

Copper Canyon Camp of the International Smelting and Refining Company
Copper Canyon
Battle Mountain
Lander County
Nevada

HAER No. NV-21

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Western Region
Department of the Interior
San Francisco, CA 94107

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**HISTORIC AMERICAN ENGINEERING RECORD
COPPER CANYON CAMP
OF THE INTERNATIONAL SMELTING AND REFINING COMPANY**

HAER No. NV-21

Location: Copper Canyon Camp of the International Smelting and Refining Company
Copper Canyon, Battle Mountain, Lander County, Nevada

U.S.G.S. Antler Peak, 7.5' Quadrangle. UTM Coordinates:

UTM Points: A=11 / 488900 / 4486600

B=11 / 488880 / 4486646

C=11 / 489300 / 4486420

D=11 / 409300 / 4486420

Present Owner: Battle Mountain Gold Company
Battle Mountain, Nevada

Present Use: Unused; incidental storage

Significance: The buildings and structures of Copper Canyon Camp represent the remaining elements of a facility constructed by the International Smelting and Refining Company (ISARCO), a Utah-based copper mining company that was, after 1914, a wholly-owned subsidiary of the Anaconda Copper Mining Company. The property was assembled between 1941 and 1944. Twenty-two of the buildings and structures were built by ISARCO during this period; the remaining two properties are unrelated to the ISARCO facility. The buildings and structures of the ISARCO facility are significant as a district, with the 22 ISARCO buildings and structures being treated as contributing elements, and the other two structures as non-contributors. The Copper Canyon Camp Historic District is significant for its association with a key period of development of mining in the local area, and as a distinguished example of its type, period, and method of construction. The property is treated as a historic district. The period of significance for the district extends from 1941 to 1945. The historic context is that of corporate copper mining in Lander County, Nevada during the mid-20th century. The property type is that of a mine and "camp."

1. PHYSICAL CONTEXT OF COPPER CANYON CAMP

Copper Canyon Camp includes 24 buildings and structures, all situated in Copper Canyon, a canyon on the southern slope of Battle Mountain in Lander County, Nevada. Copper Canyon is a discrete canyon within a series of hills, collectively called Battle Mountain or the Battle Mountain Range. The topographic feature called Battle Mountain is about 18 miles southwest of the town of Battle Mountain. The town of Battle Mountain is a railroad and highway-oriented community that is the closest urban area to the Battle Mountain mines.¹ The collective group of mines at Battle Mountain have been called the Battle Mountain Mining District through the years. It was one of the first mining districts established in Nevada, dating to 1866.

Copper Canyon was always the most actively-mined part of Battle Mountain but is by no means the only active mining area in the range. Battle Mountain includes dozens of canyons and sub-canyons, most of which were mined at one time or another. Thus, the region is laced with remnants from more than a century of mining for copper and gold, as well as incidental mining for other minerals and gemstones. In more recent years, a large part of the Battle Mountain Range has been mined using modern techniques, which rely upon large-scale earth-moving equipment and chemical processing of the ores. The landscape has been altered through the many decades of mining activities, particularly those that have occurred in recent years.

The property in Copper Canyon represents the remaining elements of one generation of mining there, the most important mining activities prior to those occurring today. The camp discussed in this report is a facility constructed by the International Smelting and Refining Company (ISARCO), a Utah-based copper mining company that was, after 1914, a wholly-owned subsidiary of the Anaconda Copper Mining Company. The property was assembled between 1941 and 1944. It represents an integrated industrial property, including the copper mine, mill, concentrator and other industrial properties, as well as residential and administrative buildings. Taken together, the related facilities comprises what its builders called a "camp," similar in some respects to a company town, although much smaller and more short-lived than properties commonly called by that name. The property is herein called the Copper Canyon Camp Historic District; historically, the area was simply called Copper Canyon, or the Copper Canyon camp.

¹ The distance between the town of Battle Mountain and Copper Canyon is an estimate, based upon historical information and observed mileage. The distances are driving mileage, not straight line miles, and these may differ as road alignments change. The history of the community of Battle Mountain is discussed in some detail in Buster L. King, "History of Lander County," M.A. Thesis, University of Nevada, Reno, 1954 and in a long oral history with Rene Watt Lemaire, "Recollections of Life in Lander County, Nevada," 1970, retained in Special Collections, University of Nevada, Reno.

2. SPECIFIC HISTORY OF COPPER CANYON CAMP

The Copper Canyon Camp Historic District was built almost entirely during the early 1940s by the International Smelting & Refining Company. The property represents a nearly self-contained community that existed for the purpose of mining copper, silver, and gold just before and during World War II, and includes residential, administrative, industrial, and miscellaneous other buildings to support that effort. The Copper Canyon area had been mined, however, long before the property was taken over by ISARCO. It is possible that a few of the features may pre-date construction of the Copper Canyon Camp by ISARCO. To account for these older buildings and to establish a context for understanding and evaluating ISARCO facility, it is useful to review briefly the history of the area before, during, and after use of this facility by ISARCO.

Copper Canyon has been mined since the 1860s and is being mined today more intensively than in nearly any historical period. Copper Canyon was always the most productive area within the Battle Mountain region but was by no means the only such area that was worked intensively. Battle Mountain is laced with hundreds of mining claims, encompassing essentially the entire topographic feature. Active mining areas were found in all of the canyons of the mountain as well as in an area called the Copper Basin, at the northeastern edge of Battle Mountain. The Copper Canyon Camp is but one element of a substantial mining area, although it reflects the most important and intensively developed of these areas.²

The Copper Canyon Camp is best understood as the culmination of pre-1945 mining at Copper Canyon and Battle Mountain area generally. As with many mining regions in the American West, the Battle Mountain region evolved through a predictable series of stages between the 1860s through the late 1930s, with each stage more capital-intensive and corporate-controlled than the previous one. The earliest mining in the region occurred during the 1860s, when individual miners established the small camp of Galena and laid claim to placer gold and silver deposits.³

² The production figures for the mines of the Battle Mountain Mining District are given in "Geology and Mineral Deposits of Lander County, Nevada," Bulletin 88, Nevada Bureau of Mines and Geology, Reno, 1977, pp. 68-71. The mines are listed individually or in groups of claims and production figures do not exceed an aggregate value of more than a million dollars. The Copper Canyon and Copper Basin claims both exceeded \$1 million, as did one other mine in the area.

³ The early history of the Battle Mountain District is summarized in several sources, including Roberts and Arnold, 1965 and in W. O. Vanderburg, "Reconnaissance of Mining Districts in Lander County, Nevada," Bureau of Mines Information Circular No. 7043, 1939.

Smaller placer claims were worked by small partnerships throughout the 19th century and much of the 20th century in many of the less productive canyons in the Battle Mountain region.⁴

Copper Canyon was distinct among the canyons in the Battle Mountain district in that it attracted corporate interests as early as the 1890s and has been controlled and worked by mining companies since that time. Various small partnerships and companies worked the Copper Canyon claims during the 1870s and 1880s, packing the ore to distant locations for smelting and refining. During much of this period, some of the ore was hauled to California, by pack train or railroad, then shipped by sailing vessel to Wales.⁵ The ore was used as ballast in those vessels, a fact that apparently resulted in economic rates for this unusual transoceanic ore shipment.

At the turn of the century, this individualistic and generally inefficient method of mining and refining was transformed through a takeover of the mining properties by corporate interests. The various claims in Copper Canyon were consolidated in 1897 by the Glasgow and Western Exploration Company, a Scottish company that could have learned of the property through the earlier Welsh connection. The Scottish firm worked the Copper Canyon claims for about two decades, shipping ore to a smelter in nearby Golconda, Nevada.⁶ The firm eventually constructed a leaching plant in Copper Canyon, although this apparently proved to be unprofitable.

The Copper Canyon claims were taken over in 1916 by the Copper Canyon Mining Company. This company would work the claims, directly or indirectly, from that year through the 1950s. This company, in cooperation with ISARCO, represents a high-point of corporate mining in the Battle Mountain area. The Copper Canyon Mining Company was a New York-based corporation with offices at 25 Broad Street in Manhattan.⁷ The company was incorporated in Delaware on November 4, 1916.⁸ For many years, the active directors of the company were C.C. Burger,

⁴ These smaller mines are summarized in numerous publications, including William O. Vanderburg, "Placer Mining in Nevada," Bulletin 27, Nevada Bureau of Mines and Geology, 1936.

⁵ Stephen Caldwell Clement, "Mineralogy of Copper Canon Quartz Monzonite Porphyry, Lander County, Nevada," M.S. Thesis, University of Utah, 1961 summarizes early mining in Copper Canyon, as do other sources cited herein. There is general agreement among the sources as to this early history.

⁶ Roberts and Arnold, 1965, p. 41.

⁷ Vanderburg, 1939, p. 22.

⁸ *Moody's Analyses of Investments* 1920, p. 1195. The most in-depth profile of this company is found in an annual report for the year 1920, filed with the papers of J. Claude Jones in the Special Collection of the University of Nevada, Reno.

R.M. Atwater, Jr., L.E. Whicher, S.L. Sherman, and E.N. Edge, all of New York City.⁹ F.S. Schmidt represented the company in Battle Mountain, although a number of local mining engineers supervised the work. The company, which also owned substantial claims at the Copper Basin, was responsible for many improvements at the Copper Canyon site.¹⁰

The Copper Canyon Mining Company worked the Copper Canyon claims most actively between 1916 and 1918, when copper prices were exceptionally high due to wartime demand.¹¹ A fire that destroyed a power plant in about 1920 shut down the company's operations in Copper Canyon and they were not resurrected directly by the company until about 1930.¹² Lessees, however, did work at the Copper Canyon mine property throughout the 1920s. The lessees alternatively mined and worked the property for copper and gold.

The intermittent use of the Copper Canyon claims, by the Copper Canyon Mining Company and others, appears to have ebbed and flowed with the price of gold and copper. Copper Canyon included complex ores that could be worked profitably for either copper or gold, or both, depending upon price and the level of the mine that was being worked at any given time.¹³ The mine was profitable during the late 1910s because of an unusually high price for copper during war time. The claims were worked marginally by lessees during the 1920s, a period of low prices for both commodities. The claims became profitable again during the 1930s when the price of gold escalated sharply and due to the discovery of reasonably good gold-bearing ledges in the

⁹Various listings in *Moody's Analyses of Investments*, 1920 to 1934.

¹⁰ The early properties of the Copper Canyon Mining Company in Copper Canyon are detailed in EMJ, Vol. 110, 1920, p. 585 and in a six-page article in *Salt Lake Mining Review* Aug. 15, 1920.

¹¹ The company profited from high prices of copper during World War I and found excellent ore in the canyon north of the area addressed in this report. The mining activities of the company during this period are recorded in great detail in a series of papers kept by University of Nevada, Reno, professor of mineralogy, J. Claude Jones. Jones was a consultant to the company and his papers are kept at the Special Collection at UNR.

¹² The company also owned the Copper Basin claims during this period and worked those claims directly. In a 1920 Annual Report, the company referred to the Copper Canyon Mine, noting "The future possibilities of the Canyon Mine may not be of great importance." Copper Canyon Mining Company, Annual Report, May 1, 1920. In J. Claude Jones papers, Special Collections, UNR.

¹³ Clement, 1961, offers a technical explanation for why certain areas of the canyon could be worked for gold, copper, or both, or for other metal as well. The canyon, in his opinion, is highly unusual geologically.

area.¹⁴ The property would be worked by the Copper Canyon Mining Company for gold during the 1930s but was leased in the early 1940s to ISARCO, a copper refining operation, during a period in which copper prices again escalated due to military build up and war.

It appears that the Copper Canyon Mining Company established a relationship with ISARCO very early in its operations of the Copper Canyon mines as well as the Copper Basin property. ISARCO was a large copper smelting company, centered in Utah although its corporate headquarters were in New York City. The company was created in 1908 through combination of several smaller companies.¹⁵ The operational heart of the company was a main smelter in Tooele, Utah. The plant, completed shortly after the company was organized, existed chiefly to process the abundant copper ores of Utah. The plant was made available for custom smelting, processing ores from any area from which transportation was feasible and economical. In time, the company established offices in Western cities specifically for the purpose of encouraging shipments to the Tooele plant.¹⁶ In 1914, ISARCO was acquired by the Anaconda Copper Mining Company, a leader in Western mining, particularly copper mining.¹⁷ Thereafter, ISARCO continued to market its custom smelting operations and, in time, took over full or partial control of the some of these mines. In Nevada, the company acquired a controlling interest in the Mountain City Copper Mining Company near Elko, and worked other mines in Nevada as well.¹⁸

It appears that the Copper Canyon Mining Company began sending its ore to the ISARCO Tooele smelter almost as soon as the company was established. Journal articles dealing with the company from the late 1910s indicate that the company was freighting its ore to the Nevada Central, a

¹⁴ Vanderburg, 1939, p. 14. The escalation of gold prices during the early 1930s was brought about principally through the efforts of President Franklin D. Roosevelt to halt monetary deflation by buying gold at artificially high prices. Whatever the cause, gold prices rose from \$20.67 to \$35 per ounce between 1933 and 1934. The price was set at \$35 an ounce by presidential decree in January 1934. William E. Leuchtenberg, *Franklin D. Roosevelt and the New Deal, 1932-1940*. New York: Harper Colophon Books, 1963, pp. 80-83.

¹⁵ *Engineering and Mining Journal*, January 2, 1909, Vol. 87, No. 1, p. 33. Hereafter, the *Engineering and Mining Journal* is abbreviated "EMJ."

¹⁶ *Copper Handbook*, 1911, p. 986.

¹⁷ Isaac F. Marcossou, *Anaconda*. New York: Dodd, Mead & Company, 1957.

¹⁸ EMJ, November 1932, Vol. 133, No. 11, p. 597.

narrow gauge line through the Reese River valley,¹⁹ via the Nevada Central to Battle Mountain, then via the Southern Pacific Railroad to a smelter in Salt Lake City.²⁰ These articles do not specifically state that the ISARCO smelter near Salt Lake City was the recipient, although that may have been the case. In a 1929 article in the *Engineering and Mining Journal*, it is specified that it was the ISARCO Tooele smelter that was processing ore from Copper Canyon.²¹

The cooperation between the Copper Canyon Mining Company and ISARCO was probably one of convenience. The directors of the Copper Canyon Mining Company were all New Yorkers with no known direct affiliation with other mining companies. There was, for example, no overlap of directors between the Copper Canyon Mining Company and either ISARCO or the Anaconda company. It is highly likely, however, that the Copper Canyon Mining Company directors were familiar with the ISARCO directors. The two companies appear to have cooperated as soon as the Copper Canyon Mining Company began to work its claims.

The Copper Canyon Mining Company constructed operations during its initial phase of work, 1916-1918. The company did not work the claims directly again until the late 1920s. It began to re-work the claims beginning in 1929, at first chiefly for copper²² and later for gold. During the late 1920s and 1930s, the Copper Canyon Mining Company and its lessees worked both the Copper Canyon and Copper Basin properties. During this time, the relationship between the Copper Canyon Mining Company and ISARCO was even closer than before. The manager of the mining operation was J.C. Brumblay. His role was described in detail in a 1932 article in the *Engineering and Mining Journal*:

Copper Canyon is developing into a gold camp under the direction of J.C. Brumblay, also Nevada agent for the International Smelter. Copper Canyon Mining Company was started as a copper producer, shipping some rich copper ore. On taking charge of the work about two years ago, Mr. Brumblay discovered that several shear zones that cut the quartzite reef at right angles carried gold. Exploration of these zones was begun, and gold ore shipments have been going out since.²³

¹⁹ David F. Myrick, *Railroads of Nevada and Eastern California*. Reno: University of Nevada Press, 1992.

²⁰ EMJ, Vol. 104, No. 6, 1917. p. 280.

²¹ EMJ, Vol. 127 No. 14, 1929, p. 570.

²² EMJ, Vol. 127 No. 14, 1929, p. 570.

²³ EMJ, Vol. 133, May, 1932, p. 301.

The operation continued through the 1930s as a gold mine, with the Copper Canyon Mining Company working on its own and leasing some claims to other parties. All ore from the operation was shipped to the Tooele smelter. Some question exists as to how extensively the Copper Canyon Mining Company developed the site during this period, i.e., the extent to which it built residential, administrative, or industrial buildings at the Copper Canyon site. Period verbal descriptions of the company indicate that the company did construct and own some buildings in the canyon. These descriptions are difficult to interpret, however, because the company also worked the Copper Basin claims at the same time. In a 1939 report for the U.S. Bureau of Mines, William O. Vanderburg notes that the company had built a variety of structures in both areas:

Copper Canyon mine is developed by the Virgin shaft, 650 feet deep, inclined about 65 [degrees], with levels established at the 113, 188-, 260-, 330-, 470-, 530-, and 590-foot stations, measured on the dip of the shaft. Workings aggregate about 4,000 feet... The equipment at the Copper Canyon mine comprises a 40-horse power Fairbanks-Morse geared hoist, 2 Ingersoll-Rand single- stroke compressors driven by Waukesha 75-horse power distillate engine, blacksmith shop, and various mining tools. [Followed by description of machinery at Copper Basin.] Both properties are equipped with camp accommodations for large crews of men.²⁴

Other published sources indicate, with less specificity, that the Copper Canyon Mining Company built buildings and structures at the Copper Canyon site.²⁵ We do know, however, that all of these buildings were north of the camp discussed in this report; few buildings existed within the Copper Canyon Camp area as late as 1940.²⁶ Oral historical sources confirm that the Copper Canyon Mining Company did construct "camp" accommodations. The heart of the camp was a series of bunkhouses, built about one mile up Copper Canyon (i.e., north, uphill) from the camp described in this report. The Copper Canyon Mining Company did, however, build three buildings within the area treated in this report. These still exist and are identified as Features 3, 11, and 14 in this report. These buildings were later taken over by ISARCO, remodeled, and incorporated into the ISARCO camp.²⁷

²⁴ Vanderburg, 1939, p. 22.

²⁵ EMJ, September 1940, Vol. 141, No.9 p. 74.

²⁶ A 1940 aerial photograph, in the possession of Archaeological Research Services, Virginia City, Nevada, was supplied by the Battle Mountain Gold Company, indicates no buildings in the area of the old camp. It is the distinct recollection of Mr. John Williams, who grew up in the canyon, however, that three of the existing buildings were built by Copper Canyon prior to 1940. These buildings are not evident in the referenced photograph. They may exist but are obscured in the large scale format.

²⁷William interview.

The fact that the Copper Canyon Mining Company owned camp accommodations is somewhat surprising, as the bulk of work, particularly in Copper Canyon, had been carried out in the 1930s by lessees. The method of operation for the leases was described by Vanderburg.

In recent years, the principal production [on Copper Canyon Mining Company properties] has been made by lessees. Usually leases are given for 1 year, with the privilege of extension for another year, such extension subject to termination by either party on 90 days' notice. The lease contract usually calls for a minimum of 100 man-shifts of labor each month for the term of the lease.²⁸

By late 1939, the company was preparing for a major expansion of its operations. In articles in the January and May, 1939 issues of the *Engineering and Mining Journal*, the company announced its intention to undertake very expensive work at the site, including sinking a new shaft and construction of a mill. The company president sought to issue new stock to pay for this work.²⁹ The company sought Securities and Exchange Commission approval for issuance of new stock but the application was denied, pending various improvements to the property, including digging of a new well.³⁰ The new well was dug in August, 1939.

Less than a year later, the Copper Canyon Mining Company agreed to lease its properties to ISARCO. While no evidence exists to support directly the contention, it appears that the lease came about because the Copper Canyon Mining Company was unable to issue sufficient stock to finance the improvements needed to open a large copper mining operation. The terms of the agreement between the two companies were complex. ISARCO agreed to construct a mill at the site of at least 300 ton capacity, and make other improvements, including developing a new source of water. ISARCO also retained an option to purchase two million shares (apparently the entirety) of Copper Canyon Mining stock at the conclusion of the lease.³¹ J. J. Lillie, manager of the Mountain City Copper Company operations, was put in charge of the new ISARCO facility. R. H. Raring, plant manager for the Copper Canyon Mining Company, remained as the resident engineer for ISARCO.

ISARCO immediately set out to construct an entirely new facility within Copper Canyon. It should be recalled that ISARCO was by the early 1940s an experienced mining firm. Although

²⁸ Vanderburg, 1939, p. 22.

²⁹ EMJ, Vol. 140, Jan. 1939, p. 72; Vol. 140, May 1939, p. 72.

³⁰ EMJ, Vol. 140, No. 8, p. 92.

³¹ EMJ, Vol. 142, May 1941, pp. 73-74.

it began as a smelting operation, the company had branched out into mine ownership and operation during the late 1910s. By 1940, it owned and operated various mines in Utah, Colorado, Nevada, and California. Many of these were in remote locations, giving the company experience in constructing livable facilities where none existed previously.

The manner in which ISARCO built the facility at Copper Canyon illustrates the resources that were available to the corporation and its parent company. As noted, the plant manager was transferred from ISARCO's copper mine at Mountain City, Nevada. The mine superintendent was S.R. Dronbay, who transferred from ISARCO's Walker Mine, a copper mine in California that closed in 1941.³² Dronbay temporarily replaced Robert Raring, who had been drafted into military service; Raring would return to operate the mine after he finished military duty and would remain with the Copper Canyon Mining Company even after the ISARCO lease had expired. A great deal of machinery was shipped to Copper Canyon from ISARCO facilities in other parts of the American West. Much of this equipment came from Rico, Colorado, an ISARCO facility that was closing down just as the Copper Canyon mine was opening.

As for design and construction, ISARCO took two basic approaches, one for residential and administrative buildings, one for industrial and support buildings. For industrial buildings, the company adopted "off-the-shelf" plans developed for comparable facilities owned by ISARCO or by its parent company, Anaconda. The mill building was built around plans for an ISARCO mill in Ophir Hill, Utah. The concentrator was built after plans for the Rico, Colorado plant, from which much of the machinery was drawn. Even smaller structures, such as a housing for a compressor, was built around borrowed plans, in this case, taken from the ISARCO Walker Mine in California. The reason for using off-the-shelf plans was that much of the equipment was itself salvaged from ISARCO plants from throughout the West. The ore bins above the Julie shaft, for example, were taken from the Ophir Mill property. The steel headframe was from an Anaconda mine, the Lower Mammoth Mine in Eureka, Utah. The re-use of older equipment drew the attention of a reporter from *Mining World*. In a 1943 article on the property, a writer commented: "Although some of the machinery and equipment used at Copper Canyon is second or third hand, the whole plant has been worked into a highly efficient and compact unit."³³

The residential, administrative, and minor support buildings, by contrast, were all custom designed, or at least are not shown as having been derived from ISARCO facilities elsewhere. The plans were all developed by the W.E. Ryberg Company in Salt Lake City. Correspondence between ISARCO officials and the Ryberg Company demonstrate that the two Salt Lake City-based companies had cooperated on similar projects in the past.

³² EMJ, Vol. 142, No. 6, June, 1941, p. 72.

³³ "International's Copper Canyon Project, Nevada," *Mining World*, December 1943, pp. 6-10.

The function of the camp and mine may be summarized quickly. With respect to the camp, the company built two sets of residential and administrative buildings, one on either side of the road at the bottom of the canyon. On the west side of the canyon (away from the mine), the camp included single-family homes and duplexes that were designed for salaried personnel or skilled personnel. Also in this area was the office and a "staff building" that appear to have functioned as a meeting place, recreational building, as well as a bunkhouse for visitors. Virtually all of the buildings constructed on the west side of the road still exist. On the east side of the canyon, the company built a series of long bunkhouses, designed to house the hourly personnel. All of the bunkhouses -- it appears from historical photographs that there were 14 of them -- have been removed.³⁴ The company also built a boarding house and store in the bunkhouse area and contracted with a couple -- Fred Dodge and his wife -- to operate the boarding house and store.³⁵ The boarding house and store have been demolished as well. All that remains on the east side of the road are two single-family residential buildings and an automobile garage, as well as two industrial structures not part of construction of the ISARCO camp. The location of the buildings is shown on Figure I.

The function of the industrial buildings up the hill from the roadway may not be summarized as briefly, simply because they collectively represented a sizeable and complex industrial operation. Most of the buildings and structures in that area still exist, either as intact units or ruins. The functional heart of the complex were Features I8, I9, and 20 -- the headframe and hoist, the crushing mill, and the fine ore mill, respectively. Also existing in that area are Feature 22, the thickener tank, and two smaller, relatively insignificant buildings. The major missing building is the power plant, which housed a large diesel generator to run the entire operation; it existed due north of the reservoir. Two other buildings existed uphill from the crusher and fine ore mill, the functions of which are not made clear in available historical documentation.

ISARCO industrial, residential, administrative, and support buildings were essentially in place in early 1942, having been constructed on a hurried basis to meet the almost insatiable demand for copper during the early years of World War II. The operation grew and prospered during 1942 and 1943. Reports from Copper Canyon were very good during 1943 and early 1944. The prosperity of the plant was measured in two terms: the "mill feed," which was running near capacity, and the mineral yield when the concentrated ore was shipped to Tooele.³⁶

³⁴As noted, the Copper Canyon Mining Company had built bunkhouses up the canyon from this site. The ISARCO-built bunkhouses were slightly downhill (south) from this site. No bunkhouse remains from either group of buildings.

³⁵Williams interview.

³⁶EMJ, Vol. 144, No. 8, p. 104; Vol. 145, No. 2, p. 128.

The situation began to deteriorate, however, during 1944, when the operation experienced severe labor shortages. In July, 1944, it was reported that the company, which could employ 150 men at capacity, could find no more than 80 to work there.³⁷ The mill feed fell to only two-thirds of capacity. In addition to labor shortages, the company suffered huge cost overruns on its construction budget. Originally thought to cost less than \$500,000 (1941 dollars), the ISARCO investments at Copper Canyon had by late 1944 totaled more than \$1 million, principally for the mill, water system, and development of the Julie shaft.³⁸ The payback was also apparently less than had been anticipated. The concentrate shipped by the company to its Tooele smelter in 1943 had yielded about \$500,000 value. Copper accounted for the bulk of marketable material, although gold and silver accounted for a much greater value, more than 65 percent of the total.

A year later, ISARCO terminated its lease of the property, relinquishing control of the mines and all improvements to the Copper Canyon Mining Company. In doing so, ISARCO also passed on the option to purchase shares of the Copper Canyon Mining Company. The *Engineering and Mining Journal* attributed the company's decision to the relatively unprofitable nature of the copper ores and to the chronic labor shortages the company had endured.³⁹

The Copper Canyon Mining Company re-hired Robert Raring, who had been resident engineer for the company before the ISARCO lease and was resident engineer for ISARCO as well during some of the lease years. For about six years, between 1946 and 1952, the company continued the operation, mining for gold, copper, lead, and/or zinc, depending chiefly upon the ore that was encountered in the Julie shaft, the focus of the operation. In April, 1946 the mine was employing between 35 and 76 men, working a gold-copper ore.⁴⁰ The Copper Canyon mill was used to process ore from the Copper Basin as well.⁴¹ Also in 1946, the officers of the Copper Canyon Mining Company organized the Nevada Equity Mines Co. to work properties near Austin.⁴² By 1949, the company had turned its focus to lead-zinc-silver ores, which were encountered deep in

³⁷ EMJ, Vol. 145, No. 7, p. 114.

³⁸ EMJ, Vol. 145, No. 11, p. 122.

³⁹ EMJ, November 1945, pp. 125-6.

⁴⁰ EMJ, Vol. 147, No. 4, p. 128.

⁴¹ EMJ, June 1946, p. 127.

⁴² EMJ, Vol. 147, No. 5, p. 128.

the Julie shaft.⁴³ A fire in 1951 halted work at the mine for nearly a year.⁴⁴ The mine did re-open briefly. In late 1952, however, the company laid off its entire work force and shut down the mine, noting that "increased freight, smelter, and supply costs made further operations impossible at current price levels." ⁴⁵

In 1959, the U.S. government took over the Copper Canyon Mining Company properties; the government sold the properties shortly thereafter to the American Smelting and Refining Company, historically an important player in the American copper industry. In 1961, the Copper Canyon and Copper Basin properties were purchased by the Duval Corporation. Some years later, the Battle Mountain Gold Company was formed and took over the Copper Canyon Mining Company properties.⁴⁶ The Battle Mountain Gold Company has since mined the area intensively, most particularly in the Copper Basin and in Copper Canyon north of the ISARCO camp.

3. PHYSICAL DESCRIPTION OF RESOURCES AT COPPER CANYON CAMP

The buildings and structures within Copper Canyon Camp are located on two sides of Copper Canyon. There are few other buildings or structures in the vicinity; the permanent and temporary buildings for the Battle Mountain Gold Company are located on a hilltop, out of sight from the camp. The camp is shown in context in Photographs 1-8.

The properties within this historic district fall into two general categories: residential and administrative buildings, located near the road at the bottom of the canyon; and industrial buildings, located uphill on the east side of the canyon. The distinction is important from a functional standpoint and also in terms of how and by whom the buildings or structures were designed. The residential-administrative group comprises what the company called the "camp." These buildings were, with a few exceptions, designed by the W.E. Ryberg Company, an architectural-engineering firm in Salt Lake City.⁴⁷ The industrial buildings -- the mine and mill --

⁴³ EMJ, Vol. 150, No. 4, p. 130.

⁴⁴ EMJ, December 1951, 107.

⁴⁵ EMJ, Vol. 153, No. 12, p. 150.

⁴⁶ "Geology and Mineral Deposits of Lander County, Nevada," Nevada Bureau of Mines and Geology, Bulletin 88, 1977, p. 66.

⁴⁷ The details regarding the design of these buildings are derived from a series of blueprints, preserved by the current owner of the mine. The blueprints are currently in the possession of Archaeological Research Services in Virginia City, Nevada. The plans are not complete, i.e., do not cover

were generally designed by ISARCO staff directly, although there is some indication that the Ryberg Company refined the plans for a few of the industrial properties. The "camp" buildings are shown as Features 1-17 on Figure 1, the industrial buildings as Features 18-24.

The Ryberg Company-designed camp buildings generally have a unified appearance. All are wood frame. With rare exceptions, the buildings were sided in a 1" x 8" shiplap wooden siding. The buildings were given a variety of windows. Many include an unusual wooden sliding window, with six lights on either side or in a three-part design, with two six-light sliding sash and a fixed sash in the center. Elsewhere, the buildings include six-over-six double-hung sash. All feature gabled roofs, usually with side gables. These elements are consistent throughout the residential and administrative area and are carried over to some of the industrial support buildings as well. Generally, the presence of these elements -- shiplap siding, sliding wooden windows or six-over-six windows -- denote the buildings designed by the Ryberg Company.

It should be noted that the residential units, which were modified for other uses, have generally been stripped of appliances and fixtures, making it difficult to determine precisely the room functions. In the discussion below, room functions are either documented, for the buildings for which plans exist, or inferred on the basis of room sizes and residual traces of appliances and plumbing fixtures. It should be noted as well that a few of the buildings described herein were originally built before 1941 but modified by ISARCO when it took over the operation. As discussed under "Historical Overview and Context," the Copper Canyon Mining Company used the area of this camp before 1941 in a limited manner. ISARCO re-used several of these buildings (it appears that three of the 24 buildings pre-date 1941), modifying these for use as part of the camp. The three re-used buildings are identified as Features 3, 11, and 14.

Residence (Feature 1). Feature 1 is a one-story, woodframe residence, measuring 24' x 37', with a 12' x 5'6" extension to the rear. The building is sided in shiplap wooden boards and features a side gabled roof. It is unusual among the residences in that it includes only double-hung windows and no sliding sash. It is the larger of two three-bedroom residences in the area and is presumed to have been the home of a ranking member of the ISARCO staff, such as the resident engineer. According to the recollections of John Williams, Sr., who worked at the plant when it was in

every building at the site. The plans nonetheless represent an invaluable source for how such a camp was designed and constructed. The Ryberg firm generally designed all but the actual operational part of the mine, with the ISARCO staff of engineers handling design for the mine and mill structures and buildings. Thus, the Ryberg Company handled all of the residential and administrative buildings as well as ancillary structures, such as warehouses and sheds.

operation,⁴⁸ this building was the home to the general manager for the plant. It is shown in Photographs A-1 through A-4.

Garage (Feature 2). Feature 2 is a one-car garage, situated near Feature I. It measures 12' x 21' and is woodframe with corrugated metal siding and roofing. The building is partially dug into the hillside. It is the only garage located in the residential compound, supporting the notion that the adjacent large three-bedroom home, Feature I, was likely the home of a ranking company official, in this case the general manager. It is shown in Photograph B-I.

Residence (Feature 3). Feature 3 is a woodframe, side gabled residence, measuring 35' x 20', with a 10' x 20' shed-roofed extension to the south side. The building appears to have comprised a living room, kitchen, bath, and three very small bedrooms, two of which are in the shed-roofed extension. The building originally featured 6 by 6 sliding wooden sash, typical of the camp buildings. It is sided in board-and-batten siding, now typically covered in tar paper. It is the only building designed with this siding. Feature 3 is shown in Photographs C-I through C-4.

Plans for the camp indicate that the building was "Pres. house," although, according to John Williams, the home was occupied by the mine superintendent, Bill Lauritzen. According to Williams, this home was built by the Copper Canyon Mining Company several years before ISARCO took over the operation. This recollection squares with the building itself; the building is not consistent with the design of residences built in 1941.

This building may, however, even pre-date the Copper Canyon Mining Company structures. During the period when the Glasgow & Western Company controlled Copper Canyon, the company constructed a 50 x 90' 50-ton copper leaching plant in the SE 1/4 NE1/4 Section 28 straddling the border of the Salt Lake #3 and #4 claims. Other improvements made by Glasgow & Western included a 14' x 36' frame office building, three 14' x 30' frame bunkhouses, and a 20' x 36' frame boarding house.⁴⁹ Feature 3, "Pres. house" has nearly the same dimensions as the 1913 Boarding House (20' x 35' for the former, 20' x 36' for the latter) and appears to be in the same location.

Storage Building (Feature 4). Feature 4 is a rubble storage building, dug into the hillside. It measures about 15' x 25', of which only a small portion is freestanding. It is framed in heavy timbers and once included a front-gabled roof, although the roof is very deteriorated. The building was used as a root cellar by the residents of Feature 3 as well as the location for a

⁴⁸Telephone interview with John Williams, Sr., February 12, 1996.

⁴⁹U.S. Geological Survey, "Mineral Survey 4175," 1913. Text and maps on file at the Bureau of Land Management, Reno, Nevada.

gasoline powered generator, the stand for which can still be seen. It is shown in Photographs D-1 and D-2.

Residence (Feature 5). Feature 5 is a small single-family residence. It measures 24' x 24', is woodframe with a side gabled roof, and is sided in 1" x 8" shiplap and roofed in metal plating. It includes a living room, kitchen, two small bedrooms, and a bath. It includes tall 6/6 double-hung windows.⁵⁰ The home was occupied at one time by Bill Adams, the mill mechanic, in the recollection of John Williams. It is shown in Photographs E-1 and E-2.

Duplex (Feature 6). Feature 6 is one of four duplexes built within the western camp area. Features 6 and 7 are identical. The building is sided in 1" x 8" shiplap, features a side gabled roof, and includes 6/6 double hung windows. It measures 25' x 42'. The plan appears to have been somewhat unusual; interior damage makes it difficult to read the building floor plan. The kitchens and baths for the two units were clustered at the center-rear of the building, with living rooms and bedrooms to either side. The right unit appears to have had separate living room and bedroom areas while the smaller left unit was more like a studio, with a single room for living and bedroom uses. One of the duplexes was occupied by Robert Raring who was the general manager of the plant during much of the time it was operated by ISARCO, although his role was interrupted by military duty during the early years of World War II.

Duplex (Feature 7). Feature 7 is one of four duplexes built within the western camp area. The building is sided in 1" x 8" shiplap boards, features a side gabled roof, and includes 6/6 double hung windows. The kitchens and baths for the two units were clustered at the center-rear of the building, with living rooms and bedrooms to either side. The right unit appears to have had separate living room and bedroom areas while the smaller left unit was more like a studio, with a single room for living room and bedroom uses. One duplex was, according to John Williams, occupied by the office manager, whose last name was Williams. Feature 7 is shown in Photographs F-1 through F-4.

Duplex (Feature 8). Feature 8 is the smallest of the four duplexes, measuring 28' x 22', creating a living area of about 310 sf per unit. The building does include two small shed-roofed storage areas, one attached to each unit. The building is sided in the same 1" x 8" shiplap used elsewhere in the camp area. Its windows have been removed. Each unit of the duplex included a kitchen, bath, and a studio-like living room and bedroom arrangement.

⁵⁰ These tall double-hung windows may have been salvaged from another camp owned by the ISARCO. A brief note on an industrial building, fitted with the same windows, indicates the windows are to be "salvaged from Ophir Hill," another ISARCO plant shut down just as Copper Canyon was opening.

Duplex (Feature 9). Feature 9 is one of the four duplexes within the camp. It was apparently built on a variation on the design for Feature 8, being 22' wide but 55' long, which includes a shed-roofed addition on the left (south) end. It is sided in a v-groove boards, not found elsewhere at the camp and included 6/6 double-hung windows. The two units are very different. The right unit was a two-bedroom and living room arrangement. The left unit included only a studio-like living room-bedroom combination, along with the shed-roofed element, probably a sleeping porch. In the recollection of John Williams, several plant employees lived in these units, including Larry Ling, an electrician, Jim Jurey, a power plant employee, and Tom Lainey, a mechanic. Feature 9 is shown in Photographs G-1 through G-4. According to the original plans, the duplexes were designed as long buildings comprised of three dual segments (six housing units.) The plans do, however, contain a notation that if duplexes were to be constructed instead of the long structure, then only the plans for the end units should be used.

Staff House (Feature 10). Feature 10 is shown on site plans as a "staff house." The meaning of that term is not clear from the plans or the building itself. It is among the larger buildings in the camp area, measuring 29.5' x 31.5', with a large rear extension. It is a front-gabled building in shiplap siding with a metal plate roof. It features the distinctive six by six sliding windows, found elsewhere in the camp area. It features an open gabled porch, centered on the facade (north elevation). The interior plan has been modified but appears to have included one large room on the left (east) side, near the front, and five smaller rooms, one of which is the shed-roofed extension to the rear. The term, "staff house" suggests this may have been a common building for the salaried employees on the west side of the road. The large room was probably a common area. The smaller rooms may have been offices or may have been bunk facilities for single men. In the recollection of John Williams, this building was a staff house for staff members of the company. Rooms were made available for the owners of the property when they visited.⁵¹ It is shown in Photographs H-1 through H-4.

Office (Feature 11). This building is clearly shown on plans to have been the office for the mine. The building includes a wood frame rectangle with a reinforced concrete vault at the rear. The main frame office building measures 19' x 41.5', while the vault measures 12' x 15' with a small frame connector. The office is sided in 1" x 8" shiplap. It is the only hipped roofed building in the camp area. It includes six by six sliding windows, sometimes with two, sometimes with three sash. The interior arrangement includes three rooms, two in the frame building and the vault at the rear. The building was also the post office for the camp, in addition to administrative offices and an office for the plant engineer, in the recollection of John Williams. Mr. Williams recalls

⁵¹Mr. Williams believes the "Staff House" was built by the Copper Canyon Mining Company in the 1930s. Plans for this building exist, however, are dated to the early 1940s, prepared by the Ryberg Company for the ISARCO lease. It is conceivable the Ryberg plan was for an expansion of an existing building, although the plans do not so indicate.

that this building was enlarged and remodeled by ISARCO, expanding upon a small office built by the Copper Canyon Mining Company several years before ISARCO lease was executed. In Williams' recollection, the northern ½ of the building was installed by ISARCO. If that be the case, ISARCO almost certainly re-sided the building as well and installed new windows; the windows are consistent throughout and there are no obvious seams in the siding. It is shown in Photographs I-1 through I-4.

Residence (Feature 12). Feature 12 is located across the street from most of the camp buildings. It was not, however, situated in the bunkhouse area; as noted earlier, the bunkhouses existed south of Feature 1-11 but all of those buildings have been removed. Feature 12 was a residence but its location away from the salaried personnel camp and its rambling and inconsistent method of construction separates it from Features 1-11. The building includes a 15' x 33' core, with four extensions: a shed roofed porch at the facade; a small wing to the right rear; a small wing to the left side; and a small entry porch. The building has been gutted, making it difficult to discern the interior plan. In the recollection of Mr. Williams, this feature was a single-family home, occupied by the company blacksmith, Charlie Brankly, and later occupied by others. It is shown in Photographs J-1 through J-3.

Garage (Feature 13). Feature 13 is an automobile garage, located directly across the road from the office building (Feature 11). The garage is dug into the hillside and includes a gabled roof in corrugated metal. The front of the building includes four sets of double side-hinged wooden doors, made of vertical boards. The corners of the building are anchored by concrete posts, with rubble infill in the areas in which the sides are exposed, i.e., not formed from the hillside. It measures about 44' x 22'. Its location in the camp area directly across from the office suggests it was a garage for the salaried employees who lived there. See Photographs K-1 and K-2.

Residence (Feature 14). Feature 14 is presumed to have been a residential building. Mr. Williams recalls that it was the residence of the Wright family, and may have been a school house before that, built for the Copper Canyon Mining Company. It measures 34' x 12' and is divided into three rooms. No fixtures or appliances remain to suggest a bathroom was included. It includes three six by six wooden sliding windows used elsewhere in the camp but is sided in tar paper. See Photographs L-1 and L-2.

Shed (Feature 15). Feature 15 is a deteriorated shed, adjacent to Feature 15. It is built of vertical boards with a shingled shed roof. The building appears to have been used for storage.

Trough (Feature 16). This feature is a concrete and timber trough, now mostly buried beneath fill. The feature has no obvious function in relation to the operation of the camp or the ISARCO mine; the structure is probably an artifact of earlier leased uses of the Copper Canyon Mine area. The Copper Canyon area, as discussed in Section 3 Feature 17 below, was leased to various

parties throughout the 1920s and 1930s; indeed, even the ISARCO facility was built on a leased basis. The concrete and timber troughs include wooden slats at the bottom, now heavily deteriorated, and metal pipes at the top of each trough. It is presumed the feature was used to transport water, perhaps in relation to a placer mining in this area. The trough is situated behind Feature 12. Feature 16 was not built as part of the ISARCO facility, has no individual merit (owing chiefly to a loss of integrity) and is not considered a contributing part of this historic district. Mr. Williams recalls this feature was built by Hugh Hullinger and Jim Elquist in 1959 or 1960.

Trough (Feature 17). This feature, like Feature 16, has no obvious function in relation to the camp buildings or the ISARCO mine and may be an artifact from earlier uses of the area, but was most likely built at the same time as Feature 16. The feature includes a timber king-post truss with a ramp leading to it. The truss has a clear span of about 30' and is raised about 12' above the ground level. A raised platform exists on one-half of the truss. It is presumed the ramp and raised platform were used to load material but there is no road leading to the feature, nor was there in 1941-45, the access having been blocked by Feature 12. Feature 17 was not built as part of the ISARCO facility and is not considered a contributing part of this historic district.

Features 18 through 24 exist uphill from the camp and represent remnants of the mine and concentrator associated with the ISARCO copper facility. These features are generally much more deteriorated than the camp buildings but are larger in scale. These represented the *raison d'etre* for the entire facility. Figure 2 is a diagram of the operations of the mine and mill, reprinted from a 1943 article on the mine in *Mining World*.⁵² This figure may be used to help explain how these various features worked with each other.

Base for Headframe and Storage Tanks (Feature 18). Feature 18 represents the base for the headframe and storage tanks above the Julie Shaft, the source of ore for the operation. The steel headframe, which had been built in 1915 and brought to this site from an Anaconda mine in Utah, was removed from Copper Canyon before the mid-1960s. The headframe was probably relocated and re-used and may still be in use elsewhere today. What remains of this property today are the concrete base for the headframe as well as two steel ore bins. One bin (as described in historical records) is 8' in diameter and 30' tall, with a 100 ton capacity; the other is 16' in diameter and 30' tall, with a 400 ton capacity. These cylinders were primary ore bins, storage bins for ore hoisted from the shaft, with 150 ton and 300 ton capacity. The function of Feature 18 (as well as Features 19-22) may be appreciated by reference to Figure 2, "Flow Diagram of Isarco Mill and Concentrator." Feature 18 includes items 1 and 2 under "equipment specifications," the ore bins.

⁵² "International's Copper Canyon Project, Nevada," *Mining World* December 1943, pp. 6-10.

As noted, however, only one of the two 2000 cubic foot bins are still in place. It is shown in Photographs M-1 through M-4.

Crushing Plant (Feature 19). Feature 19, the most intact of the industrial buildings, represents the crushing plant for the mill. Ore was drawn from the bottom of the bins in Feature 18 and fed by conveyor belts to the top of this building. The ore was separated by size and sent to one of two crushers, located on different floors of the building. The building is 35' tall, with a 27' tall first story. The interior is partially intact, including some in-place equipment. The building is shown in Photographs N-1 through N-8. The function of Feature 19 may be appreciated with reference to the "flow diagram" in Figure 2. Feature 19 housed equipment listed as items 5 through 14 in the "equipment specifications" list and as shown in the diagram.

Fine Ore Mill (Feature 20). Feature 20 represent the ruins of the fine ore mill, the largest building at the facility. Again, it will be useful to inspect the diagram in Figure 2 to appreciate how this mill operated, relying chiefly on ball mills to mill the ore for transmission to the thickener. The mill building burned some time during the 1980s and is now a two-level concrete ruins with tangles of miscellaneous equipment still in place. It is shown in Photographs O-1 through O-5.

Feature 20 included three levels of building and three corresponding levels of equipment. The top level was an ore bin, apparently not called out in the "equipment specifications" or "flow diagram." The top level also included the ball mills, shown as items 16 through 19 on the "flow diagram" in Figure 2. The intermediate level included the cells, shown as items 24 and 25 on Figure 2, as well as the pulp concentrator, shown as item 23. The lowest level, at the grade of the adjoining roadway, housed the concentrate thickener, shown as item 27 in Figure 2, and associated pumps, shown as items 28 and 29. The largest tank, a tailings thickener, shown as item 33 in Figure 2, still exists and is shown as Feature 22 in this report.

Concrete Base (Feature 21). Feature 21 includes the concrete base for metal cylinders; these cylinder may be seen at the bottom of photograph reproduced as Figure 3. The cylinders were fuel tanks, in the recollection of Mr. Williams. These features are apparently not called out in the equipment specifications in Figure 2.

Reservoir (Feature 22). Feature 22 is a large reinforced concrete reservoir, originally 40' in diameter and about 6' deep, much of that depth below grade. Feature 22 is shown in Figure 2 as item 33, the thickener. Thickening tanks were used to concentrate crushed ore by a flotation system. Generally, the water-borne particles were made to float by injection of an oil (usually a pine oil) for which the particles had an affinity and which would cause them to float. The flotation concentration method, as used by the Anaconda Copper Mining Company during this period, is

described in *Fortune Magazine*, December, 1936, pp. 83-93, "Anaconda." The reservoir is shown in Photograph P-1 through P-3.

Office/Warehouse (Feature 23). Feature 23 is an office/warehouse building, just west of the Julie Shaft. It measures about 25' x 58', with a gabled roof and a shed-roofed porch. The roof has a 2' overhang with exposed rafters. The building includes a series of six over six double hung windows and two large industrial doors, one timber, the other metal plated. It includes a small concrete vault at the rear, similar in design to the vault at the rear of the camp office (Feature 11).

This building was designed by the Ryberg Company of Salt Lake City. In the recollection of Mr. Williams, the building included office space at the east end and a warehouse at the west. It is shown in Photographs Q-1 through Q-4.

Storage (Feature 24). This is a small (18' x 20') storage building, located west of the thickener (feature 22). The building is woodframe on a wooden post foundation. The building is shingled and includes an interesting Craftsman-like roof form, with exposed rafters and bracketed purlins. It is simply an open room, with no obvious function in relation to the mill. Mr. John Williams recalls the building was used by ISARCO to store diamond drill bits and core samples. It is shown in Photographs R-1 through R-4.

Other features in the area include roads and modern water lines. The road system has been continuously upgraded through subsequent generations of mining and is not considered to be part of this historic district. The water lines were installed in very recent years and are not contributing aspects of this historic district.

4. PROJECT DESCRIPTION

The Battle Mountain Gold Company has mined its claims at Battle Mountain according to a long-range plan and resource protection plan agreed to by the Bureau of Land Management, which has regulatory jurisdiction of much of the area. In a Programmatic Agreement with the BLM and the Nevada State Historic Preservation Officer, the Battle Mountain Gold Company will preserve historic and archaeological properties at the mine until those resources are scheduled for removal, according to the long-range mining plan. As mining activities require demolition or alteration of historic or archaeological properties, the company has agreed to conduct appropriate mitigation activities, such as data recovery for archaeological sites or HABS/HAER recordation for the built environment. The company intends to begin mining in the vicinity of the Copper Canyon Camp in the near future. This recordation document is designed to preserve a record of the historic resource, prior to demolition of all buildings and structures at the site.

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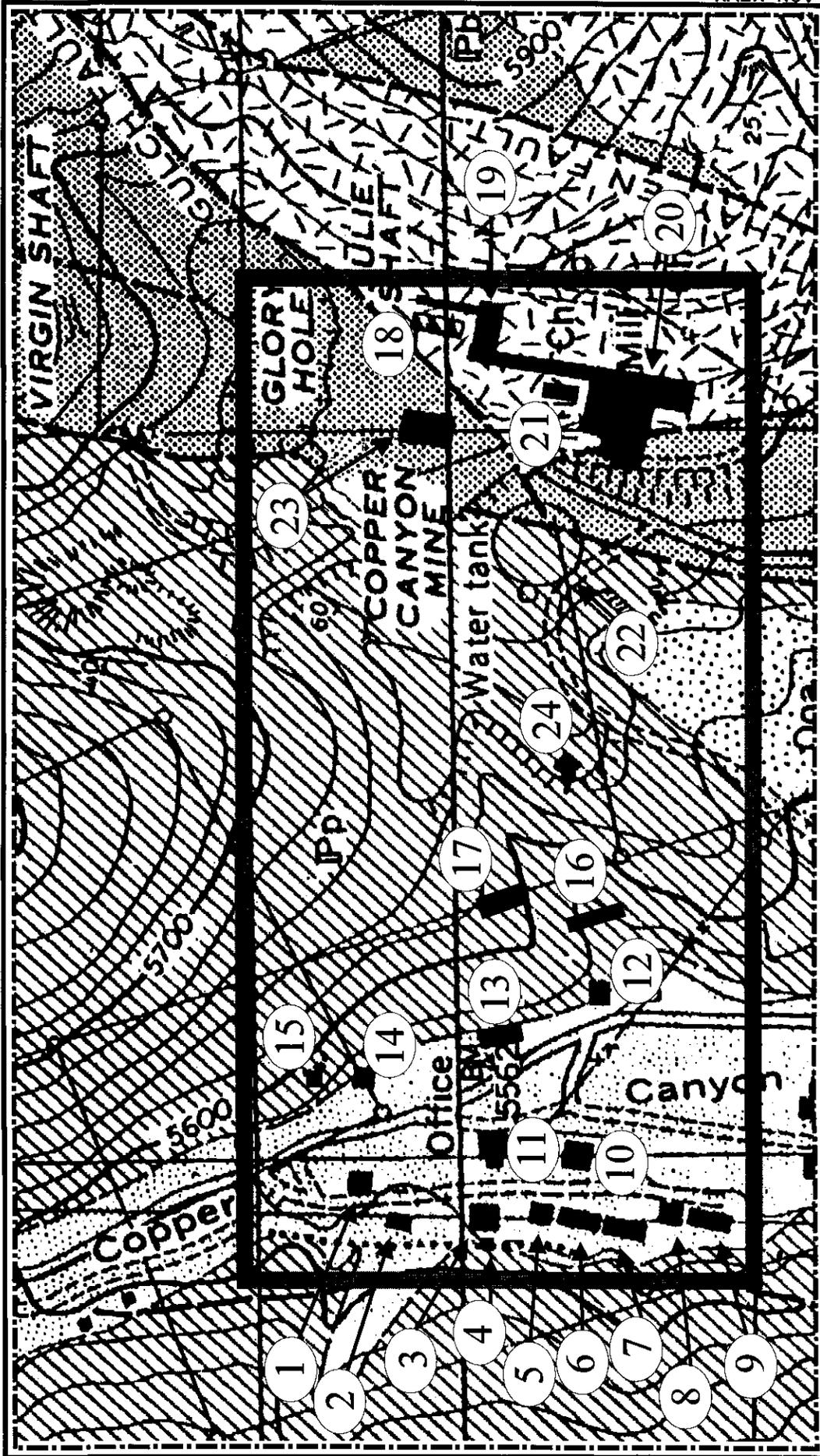


Figure 1. Location of Buildings and Structures within the Copper Canyon Camp of the International Smelting and Refining Company.

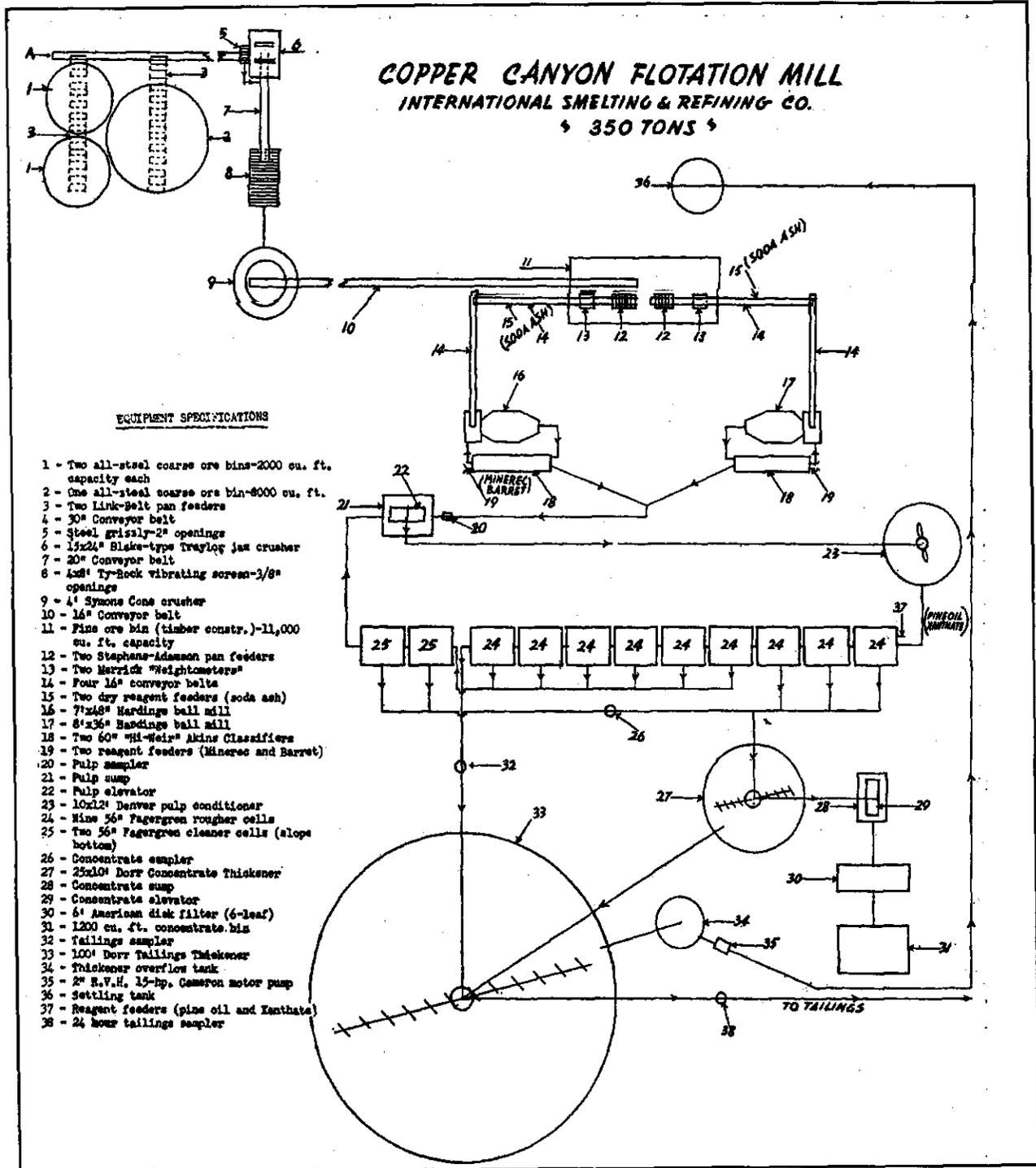


Figure 2. Flow Diagram of ISARCO Mill and Concentrator

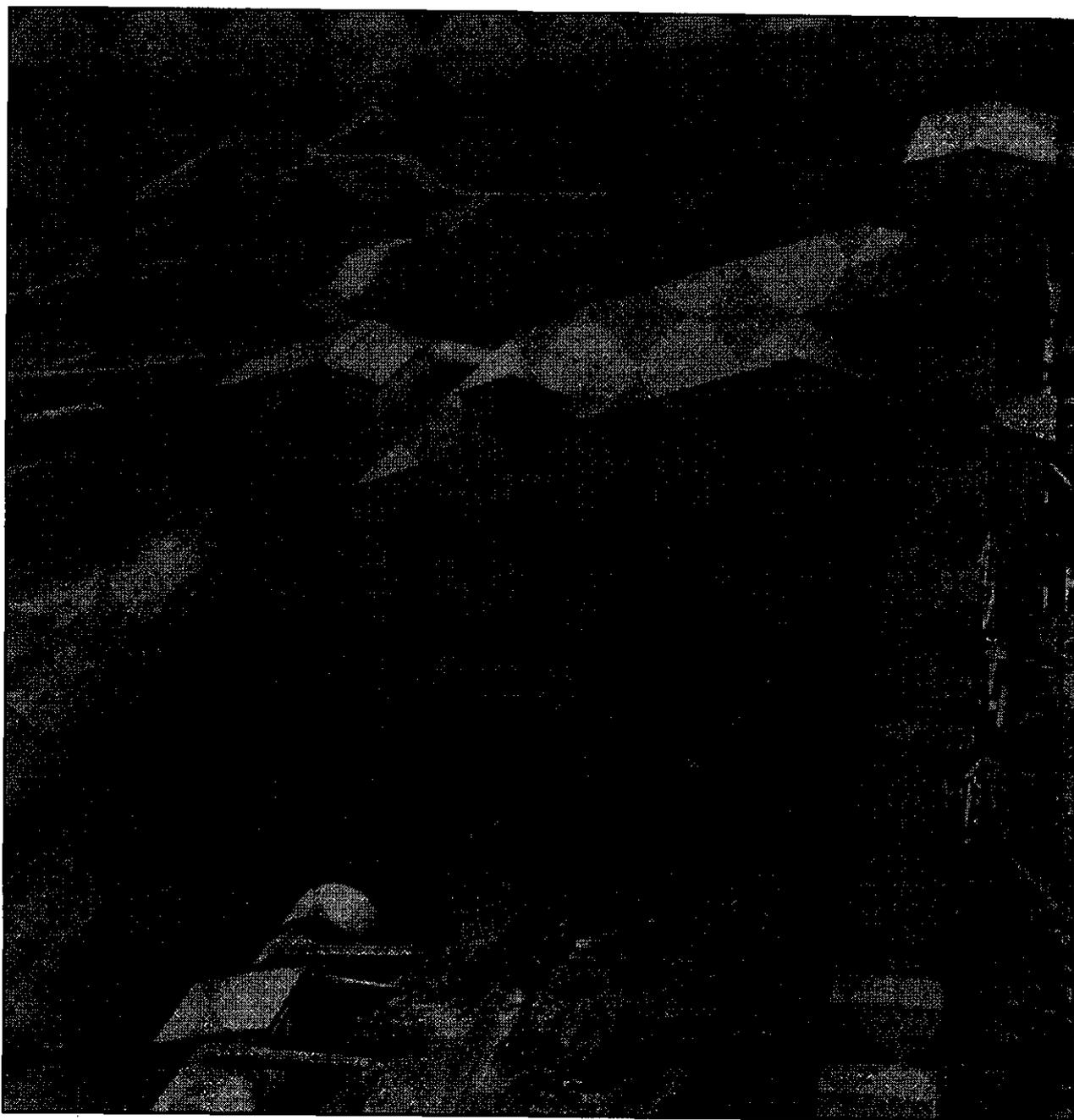


Figure 3. Copy of a 1943 photograph of the fine ore mill at Copper Canyon.