

After the material was air-dried, it was heated in either a revolving or a reverberatory-type furnace to drive off the water of crystallization and excess carbonic acid, leaving a nearly pure anhydrous monocarbonate of soda, or soda ash, which was ground and sacked for shipment.

The foregoing process is based on the principle that if bicarbonate and carbonate of soda are present in a dense solution 1 molecule of bicarbonate will unite with 1 molecule of carbonate to form sesqui carbonate, or trona, which precipitates, while sodium chloride will remain in solution unless the solution density rises above 32° B., and sodium sulfate will remain in solution up to 34° B., providing the temperature stays above 75° F.

By the foregoing process only about 25 percent of the available soda is recovered, but since the cost of handling the solution was merely a question of pumping, the low extraction was not a cause for great concern.

Some soda was also obtained in solid form from Little Soda Lake, where it occurred in a layer about 2 feet thick near the surface.

TABLE MOUNTAIN DISTRICT

The Table Mountain, Bolivia or Boyer, district is in the Stillwater Range in north-central Churchill County near the Pershing County border. The central part of the district is 57 miles north of Bermond (Frenchman's station) on the Lincoln Highway. It is also accessible from Lovelock on the Victory Highway or from Winnemucca on the Southern Pacific R. R. The distance from Winnemucca to the Boyer ranch in Dixie Valley is 87 miles; the road passes through Grass and Pleasant Valleys.

The district covers a large, vaguely defined area that contains a variety of minerals, including nickel-cobalt, copper, lead-silver, antimony, titanium, gold, and kaolin. From the viewpoint of past production, the gold deposits have been the most important.

Nickel-Cobalt Deposits

There are two nickel-cobalt occurrences in the Table Mountain district that were of sufficient importance to induce a number of attempts at exploitation in former years. The deposits are situated in the vicinity of the old camp of Bolivia about 3 miles up Cottonwood Canyon on the east slope of the Stillwater Range. The mouth of Cottonwood Canyon is 1-1/2 miles N. 35° W. from the Boyer ranch in Dixie Valley. There is a uniform grade up the canyon, but in several places the road has been washed out and some repair work is necessary to make it passable for automobile. Cottonwood Creek of variable flow, is fed by melting snows and springs; the flow may exceed a thousand gallons per minute during certain periods.

The nickel mine at Camp Bolivia was discovered in 1880 by John Mason, Charles Bell, and his brother, William. The Lovelock or Cobalt mine, about 1 mile west, was located at the same time by George Lovelock, Sr. The mines were prospected for a number of years, following their discovery, and the first ore is said to have been shipped to Swansea, Wales, from the Lovelock mine by

W. S. Keyes, a prominent early-day mine operator from Eureka, Nev. In 1887 an English company bonded the property and shipped a few tons of rich ore but did not complete the purchase. Subsequently, it was again bonded to an English syndicate, which organized the Nevada Nickel Co., which shipped about 15 tons of ore to San Francisco. In the late eighties the company erected a sulfuric acid leaching plant at the mine at a cost of \$50,000, but this venture was unsuccessful owing to the fact that the Italian chemist who designed the plant was unfamiliar with the metallurgy of nickel-cobalt ores. Later, a 5-ton-capacity water-jacketed furnace was erected at the Nickel mine, but it blew up a short time after it was placed in operation. In the late eighties a small smelting furnace was also erected at the Lovelock mine by George and Frank Bothwell and associates from New York, and from the size of the slag dumps not more than 100 tons of ore was treated. The Lovelock mine was last worked by the Mines Development Co. of Nevada. This company produced several carloads of ore that assayed as high as 26 percent copper with a small amount of nickel and cobalt. From the same vein that produced the copper ore, a few tons of nickel-cobalt ore was mined that yielded 29 percent nickel. It is also reported that 500 tons of nickel-cobalt ore was shipped from the Lovelock mine to Swansea, Wales, in the early eighties.

The mines were worked fairly continuously from 1880 to 1890, when they closed because of litigation and reopened in 1904 only to close again in 1908, since which time they have been inactive. Several years ago the Lovelock mine, comprising two patented claims, and the Nickel mine, of four unpatented claims, were purchased from the county for delinquent taxes by Tasker L. Oddie and Fred H. Luetjens of Reno, Nev.

The workings at the Nickel mine comprise about six short adits and an inclined shaft about 100 feet deep. None of the workings are more than 100 feet from the surface. There is no equipment except several dilapidated camp buildings and the ruins of the old leaching plant, consisting of mill building, leaching vats, and boiler.

In the vicinity of the Nickel mine the formation is diorite, andesite, and fine-grain quartzite, the latter forming a bold and jagged ridge above the mine workings. Some quartzite on the dumps shows the characteristic stain of arsenic minerals, with little evidence of cobalt-nickel mineralization. The nickel-cobalt ore occurs in small stringers up to several inches in width in the sheared and brecciated andesite near a fault contact striking N. 45° E. and dipping NW., the diorite forming the footwall. According to analyses made by Professor Newberry,¹⁵ the samples from the greatest depth contain niccolite, which in the upper levels consists entirely of hydrated arseniate, or annabergite, containing 33.71 percent nickel oxide, 36.44 percent arsenic acid, and 24.77 percent water. The sample lot of 15 tons mined in the early days contained 12 percent nickel, 7 percent cobalt, and 29 percent arsenic. The material on the dumps is all oxidized; no sulfide minerals were detected. A 10-pound sample gathered from the dumps by the writer assayed 7.13 percent nickel and 0.33 percent cobalt.

¹⁵ Newberry, S. B., Mineral Resources of the United States, 1883 and 1884: Geol. Survey, p. 539.

At the Lovelock mine the ore is more complex and in addition to nickel and cobalt contains copper. A number of specimens of erythrite (cobalt bloom) were found on the dumps. Here, likewise, the mineralization occurs in the andesite near a contact with diorite striking N. 40° E. and dipping 50° to 60° NW. A number of ramifying seams of gypsum occur in the andesite. Two 10-pound samples taken from the mine dumps contained 0.40 percent nickel and 0.25 percent cobalt, and 0.46 percent nickel and 0.26 percent cobalt, respectively.

Workings on the Lovelock claims are all superficial in character and total approximately 1,000 feet.

Copper Deposits

A number of copper prospects occur on Treasure Box Hill at the head of Bell Mare Canyon south of Cottonwood Canyon. Deposits are reached on horseback up Cottonwood Canyon past the nickel properties. From Boyer ranch the distance is about 15 miles. The principal properties were located in the early sixties by Alva Boyer, C. S. Kellogg, Jacob Strananger, and Patrick Reid. In the early days several wagon trains of rich, hand-sorted copper ore were mined from surface workings and taken to Sacramento for transportation to Swansea, Wales. In about 1900, a group from Colorado erected a small smelting furnace on the Azurite-Nevada Queen group of claims, which is still intact, but, judging from the condition of the smelter, no ore was reduced. About 1910 the Boyer Copper Mines Co. acquired control of 49 claims and did some development work and diamond drilling, but there was no production. In recent years claims have been idle.

The Treasure Box group of six patented claims is owned by the V. A. Twegg estate, the Crawfton Uniace estate, and John T. Reid, the latter of Lovelock, Nev. The adjoining Azurite-Nevada Queen group of five patented claims is owned by Tasker L. Oddie and Fred H. Luetjens, both of Reno, Nev.

The Azurite-Nevada Queen claims have been prospected by several adits and a number of open-cuts and the Treasure Box group by an old shaft reported to be 170 feet deep, two adits, one 800 feet long, and subsidiary drifts, raises, and winzes, totaling on the two groups of claims about 1,500 feet of workings. Most of the workings are caved and inaccessible. There is no equipment on either property except the old smelter.

According to Carpenter,^{16/} the copper ore occurs near the contact of andesite porphyry flow, overlying an earlier mass of strongly faulted green andesite. The main work on Treasure Box Hill was done in a bed of copper-bearing andesite about 100 feet thick. The contact dips about 20° NW. The ore is chiefly chalcopyrite disseminated through the green andesite and, according to Carpenter, the lower 30 feet of the bed averages nearly 5 percent copper and \$1 in gold with a trace of silver. In places just above the contact small, iron-capped veins occur in the green andesite and the andesite porphyry. When followed downward, these veins lead to massive chalcocite disseminated in a gangue of breccia, and pieces

^{16/} Carpenter, Arthur Howe, Boyer Copper Deposits, Nevada: Min. and Sci. Press, Vol. 103, 1911, pp. 804-805.

of pure black sulfides as large as a man's hand have been found occasionally. Massive bornite, tenorite, and cuprite also occur mixed with the two carbonates - malachite and azurite, - making small deposits of rich ore. Development by the Boyer Copper Mines Co. exposed a block of ore 200 feet long, 100 feet wide, and 500 feet deep, measured on the dip, containing 1.7 percent copper and about \$0.70 in gold per ton.

Dixie Comstock Mine

The Dixie Comstock mine, comprising 10 claims, is on the west side of Dixie Valley in the foothills of the Stillwater Range, about 45 miles north of Bermond on the Lincoln Highway. The property was discovered in April 1934 by Clyde Garrett, and shortly thereafter the controlling interest in the property was acquired by the Comstock Keystone Mining Co. of Virginia City, Nev. In the spring of 1935, a 30-ton-daily-capacity amalgamation mill was erected at the mine, and late in the summer of the same year flotation equipment was added. Incomplete data indicate that the production of gold and a little silver has been about \$150,000 in shipping and milling ore. In 1939 the tailings pile, containing about 6,000 tons, was being reworked by the company, and several lessees were employed in the mine.

Development includes a 200-foot incline, a vertical shaft about 100 feet deep, and drifts, winzes, and other workings, totaling about 1,500 feet. Mining equipment includes a 12-by 10-inch single-stage compressor, a 17-horsepower Hercules geared hoist, and a blacksmith shop. Milling equipment consists of a homemade ball mill 7 by 5 feet, 9-by 12-inch Blake-type crusher, simplex classifier, 4-by 10-foot, amalgamating plate, and four flotation cells. Power is furnished by an 80-horsepower 2-cylinder Fairbanks-Morse Diesel engine belt-connected to a 30-kilowatt alternating-current generator. Camp buildings at the mine can accommodate a crew of 15 men. Water for milling is supplied by a well 30 feet deep near the mine.

Gold, associated with a little silver, occurs in a large vein in a hydrothermally altered igneous formation. Mining is hindered by the intense heat and a large volume of hot water in the mine workings less than 75 feet from the surface.

Kaolin Deposit

An extensive deposit of kaolin occurs in the vicinity of New York Canyon on the west slope of the Stillwater Range about 25 miles southeast of Lovelock, Pershing County, the nearest railroad point. Very little work has been done on the deposit, and no production has been made. According to Buwalda,¹⁷ the clay appears to be a sedimentary deposit lying on a series of Paleozoic sandstones and shales, of which it is probably a member. The clay occurs in a stratum 75 to 100 feet thick extending for about 4 miles along the base of the range. In places

¹⁷ Ries, H., Bayley, W. S., and others, High-Grade Clays of the Eastern United States, With Notes on Some Western Clays: Geol. Survey Bull. 708, pp. 122-123, 1922.