sampling shows values of 5 to 40 ounces silver per ton. In most parts of the workings the gold values vary from $1 to $3 per ton; however, one isolated area is said to have a $28 gold value across a 40-inch vein which is opened for 400 feet of length. Three adits, with a total of 1,600 feet of workings, are the principal openings on the property.

OAK SPRING

The Oak Spring mining district lies near the base of the southeast part of the Belted Range in the vicinity of Oak Spring and south of Oak Spring Butte. The district is 115 miles northeast of Las Vegas and is completely within the Tonopah Bombing and Gunnery Range. It is 58 miles north by dirt road from a point on the Tonopah-Las Vegas highway 57 miles northeast of Las Vegas.

As there are no other recognized mining districts for some distance from Oak Spring, it will be necessary to describe some minor properties under this heading that are a considerable distance from the vicinity of Oak Spring.

Several springs in the vicinity supply enough water for domestic use; however, milling water would have to be obtained from a well. During exploration work, done by the Goldfield Consolidated Mines Company in 1938, four holes were drilled in various scattered spots within about 7 miles of the main part of the district. Water was found in only one, which lies 7 miles east of the central area. This is an 8-inch cased well, 350 feet deep, in which water was encountered at 291 feet. A 15 to 20 gallon per minute pumping test lasted for 55 hours then the pump broke down. A pipe line from the well to the mining properties must pass over a ridge 860 feet above the elevation of the well.

S. H. Ball reports that several prospects were being developed in the district in 1905. The activity at that time was for gold and silver, and some chrysocolla of gem quality was sold as turquoise. Lincoln states that some copper ore was shipped in 1917. In late years, the district activity has been almost completely on the occurrences of tungsten as scheelite which was apparently discovered by V. A. Tamney in 1937. Except for minor gold, silver, copper, and gemstone shipments that may have been made in the early days, about $6,000 of tungsten concentrates produced in a dry concentrator in 1940 is the only production made from the district.

Geology. The area is made up of limestone intruded by granite and partly covered with Tertiary volcanics. Ball states, "A

holes having an average depth of 88.9 feet were drilled. When in the ore body, the drilling was done on 50-foot centers and holes were bailed for samples every 2 feet. Blocked ore reserves are in two bodies, and exploratory churn drilling found a third just before the mine shut down. This third ore body requires more drilling to establish its limits; however, there is an estimated 30,000 tons of $5.64 ore blocked out.

The mill was planned and built to grind 280 to 300 tons per day, but the ore was harder than expected and only 200 tons per day could be handled. Finally, by adding more crushing and grinding, three stage crushing and two stage grinding, the mill was able to grind 300–325 tons per day. These additions were not completed until June 1941. For a few months the mill and cyanide plant handled 9,000 to 10,000 tons per month, then material shortages hampered the operation. The average milling rate from June 1941 to October 1942, when Government Order L-208 shut the mine down, was 8,600 tons per month. Extraction on the oxidized ore of the upper pit was 78–84 percent; however, during the latter period of the operation, at the lower pit, much arsenical ore was milled and the recovery dropped to about 60 percent.

Future operation will require roasting prior to cyanidation. Metallurgical tests made on the ore indicate that a 700–800° C roast for a maximum of 15 minutes is necessary on the arsenical ore. The roasted ore then gives a 90–94 percent recovery by cyanidation.

The Northumberland mine is equipped with a complete camp, general office, assay office, shops, and other buildings that are necessary for an operation of this size. All buildings are maintained in very good condition.

The Blue Bell, which is one of the old silver mines in the area, is owned by the Northumberland Mining Company. An old chlorination mill, down the canyon on the west side of the range at the edge of Smoky Valley, is said to have handled the ore from here in about 1870 or 1880. There are reported to be about 4,000 feet of workings in the mine, but they are now inaccessible.

The Last Chance group of unpatented claims, owned by Mrs. Essie Scuffe Borrego and Chester and Alice Perrine of Round Mountain, cover old silver workings adjoining the Northumberland mine on the west and lie just below the crest of the range. Two silver veins here cut both the monzonite and schist in the vicinity of the contact. The ore widths are 12 to 40 inches and

stock of granite, approximately three-fourths of a mile in diameter, cuts the Pennsylvanian limestone 2½ miles south of Oak Spring and sends many apophyses into it. The granite forming a dome, set with many exposures in block-like masses, rises above the near-lying limestone."

The tungsten mineralization concentrated in certain beds and along apparent fracture zones in the limestone. Although the scheelite occurs near the granite intrusive only minor occurrences are found directly on the contact. The area is characterized by huge outcrops of garnetite, or tactite, which usually contain little or no scheelite. The ore contains much garnet and other associated contact-metamorphic minerals; however, greater amounts of garnet are found in wide beds almost completely altered to the mineral.

Properties. The Tamney tungsten property, located by V. A. Tamney in 1937 as the Climax group and believed to be presently owned by the Pacific Bridge Company of San Francisco, is centrally situated in the district. The Goldfield Consolidated Mines Company did considerable exploration here in 1938 and again in 1940. In 1939 the U. S. Vanadium Corporation spent a reported $11,000 doing a very complete sampling job. In 1941, after these companies had relinquished their option and the price of tungsten continued to rise, the present owner became interested in the claims. Except for 15 tons of ore, treated in a local dry concentrating mill for sampling purposes, no production has been made from the claims.

Of four or five ore showings on the property, one is on the granite-limestone contact and the others are apparent bed replacements usually in the hanging wall of the wide, prominent garnet zones. Two or three of these occurrences are indicated to be of size and grade of definite interest as potential ore reserves.

Sampling by the U. S. Vanadium Corporation indicated one ore body of 175-foot length having 1.08 percent tungstic trioxide for a width of 7.3 feet; another body in three parts is indicated to have a total of about 270 tons per foot of depth containing 0.53 percent tungstic trioxide; another smaller area is calculated to have about 1,000 tons to a depth of 25 to 30 feet containing 1.60 percent tungstic trioxide.

Exploration by the Goldfield Consolidated Mines Company consists of an adit with 950 feet of workings driven 315 feet below one of the better outcrops. The adit did not encounter the ore body and it is reported that the workings are still short of the dip

projection of the ore. In addition, the company drove two shorter adits on other exposures. In 1941 the Pacific Bridge Company built more roads on the claims preparatory to driving another adit but work did not begin as the area was closed by government order establishing the Tonopah Bombing and Gunnery Range.

The only improvement on the ground is a large stone cabin in fair condition.

The Indian Trail group, lying southwest of the Tamney group, is owned by Owen R. Speirs and others. During the latter part of 1940 it is reported that 110 tons of ore from here, containing 0.94 percent tungstic trioxide, was milled at a dry concentrator in the district. Concentrates recovered were valued at $1,150 which is the only known production made from the property. The workings include a shallow inclined shaft opened into an open pit by the last mining operation.

The Crystal claims, owned by the estate of Albert Ninnis and others, lie about a mile southwest of the Tamney ground. It is reported that several hundred tons of ore from here was milled in the dry concentrator; however, the tungsten content of the ore is not known. The scheelite occurs in shear zones in the limestone and is more of a vein type deposit than the occurrences on the Tamney ground. Some relatively high grade, although sporadic, samples were found. The workings include a 30-foot shaft with 20 feet of laterals, a 70-foot shaft connecting with a 150-foot adit, and much trenching. Ore has been taken from the trenches and from a stope between the adit level and surface. Some of the workings on this group are the result of early activity on gold ores in the district.

The Garnetyte Lode claim, owned by Wesley Koyen and Dean P. Thiriot, adjoins the Tamney group on the southeast. In 1940, I. F. Smith leased this claim and milled 2,500 tons of ore in the dry concentrator he built on an adjoining mill site. Tungsten concentrate valued at $4,000 was produced. As it is known that the mill made a poor recovery, the ore is not as low grade as it appears. The principal work on the property is a large open cut in a hard garnetite bed from which the ore was mined. The Smith mill was removed shortly before World War II.

The Michigan Boy group, owned by Ed Lane of Groom, Lincoln County, lies about 6 miles southeast of the central portion of the Oak Spring district. Partly oxidized argentiferous galena occurs in a vein in flatly lying calcareous shale. As exposed in surface workings, the vein can be traced for several hundred feet; it is 8 to 24 inches wide, strikes southwest, and dips about 65° SE.

The workings consist of a 50-foot inclined shaft, several shallow shafts and holes, and a few trenches. Ore piled on the dumps of the larger openings contains 11 to 16 ounces silver per ton and 1½ percent lead.

The Rainstorm group, owned by F. A. Monson of Las Vegas, lies 10 miles southeast of the Oak Spring district proper and about 15 miles southwest of the Kelley mine in the Groom district. The property is reported to contain lead, silver, and gold ore; 80 tons of which was shipped prior to World War II and said to contain 55 percent lead, 25 ounces silver, and 0.25 ounces gold per ton. Two samples of the vein, taken by an examining engineer, averaged 31.5 percent lead, 0.07 ounces gold, and 11.6 ounces silver per ton. Workings are said to consist of a 220-foot shaft, a 150-foot adit, and several shallow shafts and cuts.

The Old Glory patented claim, owned by Arnold R. Burr and others, is situated 10 miles southwest of the Oak Spring district proper and 3½ miles southwest of White Rock Spring. It is sometimes erroneously considered in the Kawich district which is 27 air line miles northwest. The claim was patented in about 1927 and it appears that the last work was done about that time. A completely caved near-surface adit and shallow shaft were driven on shears in a highly altered calcareous shale. Samples of the mineralized zone indicate a low silver content.

A deposit of "bone" magnesite occurs in limestone near beds of chert, 14 miles north of U. S. Highway No. 95 and 2 miles northeast of the Oak Spring road. The deposit is largely low grade; however, some sorted magnesite ore contains 43.6 percent MgO, 2.1 percent SiO_2, and 3.4 percent CaO. Ownership of the claims is not known. This deposit is also inside the Tonopah Bombing and Gunnery Range.

REVEILLE

The Reveille district is in the northern part of the Reveille Range and includes the area on both sides of the range, but does not include the northern tip of the Reveille Range which is known as the Arrowhead mining district.

The district has two principal camps, Old Reveille and New Reveille. The former is 2 miles or less air line northeast of the latter, and the road distance is 10 miles. The southern camp is on the west side of the range, near its crest, and the northern camp is well down on the east side of the range. New Reveille is reached from Reveille Valley and is 25 miles southeast of Warm Springs on the Tonopah-Ely highway and 74 miles from Tonopah. Old Reveille is 21 miles by road from Warm Springs by way of

Twin Springs and Railroad Valley. The roads to the properties on the west side of the range, where most of the activity has been, are generally in good condition. The roads on the east side, however, are poor and the sandy condition of the washes often makes them nearly impassable during the dry season.

Lincoln states that the district was discovered in 1866 by Indian Jim. He showed it to white men who organized the district and named it in honor of the Reese River Reveille of Austin. He states:

> In 1867, a 5-stamp mill was erected west of the mines, and in 1869 a 10-stamp mill, but they only operated a short time. In 1875, the Gila Silver Mining Company acquired the principal properties and reconstructed the 10-stamp mill, which ran intermittently for 4 years. The camp was abandoned in 1880. In 1904, interest in the district revived and an irregular production has been kept up since.

Couch shows a recorded district production of $610,982 from 8,261 tons during 1866 to 1920, and O. J. Belleville produced $2,089 from tailings in 1946.

The mill Lincoln mentions was built in Reveille Valley 10 miles west of the western part of the district and is one of the principal landmarks in the area. The mill has been rebuilt several times, the last addition being made by O. J. Belleville in 1945.

Mineral Resources shows an intermittent production since 1911; however, much of this has not been recorded. Most of the ore has come from New Reveille, principally a lead camp. Production from here has been as recent as 1948.

Geology. The principal rocks in the area are Paleozoic limestone and quartzite with the latter the older. The sediments are covered by Tertiary rhyolite in much of the area, particularly near Old Reveille. Here the ore is found near the contact of the rhyolite with the quartzite. The ore occurs in quartzite at both Old and New Reveille. The several properties on the west side of the district and north of New Reveille are in limestone. Latite and rhyolite porphyry dikes are common in the area and it may be assumed that they are genetically related to the ore deposits.[80]

The ore minerals are cerargyrite and cerussite in the near surface ores, with the sulfides increasing with depth. Some antimony minerals are associated with the silver ores of Old Reveille

[80]Spurr, J. E., Nevada South of the 40th Parallel and Adjacent Portions of California: U. S. Geol. Survey Bull. 208, p. 163, 1903.