solution. After the desired mineral is separated from the ore, the waste or tails is discarded and the concentrated mineral product is either sold as is or is processed further in order to enhance its value.

CYANIDATION

Although this method was developed over 80 years ago, recent advances in equipment, together with instrumentation and control technology, make this a very efficient and widely used means of extracting gold and silver from ores. The process essentially consists of four steps. First, the ore is crushed and ground into sand-sized particles using large, rotating drums filled with steel balls called ball mills. The next step is to dissolve the silver and gold from the ore using a solution of sodium cyanide. The ground ore and cyanide solution is mixed together in large steel tanks for several hours. After the silver and gold are dissolved from the ore, the valuable solution then must be separated from the non-valueless solids portion of the mixture. This is done in tanks called thickeners; the solids portion goes to a waste disposal area called a tailings pond. The final step in the process is to remove the silver and gold from the solution. This process is known as precipitation and is accomplished by adding zinc dust to the solution. The zinc chemically "trades places" with the silver and gold in solution, and the silver and gold are filtered out. Some cyanide mills, particularly those processing gold, use activated carbon to remove the precious metals from the solution and thereby require fewer thickeners. The gold is later removed or "stripped" from the carbon and plated out on steel wool in an electrolytic cell. Another variation on this method is known as heap leaching and involves stacking ore in large piles. Cyanide solution is sprayed on the top of the piles and percolates down while dissolving the precious metals in the ore. The silver and gold are then removed from the solution by either carbon absorption or by zinc precipitation.

GRAVITY SEPARATION

Some ores can be processed by a method using gravity separation. After reducing the ore to a small size by crushing and grinding or screening, the valuable mineral is physically separated from the waste by taking advantage of the different weights of the desired mineral particles and the undesired waste particles. A familiar example of this method is panning for gold. A mixture of sand and gold particles can be separated by swirling the mixture in a gold pan (usually a flat-bottomed, conical pan) that is partially filled with water. The swirling action sets all the particles in motion. However, since the gold is heavier than the sand, it stays near the bottom of the pan while the sand is carried to the top and is poured off with the water. If swirled long enough, all or most of the sand will have been carried away by the water, leaving the gold particles in the pan.

Large gravity-separation plants, of course, usually process thousands of times the amount of material one person with a pan is capable of. The plants use equipment such as sluices, jigs, shaking tables, sink-float devices, and spirals. Whatever equipment is used, however, they all take advantage of a relative weight difference in order to produce the desired mineral.

Minerals recovered in this manner include gold, tin, and titanium.

FLOTATION

Flotation is the name given to the mineral-processing operation in which certain mineral particles adhere to the surfaces of air bubbles. This is accomplished in a tank which contains a mixture of finely ground ore, water, and certain chemicals. The bubbles with the desired mineral attached are skimmed off the surface and collected for further processing. The material left behind in the tank constitutes the waste product and is discarded.

A successful flotation process depends on the proper mixture of various chemicals to impart certain desired characteristics to the finely ground ore particles. Certain chemicals are used to selectively cause the desired minerals to adhere to air bubbles, while other chemicals selectively cause the waste product to not adhere to air bubbles. Other chemicals, together with the addition of air to the tank, and agitation, are responsible for the formation of air bubbles that gather the chemically treated valuable minerals on their surface while floating to the top of the tank.

Minerals recovered in this manner include barite, copper, fluorite, gold, lead, molybdenum, silver, tungsten, and zinc.
Pinson open-pit gold mine. Pinson Mining Co. photo.
Efficiency and technology are two factors making mining what it is today. The size of modern mining equipment makes it possible to mine and process large volumes of ore with a high degree of efficiency. As a result, productivity has increased even with decreasing grade, which is indicative of the rapid improvements taking place in modern mining. This has made it possible in many cases to mine areas that were previously considered uneconomical. Even with increased efficiency and improved technology, modern miners have many exciting challenges awaiting them. Today’s engineers, geologists, and miners are working to ensure that the minerals needed for our economic well-being will be available.
Genstar's Apex limestone processing plant near Las Vegas. Nevada Bureau of Mines and Geology photo.

APEX—LIMESTONE

The Apex quarry and plant, operated by Genstar Cement and Lime Co., are located 19 miles northeast of Las Vegas in Clark County. Limestone is a common rock composed mostly of the mineral calcite (calcium carbonate), and deposits that have a high calcium content but are low in impurities are rare. The limestone at the Apex quarry contains relatively high amounts of calcium. Crushed limestone and its products, quicklime and hydrated lime, probably have more industrial uses than any other substance. Such uses include metallurgy, chemicals, paper, ceramics, construction, and agriculture. Genstar has reserves that will last hundreds of years.

ARGENTA—BARITE

Milchem's Argenta mine and mill are located approximately 14 miles east of Battle Mountain in Lander County. Barite (barium sulfate) was first mined in the area in the early 1950's. Milchem Inc. acquired rights to the claims in 1966 and produced barite on a limited basis until 1975, when they built a large processing and grinding plant. Since 1975, Milchem, one of four leading barite companies, has depended on the Argenta mine and mill to supply most of its domestic production. Barite, which is relatively heavy for a nonmetallic mineral, is used primarily as a weighting agent in oil-well drilling. Barite is also used in many other products including paint, toothpaste, diagnostic medicine, glass flux, and bowling balls.
BAMCO—PLACER GOLD

Bamco’s placer gold deposit is located west of Battle Mountain, partly in Humboldt County and partly in Lander County. The placer deposits were first mined by underground methods during the 1800’s. The gold ranges in size from very fine particles (gold dust) to large pieces (nuggets). The sand and gravel is mined with scrapers, loaders, or backhoes. The gold is recovered in Knudsen bowls which spin and separate the heavier gold from the lighter rock and mineral fragments. Small grooves inside the conical-shaped bowls catch the gold. Bamco’s deposit contains about 2,000,000 cubic yards of ore, enough to last several years.

Bamco’s placer gold operations. Don Smith photo.

BLUE GEM—TURQUOISE

Blue Gem turquoise is mined from Duval’s open pit copper mine at Copper Basin. Duval Corp. photo.

The Blue Gem turquoise mine is located 13 miles southeast of Battle Mountain in Lander County. The deposit was originally found by the Indians before Nevada became a state. The turquoise was mined underground by hand up until 1965 when Duval Corp. began mining copper in the same area by open-pit methods. Turquoise, a complex mixture of copper, aluminum, phosphate, and water, is actually a high-grade copper ore, but good-quality turquoise is worth more as jewelry than as copper ore. The color of turquoise depends on how much copper is present. High-quality turquoise is deep blue, but as iron substitutes for some of the copper, the stone becomes more green. Since 1965, the Blue Gem Mine has produced about 600 pounds of high-quality turquoise per year.
CANDELARIA—SILVER

The Candelaria Mine is operated by Nerco Minerals Co. and is located approximately 40 miles southeast of Hawthorne in Mineral County. Silver was first discovered in the area by Spanish prospectors in 1863. The first mine, the Northern Belle, was opened in 1873. Large-scale open-pit operations began in 1980, producing 10,000 tons of ore per day. The silver is recovered by heap leaching. Silver is an important industrial metal, especially in photography and electronics.

Heap-leaching operations at the Candelaria mill. Occidental Minerals photo.

CARLIN—GOLD

The Carlin Mine, operated by Newmont Mining Corp., is located 14 miles northwest of Carlin in Eureka County. The gold occurs as tiny particles scattered throughout the rock. The deposit at Carlin is very important because the type of gold and the rock in which it is contained has become a model for prospecting for other disseminated gold deposits. The open-pit mine was put into production in 1965, has operated since, and is still a focal point for new discoveries. The mill processes over 2,000 tons of ore per day, and Newmont is building another mill to process even more ore. An additional 2,500 tons of low-grade ore are heap leached every day. The company produces 160,000 ounces of gold per year, and production is expected to double after the new mill is built.
The Colado mine and plant are located near Lovelock in Pershing County and are operated by Eagle-Picher Industries Inc. Diatomaceous earth, or diatomite, is the white, chalky, fossilized remains of one-celled aquatic plants that lived in lakes that covered the area during prehistoric times. It is a powerful absorbent and anti-caking agent used in the manufacture of filters, fertilizers, insecticides, insulation materials, and kitty litter. Eagle-Picher has been mining and processing diatomaceous earth since about 1945.

COMSTOCK—SILVER AND GOLD

The United Mining Corp. Comstock operations are located between Virginia City and Gold Hill in Storey County. The ore is produced from open-pit and underground mines and is processed at their 1,000-tons-per-day mill. The final product is called dore, a mixture of silver and gold. The Comstock has a long and rich history, beginning in the 1860's. Many of the Comstock's early mines produced the fabulous wealth which helped finance the Civil War and helped build San Francisco. Today, United Mining is mining lower grade ore left behind by the early miners, but there is always a chance they will find another bonanza.

Hauling ore from United Mining's New Savage Mine in Virginia City. Nevada Department of Minerals photo.
EMPIRE—GYPSUM

The U.S. Gypsum Empire quarry is located in the Selenite Range in Pershing County, approximately 6 miles southeast of Empire. Their plant is in Empire in Washoe County. The deposit was first mined in the 1920's by the Pacific Portland Cement Co. The U.S. Gypsum Co. took over in 1948. Gypsum is a calcium sulfate mineral that forms during the evaporation of seawater. Thick beds of gypsum are usually found between layers of sedimentary rocks such as limestone or shale. Since gypsum is soft and occurs in relatively thick beds, it is easily mined from the rocks around it. The gypsum is mined by drilling and blasting. Most of the gypsum is used for making wallboard and plaster. Gypsum is also used as a soil conditioner and as an additive in cement to slow the rate at which it hardens.

U.S. Gypsum’s processing plant at Empire. Keith Papke photo.

GABBS—MAGNESITE

C-E Basic’s magnesite mine and mill are located near Gabbs in northwestern Nye County. The magnesite is mined by conventional open-pit methods and is processed and refined at Basic’s plant. One hundred percent of all the magnesite produced in the United States comes from Nevada. Magnesite (magnesium carbonate) is used mainly as a refractory product for steel manufacturing, but it is also used in the manufacture of cattle feed, fertilizer, and sugar, as well as water purification. The U.S. Government originally mined the magnesite, but sold the deposit to Basic after World War II. Basic has been steadily mining magnesite ever since.

C-E Basic’s magnesite mine and refractory at Gabbs. Nevada Bureau of Mines and Geology photo.
GOOSEBERRY—SILVER
AND GOLD

The Gooseberry Mine is operated by Asamera Minerals (U.S.) Inc. and is located 24 miles east of Reno in Storey County. Traces of gold and silver were discovered at the surface in 1904. In 1910, the original shaft was dug by hand down to 50 feet. The shaft is presently 1,450 feet deep with the lowest production level at 1,000 feet. Due to the broken and fractured ground conditions, rock bolts and timbers are used to keep the mine safe. Conventional drilling and blasting is used to break up the mineral-bearing rock. The coarse ore is transported underground in ore cars pulled by battery-operated locomotives, transferred to the shaft by conveyor belt, and hoisted to the surface in ore bins. In 1974, a 350-tons-per-day flotation mill was built to process the ore.

Jack-leg drill in operation at the Gooseberry Mine. 
Asamera Minerals (U.S.) Inc. photo.

GREYSTONE—BARITE

The Greystone barite mine, operated by Dresser Industries Inc., is located 36 miles southeast of Battle Mountain in Lander County. The processing plant is in Battle Mountain in Lander County. The ore is mined by conventional open-pit methods, but the rock is fairly soft so little blasting is required. At the plant, the heavier barite is separated from the lighter waste rock by a gravity-separation process called jiggling. When the barite is pure enough, it is ground into a powder. Dresser Industries started mining barite at the Greystone Mine in 1955 and has at least 10 years of reserves.
JERRITT CANYON—GOLD

The Freeport Gold Co. Jerritt Canyon (Bell) mine and mill are located in Elko County, about 55 miles north of Elko. Freeport discovered the disseminated gold deposit in 1975, poured their first gold bar in 1981, and have gone on to become one of the largest producers of gold in the entire United States. Nearly 30,000 tons of ore and waste are mined every day. In addition to its use in jewelry and dental work, gold is an extremely good conductor of electricity and does not tarnish, making it important in the manufacture of advanced electronics and communications equipment.


McDERMITT—MERCURY

The McDermitt Mine is operated by Placer U.S. Inc. and is located 11 miles southwest of McDermitt in Humboldt County. Mercury was first discovered in the area in 1917. A succession of mines, Bradley, Bretz, Horse Heaven, Opalite, and Ryan, produced mercury between 1927 and 1970. In 1970, Placer U.S. developed an open-pit mine capable of supplying a 2,400-tons-per-day processing plant. This plant is the largest producer of mercury in the United States. Although some of the mercury occurs in its native (liquid) state, most of it is recovered from cinnabar, a common mercury mineral, and corderoite, a new mineral which was discovered in 1974 at the mine. Mercury, a metal, is chemically stable, has high electrical conductivity, and is very heavy, all properties which make it a useful material. Mercury is used primarily in electrical apparatus. Other uses include scientific instruments, dental amalgam, and agriculture.

Flotation tanks at the McDermitt mercury mine. Placer U.S. Inc. photo.
PINSON—GOLD

The Pinson mine and mill are located 37 miles northeast of Winnemucca in Humboldt County. The deposit was originally claimed by Clovis Pinson in 1885, and the claims remained in the Pinson family for a long time. The present operation began in 1980 with a start-up cost of over $15,000,000. Due to careful planning and scheduling, the company was able to recover the cost within 1 year. Pinson Mining Co. mines the ore using conventional open-pit techniques. The 1,500-tons-per-day mill uses both carbon columns and a carbon-in-pulp process to collect the gold from the cyanide solutions.

ROUND MOUNTAIN—GOLD

The Smoky Valley Mining Co. operations at Round Mountain are located 55 miles north of Tonopah in Nye County. Gold was first discovered in the area in 1906. Lode deposits were mined until 1942, followed by some placer operations until about 1960. In 1976, heap-leach operations began processing 7,000 tons per day from an open-pit mine. By 1982, reserves had been increased to 195,000,000 tons of ore containing 8,400,000 ounces of gold and 15,700,000 ounces of silver, making the deposit at Round Mountain potentially one of the largest gold mines in the country. Between 12,000 and 16,000 tons of ore are processed per day and the reserves are continuing to increase.
SILVER KING—SILVER

The Taylor and Ward Mines are located southeast of Ely in White Pine County. At the Taylor Mine, 1,250 tons of ore are mined per day by open-pit methods, producing 1,000,000 ounces of silver per year. The Taylor Mine has 15 years of reserves. The Ward Mine is underground and is scheduled to begin production in 1986. It is expected to produce 1,000 tons of ore per day, which will be processed with a flotation concentrator. Reserves of 17,000,000 tons should sustain operations for about 50 years.

SILVERPEAK—LITHIUM

The Foote Mineral Co. plant is located near the town of Silverpeak in Esmeralda County. The company produces lithium carbonate by solar evaporation and processing of brines pumped from beneath Silver Peak dry lake. Lithium, the lightest metal known, has a wide range of uses including high-energy batteries, lubricants, and ceramics. It is also used in the manufacture of synthetic rubber, aluminum, vitamin A, and as a carbon dioxide (CO₂) absorbent in submarines and spacecraft. In 1980, Foote produced 13,700,000 pounds of lithium carbonate, a source of one third of all the lithium produced in the United States.
16-TO-1—SILVER

The 16-to-1 Mine is operated by Sunshine Mining Co. and is located a few miles from Silverpeak in Esmeralda County. The mine produces silver and gold ore from a podlike mass that averages over 20 feet wide, 600 feet high, and 1,000 feet long. The ore is blasted off in vertical slices and hauled to the surface in large trucks. The 16-to-1 Mine is one of the few underground operations that uses trucks to haul the ore on ramps built inside the mine.

Miners loading explosives at the 16-to-1 Mine.
Nevada Department of Minerals photo.

SIMPLOT—SILICA

The Simplot silica mine is located 2 miles south of Overton in Clark County. Simplot Silica Products has been operating the mine since 1955 but the initial discovery was made in 1927. The silica mined at Simplot is a fine-grained sand that has a high quartz content. It is washed and sized through screens at the mine, made into a slurry, and pumped 4 miles to the drying and loading station. The high-quality sand is used mainly for making jars, windows, and other glass products. Other uses include precision molds for foundry work and sealants for drill holes. Simplot mines and processes 200 tons of silica per hour and has abundant reserves.
Pump at the Trap Spring oil field. 
Laurie Engle photo.
Oil was discovered in Railroad Valley in northern Nye County in 1954. The Eagle Springs field, developed by Shell Oil Co., initially produced 343 barrels of oil per day. Continued exploration in the area led to the discovery of the Trap Spring field by Northwest Exploration Co. in 1976. The oil in both fields occurs in fractured volcanic and sedimentary rocks. Later discoveries in Railroad Valley include Currant (1979), Bacon Flat (1981), and Grant Canyon (1982). Amoco Production Co. discovered the Blackburn field in eastern Eureka County in 1982. Nevada produces approximately 250,000 barrels of oil per month.
BACON FLAT

Northwest Exploration Co. opened the Bacon Flat field in Railroad Valley in northern Nye County in 1981. The Bacon Flat No. 1 well produces approximately 2,000 barrels of oil per month from a limestone that is more than 360,000,000 years old.

Northwest Exploration Bacon Flat No. 1 well during drilling in 1981. John Sieubel photo.

BLACKBURN

The Blackburn field is located approximately 35 miles south of Carlin in Eureka County. This area is noted for oil and gas seeps in the vicinity of Bruffey Ranch, about 3 miles east of the Blackburn field. Amoco Production Co. discovered the field in April 1982. Two wells are currently in production; the Blackburn No. 3 and Blackburn No. 10 each average 13,000 barrels of oil per month. The field has produced approximately 160,000 barrels of oil through 1984.


CURRANT

The Currant field is located in Railroad Valley in northern Nye County. One well drilled in February 1979 produced 641 barrels of oil per day. The oil is a paraffin-asphalt base oil and was discovered at a depth of approximately 7,000 feet in a non-marine limestone. The Currant field is presently inactive.
EAGLE SPRINGS

Eighty-one exploration attempts were made in Nevada before oil was discovered by the Shell Oil Co. in 1954 at the Eagle Springs field in Railroad Valley in northern Nye County. The first well produced 343 barrels of oil per day from fractured volcanic rocks. Oil also occurs in rocks composed of ancient lake sediments and in marine limestone. At the present time, 12 wells are producing 5,000 to 6,000 barrels of oil per day from depths of 6,048 to 8,694 feet.

Pump at Eagle Springs oil field. A. S. VanDenburgh photo.

GRANT CANYON

Grant Canyon is the newest active field in Railroad Valley. The Grant Canyon No. 1 well, drilled by the Northwest Exploration Co., started producing in September 1983. More than 1,800 barrels of oil per day were initially produced from depths of 4,374 to 4,426 feet. The oil occurs in dolomite (a rock similar to limestone) that is about 345,000,000 years old. In 1984, the Grant Canyon No. 3 and Grant Canyon No. 4 each produced 2,000 barrels of oil per day or greater from the same rocks. The combined production of the three wells averages 6,000 barrels of oil per day.

TRAP SPRING

The Trap Spring field, discovered by Northwest Exploration Co. in 1976, was the second oil field discovered in Nevada. It is located in Railroad Valley in northern Nye County and has produced more than 5,450,000 barrels of oil from volcanic rocks that are about 30,000,000 years old. There are 19 wells in the Trap Spring field. Oil occurs at depths from 4,000 to 5,000 feet, and an average of 40,000 barrels of oil are produced per month.

Tank battery, pump, and pipeline at the Trap Spring oil field. Ely Daily Times photo.
FUTURE OF MINING

The mineral industry in Nevada can expect an exciting and challenging future. The price fluctuations of various minerals makes the industry very competitive and progressive. With the advent of more sophisticated exploration methods, new mineral deposits will be found and new mining methods and recovery-process technologies will be developed to process the ore. As the exploration for and development of new deposits continues, so too will the need for individuals to fill the many occupations associated with the mineral industry.

Students in Nevada have a unique opportunity to learn the various skills needed to be a part of this industry. For years, the Mackay School of Mines at the University of Nevada-Reno has served as the educational center for many individuals employed in Nevada’s mineral industry. In addition, the University of Nevada-Las Vegas and the various community colleges throughout the state offer the necessary curricula (earth sciences, engineering, computer science, and economics) to provide students with the perfect blend of knowledge needed to pursue careers and fill positions in this dynamic industry.

People, machinery, ideas, and dedication are vital to this industry. With them, Nevada’s magnificent mineral industry will continue to thrive long into the future.

Modern electronic control panel at the Pinson mill. Pinson Mining Co. photo.
andesite A volcanic rock intermediate in composition and appearance between rhyolite and basalt. Andesite is composed primarily of feldspar and hornblende. The mountains of the Virginia Range in which the Comstock Lode lies are mostly made up of andesite.

assay To determine the proportion of metal in an ore by means of chemical testing.

basalt A dark volcanic rock composed of microscopic grains of augite, feldspar, and olivine. Some basalts have many holes that give the rock a Swiss-cheese-like appearance. As the lava cools, gases escape, leaving holes of different sizes. The rocks at Lunar Craters in southern Nevada are composed of basalt.

base metal A more common and chemically reactive metal. Copper, lead, and zinc are examples of base metals.

bonanza An exceptionally large and rich body of ore or a rich part of a deposit.

breccia A rock composed of larger, angular rock fragments in a matrix of very small rock particles.

calcite A relatively soft mineral made up of calcium carbonate (CaCO₃). Calcite may be colorless, white, gray, or pale yellow. It is common in many rocks and occurs as individual grains or as a cementing material in many sedimentary rocks.

chert A hard sedimentary rock composed of silica. The individual grains are so small they are not visible to the unaided eye. Some chert is composed of the remains of one-celled microscopic organisms called radiolarians whose skeletons are composed of silica.

colors A showing of visible particles of gold in a pan or in a rock.

conglomerate A rock composed of larger, rounded rock fragments in a matrix of very small rock particles.

disseminated gold A scattered distribution of very small, sometimes microscopic, gold particles in a rock.

default A fracture or fracture zone along which the rocks on one side have been displaced relative to those on the other side.

feldspars A group of minerals common in igneous, sedimentary, and metamorphic rocks. Orthoclase is a white and pink variety. Plagioclase is a white or dark grayish-brown variety that often shows narrow-spaced, parallel striations on the crystal surface.

fossil The naturally preserved remains, trace, or imprint of a plant or animal.

fracture A general term for a break in a rock.

gneiss A metamorphic rock in which the minerals are arranged in alternating bands or streaks of light and dark colors. The minerals, usually feldspar, quartz, and mica, are large enough to be seen with the unaided eye.

granite A light-colored plutonic igneous rock made up of interlocking grains of glassy or milky quartz, white or pink feldspar, and specks of dark mica or hornblende. The Sierra Nevada is made up of granite and similar rock types.

headframe A steel or timber structure with a pulley and cable system at the top used to hoist miners and materials in and out of underground mines.

high-grade Ore that contains a higher than usual concentration of valuable minerals.

hornblende A hard, shiny black mineral common in many igneous and metamorphic rocks. It usually occurs as thin fibers or blades, which gives the “peppered” appearance in many granite and andesite rocks.

hydrothermal deposit A mineral deposit formed when hot, aqueous solutions fill fractures or other open spaces in rocks or along faults. The minerals crystallize as the solutions cool.

igneous rock A rock formed by the solidification of molten materials (magma). The rock is extrusive (or volcanic) if it solidifies on the surface; intrusive (or plutonic) if it solidifies beneath the surface.

industrial mineral Any rock or mineral substance (with the exception of metals, fossil fuels, and gemstones) of economic value.

limestone A sedimentary rock composed of the mineral calcite. Shell fragments are common in many limestones. When chemical conditions are right, some calcite crystallizes in sea water and settles to the bottom to form limestone.

lode A mineral deposit consisting of a zone of veins.

metal A metamorphic rock composed primarily of calcite.

metallurgy The science and technology of separating metals and metallic minerals from ore by mechanical and chemical processes.

metamorphic rock A sedimentary or igneous rock that has been changed by pressure, heat, or chemical action.

mica A soft, flaky mineral common in igneous and metamorphic rocks. Muscovite is a light-colored variety; another variety, biotite, is dark brown or black. Because of its crystal structure, mica can be easily pulled apart into thin sheets.

mill The process or a place where ore is crushed and treated to separate the valuable commodities from the waste material.

mineral Any naturally occurring inorganic material with a clearly internal arrangement of atoms and specific physical and chemical properties.

mining district An area of land with described or understood boundaries within which mineral deposits are found. Historically, mining districts were set up by miners for the purpose of administering and governing their activities.

nonmetal A rock or mineral that does not have metallic properties.

ore Rock or mineral material from which minerals can be extracted at a profit.

ore body A continuous, well-defined mass of ore.

outcrop A solid, in-place exposure of rock at the surface.

overburden The nonvaluable rock material, either loose or consolidated, that overlies a mineral deposit.

placer A deposit of heavy minerals such as gold or platinum concentrated in stream gravels.

plutonic rock An igneous rock formed from molten material that cooled beneath the surface.

precious metal A general term for gold, silver, platinum or other relatively scarce, valuable metal.

quartz The most common rock-forming mineral. It is made up of silicon dioxide (SiO₂). Quartz crystals may be glassy or opaque (milky quartz) and exist in a variety of colors including white, rose, smoky-gray, and purple.

quartzite A hard metamorphic rock made up of interlocking quartz grains that have been cemented by silica.

rhyolite A light-colored volcanic rock composed primarily of microscopic grains of quartz and feldspar.

rocker A long, rectangular box mounted on two rocker arms. A screen inside the box separates the finer gold-bearing sands from the larger gravels. The sands are rocked back and forth in water to separate out the heavier gold.

sandstone A sedimentary rock composed of cemented sand grains, which commonly include quartz and feldspar.

schist A metamorphic rock made up of a variety of common minerals. The alignment of certain minerals such as mica or hornblende give the rock a layered appearance. The mica flakes also reflect light, making the rock appear to glitter.

sedimentary rock A rock formed by the compaction and cementation of microscopic- to large-sized broken rock fragments or fossil debris. Some sedimentary rocks are the result of chemical reactions in water that allows the minerals to form directly. Many sedimentary rocks show distinct layering, which is the result of different types of sediment being deposited in succession.

shale A sedimentary rock made up of very fine particles of clay and silt. Various clay minerals and micas are common in the rock.

silica Silicon dioxide (SiO₂). It occurs in crystalline (quartz), amorphous (opal), or impure (silica sand) forms.

slate A metamorphic rock formed from shale. Slate is easily broken into thin plates along closely spaced, parallel fractures.

stope An underground excavation formed by the extraction of ore.

striping ratio The amount of waste that has to be removed to mine a specific amount of ore.

tailings The part of processed ore that is uneconomical to treat further and is usually discarded.

trench A mineralized filling of a fault or fracture in a rock.

volcanic rock An igneous rock formed from molten material that cooled on the surface.
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Geology and Mining

Maps
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Pump at Top Spring field, Railroad Valley.
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