this group appear to be of greatest importance. The property is at the higher elevations of the district, slightly above the plateau to the northwest.

In addition to several shallow shafts and short adits, a glory hole of about 400 square feet size with adit is the principal turquoise working here. Recent mining has been done in one of the short adits. Improvements consist of a house in good condition and two small sheds.

SAN ANTONE (Cimarron, Liberty, San Antonio)

The San Antone district covers the northern part of the San Antonio Mountains and adjoins the Tonopah district on the north. It includes the camps of Liberty and Cimarron, respectively, 23 and 31 miles by road north of Tonopah. Cimarron, at the north end of the range, is at an altitude of 7,000 feet and the mining properties along the west face of the mountains are at about 6,000 feet elevation. Water is obtained from small springs near the mines. Roads in the area are all unimproved and in fair condition.

In the past the San Antone district has included the Royston area, which is on a spur of the Cedar Mountains west across the Big Smoky Valley from the San Antonio Mountains. As the miners and prospectors refer to Royston as a mining district, and as it is in an entirely separate range, it is described individually elsewhere in this publication.

Thompson and West state that the San Antone district was discovered in 1863 by a party of Mexicans and organized the next year. In 1865 a 10-stamp mill was built at San Antonio station, but it was removed a year later, and in 1867 replaced with a 4-stamp mill which ran for a short time only.

Joe Clifford[87] of Stone Cabin reports evidence that old diggings 1.5 miles southeast of Liberty were worked in 1854 by Mexicans.

Couch reports a recorded district production of $116,301 from 923 tons during 1867–1888. Small intermittent production made since the turn of the century would probably increase this total considerably, however, this production was not recorded.

Geology. The areal geology is somewhat similar to the Jett district in the Toiyabe Range to the north. Cherts, slates, and limestones believed to be Ordovician are covered by Permian volcanics[88] which in turn are covered with Tertiary volcanics, usually rhyolites and latites. A few fine-grained dikes were noted

[87]Personal interview.
[88]Op. cit.: U. S. Geol. Survey Prof. Paper 216, plate 1.

in the area, and at the north end of the Liberty an alaskite stock intrudes a mica schist and quartzite unconformably overlain by limestone.

At the Liberty mine, which has been the principal producer, a silver and gold ore occurs in Permian volcanics. Partly oxidized argentiferous galena, oxidized silver minerals, and partly oxidized copper minerals occur in Ordovician limestone at the Florence mine 3 miles northeast of Liberty. Manganese is found in shear zones in rhyolite south of Liberty. Gold ore is found in stringers and bunches in Tertiary rhyolite and Permian andesite at Cimarron.

An occurrence of molybdenum as molybdenite and its oxidation products is of interest as a potential future source of the metal. This property is just north of the old camp of Liberty.

Properties. The Liberty mine, consisting of three patented claims at the old camp of Liberty, 23 miles by road north of Tonopah, belongs to W. E. King and H. J. Kneifel of Tonopah. Couch shows a recorded production of $112,167 from 852 tons mined at this property during 1867–1873. In a recent letter to Director Carpenter, Mr. C. L. Olson of San Francisco reports that to the best of his knowledge the Liberty mine produced about half a million dollars during 1910–1912. During this period, Mr. Olson was mill superintendent and later general manager. The mill treated 35–40 tons of about $18 ore per day. He states that most of his production came from the second and third levels west off the inclined shaft, and adds that a flatly lying fault just below the third level apparently cut off the ore as no ore was found below this level. The present owners purchased the mine from Nye County in 1945, and made a 25-ton shipment from the 100-foot level that averaged about $32 per ton. The principal value of the ore is in silver which occurs in a Permian volcanic.[89] It is said that ore averaging $29 per ton, across 2 feet, is found on the 100-foot level and below. The property has a 600-foot inclined shaft with workings on three levels. A small spring used for domestic water supply is 1 mile south of the camp. Water for milling purposes may be obtained by drilling a shallow well in the flat 8 miles west of the camp.

The Spanish mine, owned by Joe Clifford of Stone Cabin, is 1.5 miles southeast of Liberty. He states that the mine was apparently worked by Mexicans in 1854. He reports finding an old hewn cedar board marked "NWC ESTRELLA." The values here are in silver in a 4- to 5-foot quartz vein appearing to be of the

[89]Op. cit.: U. S. Geol. Survey Prof. Paper 216, plate 1.

epithermal-mesothermal type occurring in a clayey chert. The vein bears N. 60° W. and dips 40° NE.; the footwall is a smooth fault plane. Two shafts, one 176 feet deep and the other 66 feet deep were sunk on the vein in the early days. The dump of the deeper shaft is reported to assay $12 in silver. An open cut on the vein 6 to 8 feet deep and about 100 feet long, was made by Clifford. He reports 1,500 pounds of ore taken from this in 1940 netted $94.

The Victory and Defense manganese prospects, owned by E. M. and Mabel E. Booth of Tonopah, are situated 2 miles south of the Liberty mine and 25 miles north of Tonopah by road. The two groups are about 2½ miles apart, the Victory being near the base of the west slope of the San Antonio Mountains, and the Defense being situated on an isolated group of the hills to the west. The prospects are rather similar in that manganese occurs as the mineral psilomelane in seams and bunches in sheared rhyolite. The Victory occurrence is found near an andesite intrusion. At the Defense, the mineral is reported to occur in a highly altered or clayey rhyolite. A placer deposit, in which nodules of manganese are found in sand, also occurs in that area.

The Hall molybdenum property, owned by Lee F. Hand, W. C. Rigg, and C. H. Hall, is situated 1 mile north of the Liberty mine and 24 miles north of Tonopah, at an approximate elevation of 6,000 feet and about 1,000 feet above the floor of the valley 8 miles west. Water for mining and milling is available at shallow depths in the valley and a 30-gallon per minute flow of domestic water can be had at a spring 2 miles south. The power line to Round Mountain and Manhattan passes about 3 miles west. Improvements at the property consist of a hoist, hoist house, and headframe at the collar of the main shaft, together with pipe and rail. All equipment is suitable for exploratory purposes.

A preliminary report by Charles A. Anderson and M. W. Cox, of the U. S. Geological Survey (1945),[90] states that the property was originally a silver prospect and that during 1935–1938 extensive exploration was done by the U. S. Vanadium Corporation, supplemented in 1943 by further exploration of the Metals Reserve Company, to determine molybdenite reserves. The U. S. Bureau of Mines check-sampled the property during the summer of 1942 with results of this sampling reported in War Minerals Report 196. The complete reports of both the U. S. Geological Survey and the U. S. Bureau of Mines are on file with the Nevada State Bureau of Mines.

[90]On file with the Nevada State Bureau of Mines.

The areal geology may be generalized as mica schist and sericitic quartzite unconformably overlain by locally silicified limestone and all intruded by a small alaskite stock roughly circular and about 2,500 feet across its surface exposure. The contact area in both the alaskite and the intruded rock contains many quartz veins and in places the alaskite contains at least 50 percent quartz. The molybdenite occurs associated with pyrite and some chalcopyrite in the quartz veins and lenses cutting both the alaskite and the intruded schist. Although the quartz veins persist away from the contact, the sulfide content decreases. The known molybdenite occurrence is limited to the southwest contact and is only exposed in the underground workings. The Survey report suggests that possible continuation of the ore zone may be found along the southeastern extension of the alaskite-schist contact. No work has been done in this area.

Most of the exploration was carried out by the U. S. Vanadium Corporation, all their work being done through the 310-foot 65° inclined shaft. After sinking this shaft from 110 feet to its present level, they drifted southeasterly 1,250 feet on the 280-foot level and cut the mineral zone with six main crosscuts. This company drove a total of 3,500 feet of laterals. From the results of their sampling, and check-sampling by the Bureau, the latter reports 1,300,000 tons of inferred ore containing an average of 0.37 percent MoS_2. This body as outlined on the 280-foot level, at a vertical depth of 254 feet, is 1,100 feet long and averages 50 feet in width. A vertical depth of 300 feet of ore below the lower limit of oxidation is assumed. The last work on the property was done by Desert Silver, Inc., for Metals Reserve Company and indicates the depth of the oxidized zone to range from 85 to 120 feet. This company sunk two vertical shafts, 180 feet and 150 feet in depth, with a total of 215 feet of laterals. They also drilled 354 feet in two diamond drill holes from the surface.

Quite obviously, this deposit is marginal and cannot be worked under present conditions; however, owing to the large tonnage of inferred ore it is important as a possible future ore reserve. Exploration of the other contact areas having the same general geologic conditions found associated with the mineral zone may, as suggested by the U. S. Geological Survey, find more molybdenite and enhance the value of the deposit.

The Blue Jack prospect, located by W. E. King of Tonopah, lies east of the Liberty mine. The ore occurrence is reported to contain gold and silver values associated with chrysocolla. The workings are said to include a 150-foot adit with 20-foot winze and a

small raise, and a 30-foot shaft. About 8–10 tons of chrysocolla ore on the dump is said to contain $21 to $24 per ton in gold and silver.

The Florence mine, owned by Walter Bowler of Tonopah, is 25 miles north of Tonopah and 3 miles northeast of the Liberty mine. At present the property is being operated by Allen Kirkendahl and Ira Jacobsen who have made intermittent small shipments in the past few months. The vein occurs in calcareous shale and limestone; it is 2 to 6 feet wide and contains partly oxidized argentiferous galena and copper minerals. The lead minerals are principally in the hanging wall and the copper minerals are found along the footwall. Ore values are mainly in silver. The vein bears N. 70° E. and dips about 30° SE. A 200-foot drift-adit with two stopes to the surface and an inclined winze is the principal working. In addition to this, several cuts and shallow shafts expose the vein for about 250 feet. Improvements include an ore bin of about 20-ton capacity, and a small shop and cabin at the adit portal.

The Cimarron group, owned by Mabel E. and E. M. Booth of Tonopah, lies 8 miles by road or 3 miles air line northeast of the Liberty mine. About $15,000 gross production reportedly has been made from the property. Gold ore occurs here in seams and bunches in brecciated zones in Tertiary rhyolite and latite underlain by what is believed to be Permian andesite. Three adits totaling about 1,000 feet and several shafts totaling 700 feet have been sunk on the property. At present the claims are under option to a group which has driven a cross-cut adit to tap the lower workings of one of the shafts. The operation is under the supervision of W. J. Loring of Tonopah. Improvements consist of a camp with several good buildings, two headframes with small ore bins, and a small mill building. Half a mile down the canyon from the camp is a small spring with the remains of two arrastres. It is generally believed that these mills were used by the early Mexican miners to amalgamate oxidized silver ores obtained from the mines near Liberty.

SILVERBOW

The Silverbow district is 53 miles east of Tonopah and lies on the west flank of the Kawich Range near a point where the range changes direction from southwest to southeast. The district reportedly was discovered in November 1904[91] and made its first

[91]Ball, S. H., Notes on Ore Deposits of Southwestern Nevada and Eastern California: U. S. Geol. Survey Bull. 275, p. 65, 1905.