

GRAND GULCH MINE  
Grand Canyon-Parashant National Monument  
Littlefield  
Mohave County  
Arizona

HAER AZ-78  
*HAER AZ-78*

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FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
U.S. Department of the Interior  
1849 C Street NW  
Washington, DC 20240-0001

## HISTORIC AMERICAN ENGINEERING RECORD

### GRAND GULCH MINE

HAER No. AZ-78

**Location:** Grand Canyon-Parashant National Monument  
Mohave County, Arizona

The Grand Gulch Mine is located on the Grand Gulch Bench between Mine Canyon and the North Fork of Pigeon Canyon, both features of the Grand Wash Cliffs. The mine is about 39 miles southeast of Overton, Nevada, and about 76 miles by road from St. George, Utah. The site lies about a mile off Bureau of Land Management Road 103 in township 34N, range 14W, sections 21 and 22 (Gila and Salt River Meridian). Its geographic coordinates are latitude 36.327536, longitude -113.790956 (World Geodetic System 1984). These coordinates represent the southwest corner of the smelter.

**Present Owner:** Grand Canyon-Parashant National Monument  
Bureau of Land Management  
U.S. Department of the Interior

The Adams Lode patented mining claim (Mohave County tax parcel 401-33-001), comprising 20.66 acres in the middle of the mine site, is privately owned.

**Present Use:** Disused; preserved as a cultural-heritage site

**Significance:** The Grand Gulch Mine was established by Samuel L. Adams, Richard Bentley, and other men from the Mormon settlement at St. George, Utah, in the early 1870s to work a vein of rich copper ore called the Adams Lode located in a remote area of northwestern Arizona about 45 miles south of the Utah border. The first miners sank a shaft, commissioned an adobe smelter, and created a small compound of stone houses and workshops during a few years of intermittent mining, but ceased work in 1882 because of the insupportable expense of hauling ore 180 miles to the nearest railhead. Encouraged by railroad development in southern Utah, the Jennings family of Salt Lake City reopened the mine in 1899 and soon installed power machinery, rebuilt and expanded the complex of buildings, and sank a new shaft that, over the next two decades, reached a depth of 500' with drifts on multiple levels. The mine was essentially tapped out and closed in 1919, but for a few years ending in 1961, the dumps were sorted, chemical processing attempted, and much of the mine's equipment dismantled and hauled away for scrap, leaving the fragmented and confused landscape of tailings piles and ruined buildings that remains at the site today.

The Grand Gulch Mine represents the challenges small late-nineteenth- and early-twentieth-century mine companies faced when trying to exploit

economic minerals in isolated and inhospitable areas of the desert and mountain west. Burdened by a remote site where even water had to be hauled in but emboldened by the promise of profitable returns, the mine's owners consistently sought to improve the transportation connections that linked the mine to its suppliers and markets. Their efforts relied on regional railroad development, which gradually reduced the difficult wagon haul to about 140 miles in 1899, 73 miles in 1905, and finally to 45 miles in 1912, at each step decreasing the cost of freighting and expanding the range of ore grades the mine could economically send to market.

The mine lies within Grand Canyon-Parashant National Monument. The original 20.66-acre Adams Lode mining claim, officially located June 23, 1873, and patented October 5, 1883, remains in private hands at the heart of the site. The balance of the mine is on public land and is managed by the Bureau of Land Management in cooperation with the National Park Service.

**Historian:** Michael R. Harrison, 2011

**Project**

**Information:**

The Grand Gulch Mine was documented by the Historic American Engineering Record (HAER), part of the Heritage Documentation Programs of the National Park Service. The principals involved were Richard O'Connor, Chief of Heritage Documentation Programs and Acting Chief of HAER, and Jeff Bradybaugh, former Superintendent of Grand Canyon-Parashant National Monument. The documentation was produced in 2011 based on field work carried out in fall 2010. The project supervisor was Dana Lockett, architect; the team included Anne E. Kidd and Alexander Matsov, architects, and Michael R. Harrison, historian. The large-format terrestrial photography was completed by James Rosenthal, and the aerial photography was completed by Jet Lowe. The project wishes to thank David Van Alfen, Glendee Ane Osborne, Jennifer Mohr, and Milt Hokanson for their generous assistance.

## Part I. Historical Information

### A. Physical History

**1. Dates of construction:** The Adams Lode, the mineral vein that forms the basis for the Grand Gulch Mine, was discovered about 1871, officially located (i.e., claimed) on June 23, 1873, and patented October 5, 1883. The history of development at the site falls into three general periods:

- *ca. 1871 to ca. 1882.* A Paiute Indian discovers the Adams Lode, and Samuel L. Adams, Richard Bentley, and other men from St. George, Utah, develop the Grand Gulch Mine. The miners sink a 100' shaft, commission an adobe smelter, and create a small compound of houses and workshops during the course of intermittent mining, but ultimately cease activity because of the unsupportable expense of hauling ore 180 miles to the nearest railhead.
- *1899 to 1919.* Purchased by the Jennings family of Salt Lake City, the Grand Gulch Mining Company recommences ore extraction from the Adams Lode. The company installs power machinery, rebuilds and expands the complex of buildings, and sinks a new shaft that eventually reaches a depth of at least 500' with drifts on multiple levels. Regional railroad development reduces the difficult wagon haul from about 140 miles in 1899 to 73 miles in 1905 and finally to 45 miles in 1912, at each step decreasing the mine's freighting expenses and expanding the range of ore grades it can economically bring to market. The mine is largely tapped out by the time falling copper prices cause the mine to close after World War I.
- *1942 to ca. 1961.* Very small-scale ore shipment restarts during World War II and continues intermittently through the 1950s. The dumps are sorted, chemical processing is attempted, and some ore is shipped away from about 1955 to 1961. This activity ends with the dismantling and the removal for scrap of much of the mine's equipment.

**2. Engineer:** Surviving payroll schedules indicate the mining company employed a succession of engineers on-site over time to work with the superintendent to determine how to develop the diggings. The extent of these engineers' involvement in designing any of the structures at the mine has not been determined.

**3. Builder / Contractor:** Contractor Morris & Evans of Salt Lake City built the adobe-and-sandstone smelter whose ruins remain at the mine.<sup>1</sup> No other contractors are known for the balance of the structures on the site.

**4. Original Plans and Construction:** A sketch plan from early 1877 is the earliest evidence found of the mine's initial layout. It depicts a dry wash bordering the claim on one side. There are two shafts, one 60' deep and another 30' deep, as well as three open cuts of indeterminate size. The plan depicts a blacksmith shop and two houses set in a contiguous row with a third house standing in line a small distance away, all built of stone. The plat also shows a "stack" along the north side of the wash, this being, perhaps, the beginnings of the adobe smelter

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<sup>1</sup> "Local and other matters. Mining and smelting," *Deseret News* [Salt Lake City], Apr. 3, 1878, 1.

brought into operation on the site in 1878. (See section B, "Description," below, for a discussion of the smelter.)<sup>2</sup>

By 1881, when surveyor John Macfarlane drew a new plat of the mine, there were two open cuts visible and five shafts, four ranging in depth from 10' to 30' and a main shaft sunk to 100'. The number of buildings had not changed, but the freestanding house was now identified as a boarding house and the stack was identified as a furnace. All improvements recorded on the plat were located north of the wash.<sup>3</sup>

**5. Alterations and Additions:** The mine closed about 1882. Although William Jennings of Salt Lake City and his sons purchased a controlling interest in the mine that year, they did not take steps to reopen the site until 1898. Once work restarted, the new owners began sinking a double-compartment shaft east of the original main shaft in 1899. This work required the removal of the original boarding house, houses, and blacksmith shop, and it is possible that the stone from their walls was reused to create the new stone dining hall and office building that rose south of the wash in 1900, as well as the new stone blacksmith shop built about the same time. A new carpenter shop and engine house, both of wood, were in place by the end of 1901.

By 1919, the mine at its fullest extent comprised all the buildings in place by 1901 plus a bunkhouse (built in fall 1907), a buggy house, two barns and a hen house, ten storage buildings of various kinds, and twenty-six tents and tent houses.<sup>4</sup>

The mine was abandoned in the early 1920s, and these buildings deteriorated. In the late 1950s, the extensive low-grade ore dumps at the mine were resorted and partially processed, work that extensively altered the man-made landscape of the site. The bunkhouse is believed to have been renovated during this time, but much of the rest of the physical plant was demolished and hauled away for scrap about 1961.

## **B. Historical Context**

### **The Arizona Strip**

The Grand Gulch Mine sits near the western edge of the Arizona Strip, a remote and isolated desert region in northwestern Arizona bounded on the south and east by the Grand Canyon and on the north and west by the borders of Utah and Nevada. Although politically part of the Arizona Territory after 1863 (and the state of Arizona from 1912), the Strip is cut off from the rest of Arizona by the Grand Canyon and functioned historically as an extension of southern

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<sup>2</sup> "Rough draft of the Grand Gulch Mine," Mar. 10, 1877, addendum to Articles of Agreement, Feb. 12, 1877, in Utah State Archives and Records Service, Washington County Recorder Deeds (Silver Reef), series 23263, Book L, 265.

<sup>3</sup> John M. Macfarlane, "Plat of the Adams Lode Mining Claim . . . surveyed . . . January 15 & 17, 1881," part of Patent for the Adams Lode, issued Oct. 4, 1883, Bureau of Land Management, General Land Office Records, serial patent no. 8244 for mineral certificate 78, BLM serial no. AZAZAA 001770.

<sup>4</sup> "General Inventory for Grand Gulch Mine for Machinery, Tools, Supplies, etc.," Jan. 31, 1919, Nevada State Museum & Historical Society, Grand Gulch Mining Co. Records (MS 70) (hereafter cited as **NSM**), folder: "Misc. Financial Papers 2."

Utah. The Mormon settlers of Utah's "Dixie" and southern Nevada's Virgin River Valley provided the initiative, capital, and labor for much of the stock raising, lumbering, mining, and limited settlement that took place in the Strip beginning in the 1860s and 1870s.<sup>5</sup>

### **Arizona mining**

The mining of ore minerals was a leading economic engine in the American mountain west and desert southwest in the second half of the nineteenth century. Congress created the Arizona Territory in 1863 in part from a desire to protect the nascent mining interests of the region. While the central and southern parts of the territory proved to contain the region's richest copper deposits, most of which were discovered in the 1870s, mineral exploration occurred throughout the territory, and many claims were located in the region of the Grand Canyon during the last quarter of the nineteenth century. A number of promisingly rich mineral deposits were discovered in the Arizona Strip, but their remoteness from regional transportation networks as well as from sources of water and fuel limited their development. The Grand Gulch Mine is among the more successful of these small mines and demonstrates the limitations and challenges that faced miners in this isolated region.<sup>6</sup>

### **The Adams Lode**

The geology of the region north of the Grand Canyon is characterized by flat-bedded limestones and sandstones. At the mine, the surface, under a few inches of sandy soil, is sandstone to a depth of about 100'; this sandstone then grades into the limestone beneath. The economic minerals in the Adams Lode, the ore body at the Grand Gulch Mine, appear in an intermittent ring around a vaguely pear-shaped rock formation called a breccia pipe that is some 200–300' across and about 230' deep. At a certain point in the geologic past, a collapse created a steep-walled, pipe-like void in the prevailing Redwall Limestone of the Grand Wash Cliffs. This cavity eventually filled with breccia, i.e., rock fragments cemented together over time by accumulating sand and minerals deposited by fluidic action. Water passing down through the ring fracture between this breccia plug and the surrounding rock strata produced the irregular band of primary-ore mineral deposits that attracted miners to the site.<sup>7</sup>

Mine general manager Walter Jennings noted in 1911 that the Adams Lode ore consisted of "malachite, azurite, chalcocite, and the red and black oxides of copper, all carrying a few ounces

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<sup>5</sup> Jeffrey H. Altschul and Helen C. Fairley, *Man, Models and Management: An Overview of the Archaeology of the Arizona Strip and the Management of its Cultural Resources* (U.S. Forest Service / Bureau of Land Management report, 1989), chapter 5.

<sup>6</sup> Eldred D. Wilson, "Early Mining in Arizona," *Kiva* 11, no. 4 (May 1946): 39–47.

<sup>7</sup> James M. Hill, "The Grand Gulch Mining Region, Mohave County, Arizona," in *Contributions to Economic Geology 1913, Part I. Metals and Nonmetals except Fuels*, edited by F. L. Ransome and Hoyt S. Gale, 46–49, H. Doc. 785, 63d Cong., 2d sess. (Washington, D.C.: G.P.O., 1915); Michael E. Lane, *Mineral Investigation of the Pigeon Canyon, Snap Point, Nevershine Mesa, and Last Chance Wilderness Study Areas (BLM), Mohave County, Arizona*, U.S. Bureau of Mines Mineral Land Assessment MLA8-84, 1984, pp. 5, 7–8, copy in Grand Gulch Mine historical files, Grand Canyon-Parashant National Monument, St. George, Utah (hereafter cited as **PARA**); Karen J. Wenrich and Hoyt B. Sutphin, "Recognition of Breccia Pipes in Northern Arizona," *Arizona Bureau of Geology and Mineral Technology Fieldnotes* 18, no. 1 (spring 1988): 1–5.

of silver. . . . The ore found in these beds is usually high in grade, being in some places pure chalcocite." Another source adds cuprite and melaconite to the mineral list.<sup>8</sup>

### **Discovery and early development, 1871–1882**

The copper deposits on the site that became the Grand Gulch mine were discovered about 1871 by a member of the Shivwits band of Paiute Indians. According to a 1911 description, this man "made known his discovery to men living at St. George, a small Mormon settlement in the southern part of Utah, about eighty miles north of the discovery. The extreme high grade of the ore excited considerable attention." The men of St. George who took an interest in the deposit included prominent leaders in the community, including Richard Bentley, Samuel Crosby, James Pierce, and Erastus Snow, but blacksmith Samuel L. Adams appears to have taken the greatest initiative. Adams led a group to the site in March 1871 and reported back to St. George that the "prospects are much more flattering than at first anticipated."<sup>9</sup>

Adams and company officially located their claim, which they named the Adams Lode, on June 23, 1873, and filed a notice of location with the recorder of Washington County, Utah.<sup>10</sup> The Adams Lode claim covered 20-2/3 acres, the maximum and typical size allowed by federal law. With the registered claim, the miners could legally extract minerals from their defined tract, but to keep it, they had to spend at least \$100 a year on labor or improvements at the claim. They did this, working the claim "now and again" and producing by 1881 "a few tons of copper bullion."<sup>11</sup>

In July 1873, H. C. Kiesel, a Salt Lake City retail clerk, traveled to the Grand Canyon by way of St. George and the western Arizona Strip, camping at remote Black Rock and Pakoon springs on

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<sup>8</sup> W. P. Jennings, "Grand Gulch Copper Mine," *Mining and Scientific Press* (Feb. 18, 1911): 269; Walter Harvey Weed, *The Mines Handbook*, vol. 15 (Tuckahoe, N.Y.: Mines Handbook Co., 1922), 283.

<sup>9</sup> Jennings, "Grand Gulch Copper Mine," 269; "Home news," *Deseret Evening News*, Apr. 5, 1871, 9; "Paymaster deal," *Deseret Evening News*, Nov. 29, 1904, 6; "Purchase mine for \$500,000," *Salt Lake Herald*, Jan. 18, 1906, 1. Samuel Adams wrote in one of his many reminiscences that the lode was discovered in 1868, but this date is not supported by other evidence. Similarly, mine superintendent S. R. Callaway told U.S. Geological Survey geologist James M. Hill in 1913 that the ore deposit was discovered about 1853, but this date is either a mistake or misprint, as it predates the very settlement of St. George in 1861. Callaway also told Hill that Adams bought the prospect "from the Indians for a horse and some flour." Samuel L. Adams, "A Night of Horror," in *Samuel Lorenzo Adams 1833–1910: Stories of His Life and His Ancestry*, compiled by Eleanor McAllister Hall (privately printed, 2005), n.p., copy in PARA; Hill, "Grand Gulch Mining Region," 42–43.

<sup>10</sup> The mine is located within the Bentley Mining District, which, to all appearances, was created in order to locate the Adams Lode. The district has no specific boundaries but was an administrative convenience established to comply with customary western mining-claim practice and the Mining Act of May 10, 1872 (17 Stat. 91). The first Adams Lode notice of location, filed June 23, 1873, was flawed or incomplete in some way, so the claimants signed a second notice on January 1, 1876, which is reproduced in the Patent for the Adams Lode (see footnote 3). The 1876 notice of location can also be found in Washington County, Utah, Bentley Mining District Book A, 35; Washington County Book J, 151–52; and Mining Records of Mohave County, Arizona, Book B, 572–73.

<sup>11</sup> Quotes from John M. Macfarlane's field notes from his survey of the Adams Lode Mining Claim, January 1881, part of Patent for the Adams Lode (see footnote 3).

the way. Kiesel's party included Samuel Adams, Richard Bentley, and Williard Snow, one of the sons of Erastus Snow. These men departed from the main group at Pakoon to visit the Adams Lode. "Professor Thompson went over with them and saw the mine," Kiesel reported. "His opinion is that it seems to be a pocket of mineral in sand stone, and probably would peter out as soon as they go down on it twenty-five or thirty feet. They have worked on it some, just enough to hold it."<sup>12</sup>

By September 1873, the miners had succeeded in clearing a wagon road from St. George to the mine. By June 1874, they had sunk a shaft, and in August Richard Bentley brought a load of three tons of ore to Salt Lake City to be assayed and sold, the earliest record yet found of ore being brought to market from the mine. With this achievement, Adams, Bentley, and their associates incorporated the Grand Gulch Mining Company at St. George on September 15, 1874.<sup>13</sup>

Fourteen men incorporated the company, all but two of them being the same men who signed the notice of location in 1873. These fourteen men were:

Richard Bentley	Erastus Snow
Benjamin H. Paddock	Frank Lougheny [or Loughny]
A. R. Whitehead	Joseph Birch
William H. Branch	Samuel O. Crosby
Samuel Cunningham	Walter E. Dodge
James Pierce [or Pearce]	Jesse W. Crosby*
Samuel L. Adams	Jacob Gates* <sup>14</sup>

\* Not a signer of the notice of location

The ore available at the mine was unusually rich in economic minerals. Some samples assayed between 45 and 50 percent copper and contained about 16 ounces of silver to the ton; others averaged 30 percent copper with a little silver.<sup>15</sup> "To-day we were shown a piece of fine copper," the Salt Lake City *Deseret News* reported in fall 1875, "weighting twenty-eight ounces, made from fifty-four ounces of ore, from the celebrated Adams Lode, near St. George, being the result of the last trial made by Mr. S. L. Adams. The specimen, which is on exhibition at the Museum, was brought from the South [i.e., from St. George to Salt Lake City] by A. M. Musser, Esq." Not long afterward, "a large lump of copper, impregnated with si[l]ver, weighing forty pounds, smelted from ore taken from the Grand Gulch mine" was presented to LDS church

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<sup>12</sup> H. C. Kiesel, "Exploring expedition," *Salt Lake Daily Tribune*, July 30, 1873, 2.

<sup>13</sup> "Territorial dispatches," *Deseret News*, Sept. 10, 1873, 9; Letter to editor dated June 7, 1874, *Deseret News*, June 17, 1874, 1; "From the south," *Deseret News*, Sept. 2, 1874, 1; Walter Harvey Weed, *The Mines Handbook*, vol. 12 (New York: Stevens Copper Handbook Co., 1916), 541.

<sup>14</sup> Indenture transferring assets to the newly incorporated Grand Gulch Mining Co., Sept. 16, 1874, in Utah State Archives and Records Service, Washington County Recorder Deeds (Silver Reef), series 23263, Book J, 262-65.

<sup>15</sup> "From the south," *Deseret News*, Sept. 2, 1874, 1; Macfarlane, field notes.



president Brigham Young, along with a miniature corkscrew, gimlet, and spur made of copper from the mine.<sup>16</sup>

Despite the promising ore, the company had difficulty making a profit because the remoteness of the mine led to high hauling costs, both to bring supplies in and to ship ore out. In December 1875, the company completed a smelting furnace near St. George in order to reduce its own ore to bullion and thereby save on the expense of shipping valueless gangue minerals. Even as the smelter was being tested, the company announced its hope to erect another one closer to the mine. Although the smelter outside St. George appears to have worked, it was apparently inadequate for the company's needs. In May 1876, the company shipped eighteen tons of unprocessed ore to Salt Lake City at the same time as it shipped just five tons of smelted copper bullion. The company brought an additional 21 tons to St. George that it simply sold to the local co-operative merchants Edwin G. Woolley, Robert C. Lund, and Thomas Judd, who shipped it at their own expense to Salt Lake City by Wells Fargo & Company. The mine then ceased operations for a time.<sup>17</sup>

In February 1877, the company leased a portion of the mining claim to George Henry and Christian Heinecke, who agreed to produce at least 100 tons of ore per month starting by May 15. They could get out of the agreement on thirty-days notice, and it is unclear if they did any mining toward this ambitious goal.<sup>18</sup> A year after this agreement, a St. George correspondent to the *Deseret News* ended his report, "I had nearly forgotten the Grand Gulch! They have made another start, and we hope it will not be long before we have copper roofs. We certainly wish them success for they certainly 'Try, try again,' and as there is no end to the supply of ore, perseverance will be sure to bring success." This time, the company did not return to its St.

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<sup>16</sup> "Local and other matters," *Deseret News*, Oct. 27, 1875, 6; "Metallic," *Deseret News*, Jan. 19, 1876, 8. Similarly, the *Deseret Evening News* commented in 1900, "The richest samples of copper ore in the State fair are from [the Grand Gulch Mine]. Assays from them show as high as 74.1 per cent copper." "Two strikes in the Grand Gulch," *Deseret Evening News*, Oct. 5, 1900, 6.

<sup>17</sup> "Local and other matters. From Dixie," *Deseret News*, May 5, 1875, 13; "Southern Utah. Copper," *Salt Lake Daily Tribune*, Dec. 19, 1875, 4; "Bonanza city," *Salt Lake Daily Tribune*, Feb. 13, 1876, 4; "Local and other matters. From south," *Deseret News*, May 10, 1876, 8.

A note in the Washington County Recorder Deeds Book L, p. 240, implies the mine was worked under lease around this time.

"To the Grand Gulch Mining Company

"This certifies that Fisher and Richards worked Ninety one (91) days from the 1st of January to date on the Grand Gulch Mine in the Adams Lode, Bentley District Arizona for which the Pioneer Mining and Smelting Company paid them \$424.00 said work to apply on the annual requirement of the Law as per Article of Agreement entered into by said Pioneer Mining and Smelting Co. per John Blackburn Agent with your Company.

"Respectfully

"Seth A. Pymm

"Secy. P. M and S. Co.

"St. George, March 1st, 1876"

The original agreement referred to has not been found.

<sup>18</sup> Articles of Agreement, Feb. 12, 1877, in Utah State Archives and Records Service, Washington County Recorder Deeds (Silver Reef), series 23263, Book L, 259-65.

George smelter but hired Morris & Evans of Salt Lake City, specialist smelter builders, to erect a reverberatory furnace at the mine itself. The contractors shipped some of the material they needed from Salt Lake City, and the smelter was running by the end of May 1878. The company hoped to build additional furnaces “presently,” and Richard Bentley optimistically partnered with Woolley, Lund, and Judd to open a store at the mine. Nevertheless, work ceased again within just a couple months.<sup>19</sup>

Although no further mining seems to have been done at Grand Gulch until 1881, the company sought a patent on its claim. According to federal law, once owners invested \$500 in labor or improvements in a claim, they could apply for a patent, which granted them ownership of the land, not just the right to find and recover minerals. The patent application required submission of a plat and field notes compiled by a government surveyor, and the Grand Gulch Mining Company arranged for this survey in the fall of 1880. It was carried out in mid January 1881 by U.S. Deputy Surveyor John M. Macfarlane, assisted by chain carriers Charles W. Dodge and William Adams, sons of shareholders Walter Dodge and Samuel Adams. Flagman Jesse W. Crosby was probably a relative of shareholder Samuel Crosby; no connections are evident for axeman Hyrum S. Liston. Macfarlane’s plat and notes preserve a record of the physical extent of the mine at the time. There was a main shaft 100' deep, two shafts 30' deep, a shaft 10' deep, and one more 12' deep, all within a few hundred feet of each other. There were several small prospecting holes scattered about, and, about 30' from the main shaft, a small open cut about 5' deep measuring 20' long by 14' wide. A second, longer open cut lay a couple hundred feet away, measuring about 150' long by 4' wide by 3' deep. Alongside these workings, the site contained a boarding house, a row of several small stone houses, a blacksmith shop, and the already mentioned adobe furnace. Together they made up the \$500 worth of improvements the company needed for its patent application.<sup>20</sup>

The government issued a patent to the Grand Gulch Mining Company for the Adams Lode on October 5, 1883. Although Adams and his associates located eight additional claims covering the land surrounding the original Adams Lode claim, only the latter, as the site of the bulk of the improvements, was ever patented.<sup>21</sup>

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<sup>19</sup> Amram, letter to the editors dated Mar. 25, 1878, *Deseret News*, Apr. 10, 1878, 14; “Local and other matters. Mining and smelting,” *Deseret News*, Apr. 3, 1878, 1; “Local and other matters. Grand Gulch,” *Deseret News*, May 22, 1878, 9; Amram, letter to the editors dated May 30, 1878, *Deseret News*, June 5, 1878, 11; Amram, letter to the editors dated June 16, 1878, *Deseret News*, July 3, 1878, 7; Amram, letter to the editors dated July 13, 1878, *Deseret News*, July 24, 1878, 16; D. B. Huntley, “The Mining Industries of Utah,” in Department of the Interior, Census Office, *Statistics and Technology of the Precious Metals* by S. F. Emmons and G. F. Becker (Washington: G.P.O., 1885), 483.

Orson F. Whitney’s *History of Utah* notes the failure of the Woolley, Lund, and Judd store at the mine; nevertheless, “the firm retrieved its losses by establishing a flourishing mercantile business at St. George” for which they became well known; Orson F. Whitney, *History of Utah* (Salt Lake City: George Q. Cannon & Sons, Co., 1904), 4:554.

<sup>20</sup> Macfarlane, field notes.

<sup>21</sup> Patent for the Adams Lode (see footnote 3); Hill, “Grand Gulch Mining Region,” 43. It is possible Hill was mistaken in crediting the eight additional claims to Adams, as another source credits them to the work of Thomas Jennings between 1899 and 1902: “Pulls out of Grand Gulch,” *Salt Lake Herald*, Feb. 8, 1902, 6.

In 1881, while the patent application was progressing, Samuel Adams leased the mine from his fellow shareholders and partnered with James Wills to resume work. They brought in a blower and an engine, put the smelter back in operation, and successfully began shipping bullion to St. George in August. The first shipment reportedly comprised “1766 pounds of beautifully clear, fine grained, copper bars,” and Adams told another reporter that the smelter was producing 5,000 pounds of 92-percent copper bullion every ten hours.<sup>22</sup>

To market the bullion, Adams and Wills hired freighters to haul the metal 80 miles to St. George and then an additional 100 miles to Milford, Utah, the closest railroad stop. From there, the bullion traveled by the Utah Central Railroad to Salt Lake City, where one load was sold for about 14.5 cents a pound to the local agent of Pope, Cole & Company, a Baltimore copper refiner.<sup>23</sup>

The *St. George Union* reported in June 1882, “The Grand Gulch Smelter is still running, occasionally, turning out fine buttons of pure copper, – the largest button cast weighing 633 lbs,” but after this note nothing more is known of work at the mine until 1899, and it is presumed the company ceased operations again. In fact, the property was seized by Mojave County for nonpayment of taxes in 1886 – it was redeemed by the owners, to all appearances – as well as listed on the county’s delinquent tax roll in 1891. H. W. B. Kantner’s 1896 *Handbook on Utah mining* noted the mine’s long inactivity. “It is an immense copper proposition, but the haul by wagon is too great for successful and profitable working. . . . A shaft 100 feet deep showed copper all the way that ran 45 per cent, and carried 25 ounces in silver. There is plenty of this kind and grade of ore all through this district that would pay to haul fifty miles to market, but not several hundred as is now necessary.”<sup>24</sup>

### **Later development, 1899–1919**

The Jennings family of Salt Lake City, led by merchant William and assisted by many of his sons, bought control of the Grand Gulch Mining Company in 1882. Walter E. Dodge later claimed the purchase price was \$30,000, but this figure has not been confirmed in other sources. On March 14, 1896, the company was reincorporated in Salt Lake City with \$50,000 in capital stock and 50,000 shares. Two years later, it moved its office operations from St. George to Salt

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<sup>22</sup> Quote from “St. George items,” *Provo Territorial Enquirer*, Aug. 3, 1881, 3; “Local and other matters. The copper prospect,” *Deseret News*, May 4, 1881, 1; “Local and other matters. The Grand Gulch,” *Deseret News*, July 20, 1881, 1; “Copper,” *Ogden Daily Herald*, Sept. 22, 1881, 2; Henry Eyring, *The Journal of Henry Eyring, 1835-1902*, entries for Mar. 1881, <http://www.bunker.org/henryeyring.html>, accessed May 19, 2011.

<sup>23</sup> “Copper,” *Ogden Daily Herald*, Sept. 22, 1881, 2.

<sup>24</sup> “Local and general,” *St. George Union*, June 1882, 3; “Supervisor’s sale,” *Mohave County Miner*, Dec. 12, 1886, 2; “Delinquent tax-roll of Mohave County, Territory of Arizona, for the year 1890,” *Mohave County Miner*, Jan. 31, 1891, 2; H. W. B. Kantner, *A Handbook on the Mines, Miners, and Minerals of Utah* (Salt Lake City: R. W. Sloan, n.d. [ca. 1896]), 258.

Lake. In 1898, with a bond underwritten by Mrs. M. V. Mitchell of Salt Lake, the company began to reopen the mine.<sup>25</sup>

The first new shipments of ore left the desert in fall 1899. The nearest railroad shipment point was now Modena, Utah, 65 miles north of St. George and 130 miles from the mine. In 1899, wagon haulage to Modena cost the company \$25 a ton. To send that same ton the remaining 260 miles from Modena to Salt Lake City by rail cost only an additional \$6. One early shipment of ore assaying between 58 and 68.8 percent copper brought a price in Salt Lake of \$76 a ton, an amount high enough to justify the costly freight rates. The mining company was able to pay its first dividend, \$2,300, in January 1900 on \$12,000 realized from the sale of 140 tons of ore. (For a list of shareholders in 1900, see Appendix III.)<sup>26</sup>

The reorganized company's first president and general manager was eldest brother Thomas W. Jennings, who was also, by 1898, its leading shareholder. He quit his leadership role in a bit of family maneuvering at the 1902 annual meeting, and was replaced as president by James E. Jennings. Before long, however, Walter P. Jennings came to fill the combined roles of secretary, treasurer, and manager, a position he maintained for almost twenty years.<sup>27</sup>

The company's first superintendent was Isaac "Ike" Jennings, who oversaw the mine's daily operations on site. In May 1901, he was replaced by James A. Larson, who was "well and favorably known in Salt Lake City as a reliable and capable mining man" and had formerly had charge of the Independence Mine in Colorado. He, too, was soon replaced, in April 1902, by an engineer identified in the *Salt Lake Mining Review* as "J. P. Rohlfing." This was possibly Diedrich P. Rohlfing, a German-born mining engineer who lived in Salt Lake City for many years. Ike Jennings returned as superintendent in 1904, but James Earles filled the role in May 1906. This revolving door of on-site management ended with the appointment of Samuel R. Callaway (1863-1939) as superintendent in July 1906, a position he held at least until 1919. Callaway had previously been employed at the Annie Laurie Mine at Kimberly, Utah.<sup>28</sup>

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<sup>25</sup> "Grand Gulch copper," *Salt Lake Daily Tribune*, Aug. 5, 1882, 4; "Dixie and its wealth," *Salt Lake Tribune*, July 5, 1896, 5; Kantner, *Handbook on the Mines . . . of Utah*, 27; "Coal mine," *Ogden Standard*, Jan. 14, 1898, 4; "Good from Grand Gulch," *Salt Lake Tribune*, Jan. 7, 1899, 6.

<sup>26</sup> "Rich copper strike," *Salt Lake Tribune*, Nov. 26, 1899, 15; "Grand Gulch shipment," *Deseret Evening News*, Dec. 2, 1899, 8; "News of Grand Gulch," *Deseret Evening News*, Dec. 27, 1899, 6; "Here and there," *Salt Lake Mining Review*, Jan. 30, 1900, 10.

<sup>27</sup> "Mining brevities," *Salt Lake Mining Review*, Aug. 30, 1899, 12; "Pulls out of Grand Gulch," *Salt Lake Herald*, Feb. 8, 1902, 6; "Mining notes," *Salt Lake Herald*, Feb. 9, 1902, 6.

<sup>28</sup> An October 1901 reference to a "Superintendent Anderson" at the mine ("Grand Gulch strikes," *Salt Lake Herald*, Oct. 13, 1901, 6) is a mistake, as two pieces of mine ephemera preserved in PARA show Superintendent Larson still at the mine in December 1901 and January 1902 ("John A. Larson to Grand Gulch Mining Co.," expense report for Dec. [1901]; Grand Gulch Mining Co. to John A. Larson, expense report, Jan 1, 1902, both in PARA). "Rich copper strike," *Salt Lake Tribune*, Nov. 26, 1899, 15; "Grand Gulch Mine booms," *Deseret Evening News*, Dec. 21, 1899, 6; "Returns from Grand Gulch," *Deseret Evening News*, May 30, 1901, 6; "With engineers and millmen," *Salt Lake Mining Review*, Apr. 15, 1902, 11; "In and around Marysville," *Salt Lake Mining Review*, Nov. 30, 1904, 6; "New discovery in Grand Gulch," *Salt Lake City Inter-Mountain Republican*, May 25, 1906, 6; "Mining notes and personals," *Richfield Reaper*, July 19,

During the first year of renewed operation, while ore extraction continued from the old main shaft, workers began sinking a new double compartment main shaft further to the east. To serve the new drifts from this shaft, a consignment of T-rails and ore cars went to the mine in 1900 and a Buffalo whim was installed to haul ore and spoil to the surface, only to be replaced by a Fairbanks-Morse gasoline hoist the next year. A combined dining hall and office building was built in 1900, and new carpenter, blacksmith, and machine shops were in place by the beginning of 1902. The owners even discussed building a new smelter at a nearby spring, although nothing came of this, and they did not reuse the existing smelter. To pay for some of these improvements, the company paid no dividends in 1901 and 1902.<sup>29</sup>

By the end of 1901, the company had sent over \$70,000 worth of ore to market in its first two years of operation. Shipments continued during 1902, with two assaying strongly at 48.5 and 49.5 percent copper per ton. Yet, even at this richness, the cost of the long overland haul to Modena was too high for sustained operations, and the company suspended work during 1903, paying no dividends that year.<sup>30</sup> Construction on the San Pedro, Los Angeles, and Salt Lake Railroad, however, promised to create a railroad stop at Moapa, Nevada, 70 miles by road from the mine, and the company resumed mining in late 1904, aided by an assessment of 4 cents per share levied upon the shareholders. It began hauling ore west to Moapa, via St. Thomas, Nevada, in March 1905, as soon as the new rail line was ready to receive freight.<sup>31</sup>

The opening of the rail line to Moapa allowed economical shipment of ore averaging as low as 35 percent copper. Despite this advantage, the company's financial difficulties appear to have continued. In January 1906, the stockholders granted an option to W. J. Guthrie of Butte, Montana, in association with two substantial investors in Utah mining properties, Samuel Newhouse of Salt Lake and the investment bankers Schirmer, Chapin & Emmons of Boston, to buy the mine for \$500,000. Respected mining engineer Auguste Mathez inspected the mine in February for the prospective buyers. While the contents of Mathez's report are unknown, they seem to have convinced Guthrie, Newhouse, and Schirmer not to exercise their purchase option. In May 1906, however, William H. McIntyre, a prominent Salt Lake rancher, mine developer, and real-estate holder, took a controlling interest in the company by purchasing James

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1906, 8; "S. R. Calloway leaves Annie Laurie to go with Grand Gulch," *Salt Lake Herald*, July 23, 1906, 6; "Personal mention," *Salt Lake Mining Review*, July 30, 1906, 15.

<sup>29</sup> "News of Grand Gulch," *Deseret Evening News*, Dec. 27, 1899, 6; "Southern copper mines," *Deseret Evening News*, Feb. 14, 1900, 6; "Back from Grand Gulch," *Salt Lake Herald*, Mar. 14, 1900, 6; "Mining notes," *Salt Lake Herald*, Aug. 24, 1900, 6; "Grand Gulch election," *Salt Lake Telegram*, Feb. 5, 1902, 3; "Pulls out of Grand Gulch," *Salt Lake Herald*, Feb. 8, 1902, 6.

<sup>30</sup> "Grand Gulch strikes," *Salt Lake Herald*, Oct. 13, 1901, 6; *Salt Lake Mining Review*, Feb. 28, 1902, 12; *Salt Lake Mining Review*, Nov. 15, 1902, 21; "Utah dividend payers," *Salt Lake Mining Review*, Dec. 30, 1903, 17; "In and around Marysvale," *Salt Lake Mining Review*, Nov. 30, 1904, 6.

<sup>31</sup> "Notice of sale," *Deseret Evening News*, Feb. 11, 1904, 9; "Grand Gulch copper," *Deseret Evening News*, Apr. 6, 1904, 6; "Mines in the south," *Salt Lake Herald*, Nov. 28, 1904, 6; "Mining below St. George," *Salt Lake Herald*, Dec. 5, 1904, 6; "New road to Moapa," *Salt Lake Herald*, Mar. 31, 1905, 7.

Jennings's shares and installed James Earles, former superintendent at the McIntyre family's Mammoth Mine in Utah's Tintic Mining District, as superintendent at Grand Gulch.<sup>32</sup>

From this point, the mine appears to have remained in continuous operation until about 1919. At the start of 1911, the mine's main double compartment shaft had been sunk to a depth of 460', and in July a station was begun at the 500' level. "A considerable tonnage of 18% ore is being stored for shipment when the market or transportation conditions are a little more favorable," general manager Walter Jennings wrote in 1911, "while a product of 6 to 8% is piling up in huge dumps all around the property."<sup>33</sup> A spur railroad line from Moapa to St. Thomas, first proposed in 1907, opened in 1912, and this reduced the wagon-haul distance to 45 miles. Once again, overall shipping costs went down, and the mine began sending ore averaging 15 to 20 percent copper to market. During 1912, according to one report, the mine increased its shipping tonnage to about 150 tons per month and in the course of the year shipped about 100 percent more ore to market than the year before, for an increase in receipts from ore sales of about 100 percent. Six carloads of ore sold for an average of \$40 a ton in August 1912.<sup>34</sup>

World War I increased the national demand for copper and other minerals. Total U.S. primary copper production increased 39 percent in 1916 over the year before, while the price of the mineral increased 55.4 percent. The Grand Gulch Mine increased its workforce and its production during the war and realized a temporary increase in earnings as a result. One 65-ton shipment of ore in November 1916 sold for an average of \$184 a ton. In the second half of 1917, the company employed at least sixty people on-site and shipped about 200 tons per month. Freighter Harry Howell later recalled, "Along in 1916, 1917, and 1918 the Grand Gulch Trail was the scene of much activity. Some times there were as many as thirty or forty different outfits on the road at a time. These were mostly six, eight, ten, and twelve horse outfits and the overage load was figured about a ton to a horse."<sup>35</sup>

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<sup>32</sup> "Purchase mine for \$500,000," *Salt Lake Herald*, Jan. 18, 1906, 1; "An option given," *Ogden Standard*, Jan. 19, 1906, 8; *Salt Lake Mining Review*, Jan. 30, 1906, 2; "Men of wealth in Grand Gulch," *Salt Lake City Inter-Mountain Republican*, Feb. 12, 1906, 8; "Grand Gulch deal," *Salt Lake City Inter-Mountain Republican*, Feb. 14, 1906, 6; "New discovery in Grand Gulch," *Salt Lake City Inter-Mountain Republican*, May 25, 1906, 6; "Utah capitalist dies," *Salt Lake Telegram*, Aug. 20, 1926, 1; "Death of William McIntyre," *Salt Lake Mining Review*, Aug. 30, 1926, 21.

<sup>33</sup> Jennings, "Grand Gulch Copper Mine," 269. The notation "Started to cut 500 station[,] July 9/11" appears in the Grand Gulch Mine Time Book, 1909-11, n.p., Washington County Library, St. George, Utah.

<sup>34</sup> "Extension planned to Grand Gulch mines," *Salt Lake City Inter-Mountain Republican*, Apr. 24, 1907, 7; "New road reduces haul to 45 miles," *Mohave County Miner*, Aug. 17, 1912, 1; "Mohave County Production," *Mohave County Miner*, Jan. 11, 1913, 3.

<sup>35</sup> Production increase calculated from U.S. Geological Survey copper statistics data in Thomas D. Kelly and Grecia R. Matos, *Historical Statistics for Mineral and Material Commodities in the United States*, U.S. Geological Survey Data Series 140, 2010 edition, <http://pubs.usgs.gov/ds/2005/140/>, accessed May 2, 2011; price increase calculated from data in Walter Harvey Weed, *The Mines Handbook*, vol. 15 (1922), 33. "\$190 ore is shipped by Grand Gulch Mine, bringing \$12,000," *Salt Lake Herald*, Nov. 12, 1916, 38; "Grand Gulch camp being cleaned up," *Washington County News*, Aug. 9, 1917, 1; *Salt Lake Mining Review*, Oct. 15, 1917, 27. Howell quote from Mike Belshaw and Ed Peplow, Jr., *Historic Resources Study, Lake Mead National Recreation Area, Nevada* (National Park Service report, Aug. 1980), 131.

At the same time, however, the quality of the ore was in decline, with the company generally shipping 13 to 15 percent ore. Because the mine's engineers believed the Adams Lode had been formed by upward geological forces and that additional high-grade ore could be found if the mine were only sunk deep enough, the company decided in mid 1918 to invest in new drills and an air compressor better suited to deep work. "[I]t is the intention of the company to do a large amount of exploratory work," the *Mohave County Miner* reported. "The shaft on the property is down 600 feet and while no large bodies of ore have been found below the 400 level it is probable that sooner or later a greater body of ore will be opened." Geologists now believe the mineralization at Grand Gulch formed through fluidic action from above; in hindsight, deeper workings at the mine were unlikely to discover additional minerals.<sup>36</sup>

Pat Bundy, who hauled freight for the mine during the war, told geologist George Billingsley in 1974 that "a mine shaft operator, Bert Snow, accidentally set fire to the mine shaft" in 1917 or 1918. Billingsley writes that "The fire spread to the underground timbers, finally burning out the mine." Geologist Ed Huskinson, Jr., during a 1997 survey, found an approximately 100' stretch of tunnel in the mine's 100' level blackened with soot; other than this, no further evidence for this fire has been found, and its size and severity remain unconfirmed.<sup>37</sup>

With the mine tapping out and cash reserves decreased by the investment in new equipment, the company was hurt by the 1919 post-war fall in copper prices.<sup>38</sup> After shipping 3,159 tons of ore in 1916, 2,417 tons in 1917, and 931 tons in 1918, the mine shipped only 184 in 1919, very likely all of it in one last three-railcar shipment reported by the *Salt Lake Mining Review*. In the same notice, the paper recorded that the mine closed down for the winter on October 1, 1919, with "only a watchman being left in charge."<sup>39</sup>

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<sup>36</sup> *Salt Lake Mining Review*, Sept. 15, 1918, 25; "Grand Gulch Shipping carload ore monthly," *Mohave County Miner and Our Mineral Wealth*, Sept. 21, 1918, 2; "Dips, spurs and angles," *Salt Lake Mining Review*, Sept. 30, 1918, 41; Wenrich and Sutphin, "Recognition of Breccia Pipes in Northern Arizona."

<sup>37</sup> George H. Billingsley, Earle E. Spamer, and Dove Menkes, *Quest for the Pillar of Gold: the Mines and Miners of the Grand Canyon* (Grand Canyon, Ariz.: Grand Canyon Association, 1997), 25; "Grand Gulch Mine, 100 ft level," map accompanying letter from Ed Huskinson, Jr., to Bernard LeFebre, July 2, 1997, in Arizona Department of Mines and Mineral Resources, Grand Gulch Mine file (hereafter cited as **DMMR**).

<sup>38</sup> Walter Harvey Weed, *Mines Handbook*, vol. 14 (New York: W. H. Weed, 1920), 39, 165.

<sup>39</sup> *Salt Lake Mining Review*, Oct. 15, 1919, 43. Annual ore totals from Paul Luff to A. J. Martin, Mar. 31, 1952, **DMMR** (see Appendix I). The *Mining Review* article gives a different ore total for 1918, 1,020 tons.

The watchman noted by the *Mining Review* was Robert C. Lund, Sr., a son of the prominent St. George merchant of the same name. The *Washington County News* noted some of his comings and goings over the next few years. February 1921: "Mr. and Mrs. R. C. Lund came in from the Grand Gulch mine Saturday. Mrs. Lund will remain here [in St. George] and Mr. Lund will return to the mine soon." March 1921: "R. C. Lund and Joseph Lund [possibly Robert's brother] spent the week end here on business from the Grand Gulch mine, and to visit relatives." November 1923: "R C Lund Sr came in Monday from the Grand Gulch mine of which he is superintendent." "General and local news," *Washington County News*, Feb. 10, 1921, 8; "General and local news," *Washington County News*, Mar. 10, 1921, 8; "General and local news," *Washington County News*, Nov. 8, 1923, 8.

Although the 1922 edition of the *Mines Handbook* listed the Grand Gulch property as “temporarily closed down,” evidence suggests a small amount of activity continued. In December 1922, freighter John L. Connelly died in the desert about 16 miles from the mine after falling and hitting his head on a rock while trying to catch two runaway horses. He was hauling a load of cedar posts from Grand Gulch to St. Thomas at the time. Whatever activity these cedar posts were related to, it does not seem to have been mining, and no additional ore was shipped from the mine until 1942. Surveyor H. M. Muscott observed in 1940 that the Adams Lode had been abandoned for years. “The old road which originally served this mine is in bad condition, being only a poor pack trail at this date.”<sup>40</sup> Photographer William Belknap visited the mine in 1947, and his surviving photographs reveal a neglected site, with wood roofs deteriorating in the desert sun and the office and dining room building turned into a ruin, possibly from fire damage at an unknown date.<sup>41</sup> Three dozen tons of ore were shipped in 1942, and additional small amounts followed in 1943, 1946, 1948–49, and 1951, probably all removed by leasers, as the company remained in existence but in the hands of a receiver until at least 1952.<sup>42</sup>

LaDell Jessup reported in a 1974 interview that “The old Grand Gulch Mine dump was reworked from 1955 to 1961, Sam Mosher, a Signal Oil and Gas Company millionaire, financing the operations.” Ownership of the mine at this time is unclear. A substantial crew of almost thirty men and women worked under the supervision of Winfield “Bill” Covey. They set up a sorting belt, ten vacuum cells, and other equipment to grade the spoil from the ore dump, and “drilled and tested around in search of other orebodies.” Some of the ore was reportedly taken to Hurricane, Utah, for processing. This group likely also cut the airstrip that now lies southwest of the mine. Because they were also working at the Copper Mountain Mine about 50 miles by road to the east, Fenn Jessup and Merlin Peterson built an airstrip at Copper Mountain and flew most of the mine-cart rails from Grand Gulch to Copper Mountain. They carried three at a time slung underneath a Piper Super Cub airplane, making three or four trips a day until all the rails were moved.<sup>43</sup>

When the dump operations were completed, Ray Golenor was hired to oversee the dismantling of the mine’s remaining equipment for scrap. LaDell Jessup undertook hauling it to auction in Henderson, Nevada, over a six-month span. After this, the Grand Gulch and Copper Mountain mines were put up for sale. The chain of ownership of the Adams Lode patent after this point has not been reconstructed, but in 2000 the land surrounding the patent claim was removed

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<sup>40</sup> Weed, *The Mines Handbook*, vol. 15 (1922), 283; “J. L. Connelly loses life at Grand Gulch,” *Washington County News*, Jan. 19, 1922, 1. Surveyor Muscott’s field notes on T34N R14W are from the Bureau of Land Management’s General Land Office records, Book 4291, p. 73, but are quoted here from a summary document in PARA.

<sup>41</sup> Belknap Photographic Services, Boulder City, Nev., seven views of Grand Gulch Mine taken Feb. 1947; William Tweed, memo to Lake Mead NRA chief of interpretation, Apr. 23, 1976, copies in PARA.

<sup>42</sup> Paul Luff to A. J. Martin, Mar. 31, 1952, DMMR.

<sup>43</sup> Nellie I. Cox, *A Harsh Land and Proud: Saga of the Arizona Strip* (Las Vegas: Cox Printing Co., 1982), 314–15; Roman Malach, *The Arizona Strip in Mohave County* ([Kingman, Ariz.: Arizona Bicentennial Commission], 1975), 33.



from public entry by the creation of Grand Canyon-Parashant National Monument, effectively preventing any substantial future mineral extraction work at the site.<sup>44</sup>

### **Economic Impact**

The Grand Gulch Mine was a small operation. In 1916, the mine's most productive year, Utah smelters produced 11.58 percent of all U.S. copper, and the Grand Gulch contributed 0.38 percent to this total. Although the mine's copper was probably counted with Utah's numbers, its significance diminishes even more when compared to Arizona's figures. Arizona produced 35.67 percent of American copper in 1916, but the Grand Gulch Mine's output amounted to just 0.12 percent of this total.<sup>45</sup>

Despite its relatively small production, the mine was a magnet in a desolate region. For most of the mine's active years there were no other population centers in the western Arizona Strip, aside from the Mount Turnbull area about 40 miles away, and the mine served as a Mohave County polling place as well as a registration point for the draft during World War I.<sup>46</sup> It provided jobs for men and women from southern Utah and southeastern Nevada, and formed a small but relatively steady market for area ranchers and farmers in Nevada's Virgin River and Muddy valleys.

## **Part II. Structural / Design / Equipment Information**

### **A. General Statement**

**1. Character:** Life and settlement in the Arizona Strip have always been tied to the availability of water, yet there is no water at the Grand Gulch Mine. Neither are there any trees for lumber or fuel, nor many animals for food. There is just copper ore. Or, rather, there was copper ore, discovered in the 1870s and felt to be rich enough to justify the enormous effort of hauling water, food, construction materials, and machinery across the desert, as well as the equally great effort needed to take the ore to market hundreds of miles away. While the ore lasted, the mine was shaped by the transportation challenges of its remote and inhospitable location, which lessened only incrementally as railroad connections got progressively closer over time. The great distances separating the mine from the sources of its workers, materials, and markets is obvious at the site, not only in the sparse vastness of the surrounding rolling plain, but also in the weathered scrap lumber, machinery fragments, and empty packaging from a century ago that could not have been manufactured anywhere nearby. The surviving sandstone mine buildings and the great dumps of rocky spoil that dominate the mine are literally cut from the natural landscape that surrounds them.

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<sup>44</sup> Cox, *A Harsh Land and Proud*, 316; "Mining claims for sale," *Pay Dirt*, Aug. 18, 1961, copy in DMMR.

<sup>45</sup> See Appendix I for the mine's annual production figures. It shipped 3,159 tons of ore in 1916, yielding 853,705 lb of copper. Arizona copper production that year was 693 million pounds, Utah production was 225 million pounds, and total U.S. production was 1,943 million pounds, based on smelter production figures compiled by the *Engineering and Mining Journal* and quoted in Weed, *Mines Handbook*, vol. 15 (1922), 39.

<sup>46</sup> "Thirteen million men to be registered Thursday Sept. 12," *Mohave County Miner and Our Mineral Wealth*, Sept. 7, 1918, 1.

**2. Condition of Fabric:** The Grand Gulch Mine is essentially a ruin. Abandoned in the early 1920s, its tunnels, buildings, structures, and machines were not maintained for decades and deteriorated in the harsh desert climate. The remains were largely destroyed during the final phase of work at the site in the early 1960s, which not only disturbed and redistributed the landscape of tailings created during the mine's heyday, but swept away many historic structures and machines. The resulting jumble is now difficult to correlate to the documentary and photographic evidence of the mine that was, although enough remains to give a general feeling of the aesthetic of the mine's original buildings as well as a sense of how big the overall operation was.

## **B. Site Layout**

The Grand Gulch Mine is approached by road from the northeast. As the road descends into the site, it meets and crosses a shallow wash that deepens and develops into the beginnings of a rocky canyon, effectively dividing the site into two hills. Extensive piles of tailings dominate the southern and southeastern edges of the northern hill, creating a confused and rolling terrain that obscures the natural topography of the area. An adobe smelter chimney sits at the base of the piles, while a wood shed, a ruined stone blacksmith shop, and other fragments from the mine's physical plant dot the piles' northern boundary. The hilltop north of the tailings is bounded by a sort of ring road that connects to the main road at either end and defines the extent of the tent camp that once sat on this side of the mine. To the west, an extensive area between the ring road and where the hill drops off into the canyon below is littered with processing-equipment pieces and dotted by flat areas of stained earth that are evidence of post-World War II chemical ore processing.

A second low hill rises on the south side of the wash, which the main road runs to and around, passing as it goes the stone ruins of the mine's office and dining rooms, two stone food cellars, piles of scrap machinery, and, further along, a stone bunkhouse. On the rise above these buildings sit a deteriorating wood outhouse and the frame for a now-missing water tank. The road proceeds around the hill to the south, then forks, its southwestern branch leading to the mine's powder house and its southeastern branch leading to the intersection of two landing strips cut in the 1950s.

The mine proper is hardly perceptible within this overall landscape, but two shaft collars and a winze, nearly hidden within the piles of tailings, lead into its surviving tunnels. Surveys in 1984 and 1997 identified an adit and a breakthrough to the surface about 150' southeast of the main shaft (in the ravine south of the blacksmith shop) that once formed entrances to the mine, but these have collapsed and are now difficult to discern. Geologist James Hill described the subterranean extent of the mine in 1913:

From the shaft, which is vertical and 500 feet deep, levels have been run at 100, 200, 300, and 400 feet below the collar. These levels, owing to the peculiar shape of the ore body . . . are generally of circular plan. At the 100-foot level the ore zone is only a few feet from the shaft. Between the surface and this level there are sublevels in ore at 28, 40, and 60 feet. The 200-foot level has been driven nearly

around the circle, though the connection has not been made. On the northwest side of the circle there are four sublevels between the 100 and 200 foot levels, and short sublevels have been driven between these main levels at other places. On the 300-foot level, at the time of visit, a drift around the east and southeast sides of the circle was being pushed to the west at the south side, to connect with an underhand stope in ore on the 200-foot level. On the 400-foot level there is a crosscut to the east and short drifts on the east side of the circle. A station has been cut at the 500-foot level, but no drifting has been done.<sup>47</sup>

A 1984 investigation was not able to explore the mine below the 200' level, due to safety concerns, but it did document workings at the 65, 100, 103, 115, 128, 140, and 157' levels.<sup>48</sup> A resurvey in 1997 visited only the 50, 85, and 100' levels and noted one more at 125 or 130', but could get no lower. Failed timbering and many collapses make the mine unsafe to enter today.

In addition to the mine tunnels, there is an open cut, 21'-5" wide x 179'-0" long, by the main road as it approaches the mine headquarters, as well as an extensive area of terracing covering about 3.8 acres that has been cut with earth-moving machinery high on the hill east of the mine. These features, and a shallow test pit about 5' x 4' x 6' deep that lies north of the ring road, are probably artifacts of mineral prospecting, although nothing more is known about them.

#### **D. Buildings and Structures**

By the time the mine closed in fall 1919, the site contained at least twenty wood or stone buildings in addition to twenty-six tent frames and tent houses that provided sleeping quarters for the majority of the miners. Only nine buildings now survive, in whole or part, plus numerous structural fragments such as concrete pads and timber framing that once supported mining equipment or now-lost buildings.

*Smelter.* This smelter is the remains of a reverberatory furnace completed at the mine by the Salt Lake City builders Morris & Evans in May 1878. (A "stack" shown on a March 1877 sketch of the mining claim may be the beginnings of this smelter, or it may be an entirely different structure since removed.) The smelter is built of adobe bricks with an encircling base of native sandstone laid up in rough courses with earthen mortar. The whole appears to sit on stone foundations. Newspaper accounts say Morris & Evans shipped construction materials from Salt Lake City, and these may refer to the adobe bricks, as the cut stone around the base of the smelter was clearly cut on site.<sup>49</sup> Historic photographs demonstrate the smelter has been eroding over time and is shorter now than it was originally.<sup>50</sup>

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<sup>47</sup> Hill, "Grand Gulch Mining Region," 46. One newspaper report says the main shaft reached the 600' level during 1918, but no other report of workings at this depth has been found; "Grand Gulch Shipping carload ore monthly," *Mohave County Miner and Our Mineral Wealth*, Sept. 21, 1918, 2.

<sup>48</sup> Lane, *Mineral Investigation*, 20-26.

<sup>49</sup> "Rough draft of the Grand Gulch Mine," Mar. 10, 1877 (see footnote 2); "Local and other matters. Mining and smelting," *Deseret News*, Apr. 3, 1878, 1; "Local and other matters. Grand Gulch," *Deseret News*, May 22, 1878, 9.

The smelter with its chimney is about 12'-8" square at its base and rises 32' in three distinct stages. The lowest stage, which is stone around the adobe core, is 6' high and has four arched openings, one on each side. All are closed up except that on the south. The second stage, about 8' high, is also stone around the adobe core, but it is stepped in about 1'-10" inches from the stage beneath. It has an arched opening 6'-2" high on the north side, and a short stone bridge connects this opening to the hill behind. A crude second opening is cut through the stone and adobe on the south side at this level. The second stage was once reinforced by eight vertical logs held tight against the exterior corners of the stack by wrought-iron bars and rods embedded in the stonework. One log remains in place to the right of the north arched opening. The tapered adobe body of the smelter chimney rises from this second stage. It, too, is reinforced by iron bolts and flat, wrought-iron bars, a few of which still hold wood blocks against the outer surface of the chimney.

The smelter has a single interior chamber. To have functioned as a reverberatory furnace, it would have required some form of additional masonry or iron structure inside to form a firebox and a hearth. No evidence of these survives, but the remains of a slag pile in the wash below the smelter confirm that the furnace was operable at one time.

*Stone ruins [loading platform].* An early photograph shows a short, rectangular stone structure across the road from and about 20'-30' north of the smelter, about where this small native-sandstone ruin protrudes from one of the mine's spoil piles. Other photographs from 1917 and 1947, however, show a long wood platform fronting the north side of the road about where this earlier stone structure had been. The wood platform was open to the road along its long south side but had wood walls on its three remaining sides to hold back the cascade of mine tailings that rose around it. The platform was probably used for loading ore sacks onto freight wagons. As freighter Merle Frehner told an interviewer, "There was a platform that extended out and they throw a plank . . . and dump it [the ore] with the wheelbarrows right in."<sup>51</sup> Wood posts protruding from the spoil pile around the ruins are probably the remains of this loading platform. The ruins themselves may be from the earlier stone structure, once hidden beneath the loading platform; foundations for the wood platform; or something else entirely.

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Builders Elias Morris and Samuel L. Evans formed Morris & Evans about 1869. "Upon the opening of the mining industry in Utah they made a specialty of the manufacture of fire-brick and the putting up of furnaces. Morris and Evans built the Germania works, also smelters at Sandy, Bingham, Little Cottonwood, Flagstaff, East Canyon, Stockton and American Fork; they erected the Ontario mill and put in the Cornish pump at the Ontario mine, Park City; also erected many other buildings, including the basement story of the [Salt Lake City] Temple, the Deseret National Bank, Z. C. M. I., Mayor Little's residence and the University." Orson F. Whitney, *History of Utah*, 4:488.

<sup>50</sup> A set of photographs by Wilford Webb, show the mine in 1917. They are held by his descendants, but there are copies in PARA; Belknap's seven photographs of Grand Gulch Mine show the smelter in 1947.

<sup>51</sup> Belshaw and Peplow, *Historic Resources Study*, 130.

*Wood retaining wall.* This heavy-timber retaining wall lies along the road that leads past the smelter and up to the main shaft. Its historic purpose and construction date are not known but the angle iron pieces that hold the timbers in place date it after World War II.

*Shed.* The construction date and original use of this wood, pitched-roof shed are unknown. Measuring 8' wide x 9'-10-1/2" long, it appears in many early photographs of the mine, yet its dimensions do not obviously link it to any building listed on the mine's 1919 general inventory. The shed sits directly on the ground, has a dirt floor, and has no interior features.

A 2003 Park Service assessment described the shed this way:

The roof is built with widely spaced 2x4 rafters – one at each end, and one in the middle, with a 2x6 ridge, and covered with 1x10 boards with 1x4 battens. The walls are frameless, with horizontal 2x4's at the top and bottom, and 1x10 boards with 1x4 battens. There are 1x6 trim pieces at the ridge, rakes, and the tops of the walls. There is a wood framed doorway, but no door. The floor is built from 2x14 planks. There is no obvious foundation.<sup>52</sup>

*Concrete tank.* This open-topped two-compartment concrete tank is probably the "23 x 11 x 6ft 6in Cement Circulating Tank" listed in 1919 as a fitting within the mine's engine house. The engine house was built in 1901 and enlarged in 1918. It was still standing in 1947, but it collapsed or was demolished sometime later. The tank is contained within the footprint of the demolished house. It is built into a cut in the hillside, with its north wall poured directly against the hill, and was poured in place atop a concrete pad. The interior has a bituminous coating, and the entire box is now covered by a weathered and deteriorating wooden shed roof. The tank is equipped with several pipes and valves along its base inside and out.

*Concrete and wood machinery foundations.* Five concrete foundation piers and at least five timber foundation fragments, all studded with steel anchor bolts, are ranged in the space between the concrete tank and the main shaft. Like the tank, these sit within the footprint of the mine's 1901 engine house, and they probably served as supports for engines, tanks, or other machinery. All are likely contemporaneous with the tank, but this is not certain.

*Blacksmith shop.* This 22' x 17' one-room stone building was built ca. 1900 to act as the mine's blacksmith shop. It replaced an earlier stone blacksmith shop built before 1876 that had stood some 200' to the west. It is possible some or all of the masonry in this building was reused from the earlier building. The building is built of local sandstone blocks laid in rough courses and set with earthen mortar. The north wall is partially set against the hillside. Like the other stone buildings at the mine, this shop had a pitched wood roof with gables at either end. A 1947 photograph shows it also had a tall, wood chimney box rising from the east end of the roof. No fragments of the roof now survive, and it is presumed that it collapsed and its remains were cleared away long ago. There is a double wood doorway

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<sup>52</sup> Mark L. Mortier, *Parashant National Monument Historic Preservation Report: Condition Assessment and Preservation Recommendations, Grand Gulch Mine and Pine Well Ranch*, September 30, 2003 (Santa Fe: National Park Service Intermountain Support Office), 90.

opening through the south wall. The wood jamb and lintel survive, but the doors are missing. There are window openings in the north and west walls. The interior has a dirt floor and contains the remains of a stone hearth along the east wall and what was probably a cement quench tank along the west wall. A concrete pit, now mostly buried, is set into the floor in the middle of the building.

*Stone wall.* This L-shaped stone wall surrounded the coal yard immediately west of the blacksmith shop.<sup>53</sup> It has sometimes been mistakenly identified as the ruins of a boarding house. While a boarding house is shown adjacent to a blacksmith shop on an 1881 plat of the mining claim, that house and shop were further west than the current blacksmith shop and were removed when the mining company began sinking its new main shaft in 1899.<sup>54</sup>

*Office, kitchen, dining rooms, and store; also called the mine headquarters or the main house.* This single-story native-sandstone building was built in the summer of 1900 to serve as a dining hall and hotel or boarding house.<sup>55</sup> It took over the functions of an earlier stone boarding house and houses removed in 1899 to allow work on the new main shaft. Originally about 80' long x 24' wide and comprising four interconnecting rooms, this building gained an attached but non-communicating 18'-9" x 15'-6" one-room addition on its east end sometime later. By 1919, the addition contained the mine office and probably doubled as the superintendent's sleeping room. It featured a 6' x 15' screened porch along its north wall. The four original main rooms served as kitchen, dining rooms, women's quarters, and store.<sup>56</sup>

A 1947 photograph shows the building without its roof, doors, window frames, and interior finishes, these having been destroyed or removed at an unknown date.<sup>57</sup> The building is now a ruin, with the westernmost room entirely demolished and the north wall largely collapsed. The walls of the addition remain substantially intact. All five rooms once had north-facing exterior doors. Each of the four main rooms had two north windows and a single south window; the addition had single windows facing north and south. The main building formerly had a pitched roof with gabled ends, while the addition was built with a lean-to roof. No roof, ceiling, porch, or floor evidence remains in situ, but two piles of lumber adjacent to the eastern end of the building are probably fragments of the roof. As far as can be determined, the building had wood door and window lintels throughout. The one apparent exception is the pass-through between the two original center rooms (now the westernmost surviving rooms), which is capped by an arch built up with four header

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<sup>53</sup> The coal pile and surrounding wall appear in one of Belknap's seven photographs of Grand Gulch Mine.

<sup>54</sup> Mortier, *Parashant Historic Preservation Report*, 106; Macfarlane, "Plat of the Adams Lode Mining Claim."

<sup>55</sup> "Mining notes," *Salt Lake Herald*, Aug. 24, 1900, 6.

<sup>56</sup> Athole Milne, Ivey Stratton, and Lydia Stevens all recalled the women sleeping in this building; Cox, *A Harsh Land and Proud*, 310, 313, 317. Five beds and a cot are among the contents of the kitchen and dining rooms listed in "General Inventory for Grand Gulch Mine," Jan. 31, 1919, NSM.

<sup>57</sup> Belknap, seven photographs of Grand Gulch Mine.

courses of fire brick. This arch was shored up with wood cribbing in 2009.<sup>58</sup> A 2003 National Park Service assessment noted,

The walls are approximately two feet thick, built from roughly coursed native stone, which has been shaped into rough rectangular shapes, and set with earthen mortar. The stone is laid up in two partially interlocked “wythes,” with smaller stones and rubble used to fill some of the center voids. The mortar mix may be mixed with mine tailings, as evidenced by the particle size and character of the aggregate. There are traces of whitewash and plaster in several of the rooms, especially in the addition, which appears to have a more weather resistant plaster.

The walls of the addition are of similar construction, but the stones used are generally larger, and some of the mortar joints appear to have been pointed with a more resistant material – possibly utilizing lime in the mixture.<sup>59</sup>

*Meat cellar [east dugout].* This 15' x 19' one-room building is probably the “meate cellar stone 16 x 20 ft” containing butcher’s tools noted in a 1919 mine inventory. Whether it was used simply for butchering or for meat storage, too, is unknown. Its date of construction is unknown, but its style of construction is similar to that of the adjacent kitchen and dining room building. An early photograph shows that it originally had a wood roof with open gables to front and rear, similar to that on the west dugout (see below).

The body of the building comprises walls 6'-6" high made of native sandstone blocks laid up with earthen mortar in rough courses. It is built into the hillside with the base of the north wall sitting on grade and the south wall masonry completely buried in the hill. The sandstone walls now support knee walls and a pitched roof with shallow gables to front and rear. The knee walls and roof are built of dimensional-lumber framing clad in galvanized sheet metal, and date from after the middle of the twentieth century. A single doorway opens through the middle of the north wall onto a concrete stoop. A wood doorframe survives, but the door is missing. Four wood-framed windows pierce the east and west knee walls, two windows to either side. The sashes in the east windows are missing.

The interior walls are finished with unpainted gypsum wall board nailed to wood furring. There is a wood-frame ceiling, the gypsum board covering of which has mostly collapsed onto the poured-concrete floor. Fragments of a modern electrical lighting system survive inside and out.

*Vegetable cellar [west dugout].* This 12' x 15'-11" one-room building is probably the “Vegetable cellar stone 13 x 19 ft” listed on the mine’s 1919 general inventory. Its date of construction is unknown. Although built of the same native sandstone blocks set with earthen mortar as the

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<sup>58</sup> Belknap, seven photographs of Grand Gulch Mine; Photograph of Grand Gulch Mine, ca. 1912, Arizona State Library, Archives, and Public Records, History and Archives Division, Historical Photograph Collection, image no. 97-5067.

<sup>59</sup> Mortier, *Parashant Historic Preservation Report*, 17–18.

neighboring meat cellar and headquarters, its walls are less neatly laid into courses than those of the adjacent buildings. It is partly set into the hillside, with the north wall on grade and about half of the south wall buried in the ground. A single doorway with wood frame, sill, and lintel opens through the north wall onto an irregularly laid stone stoop. The interior is unfinished with a dirt floor, and fragments of a wood shelf or bench survive along the east wall. The building has no windows.

The pitched, front-and-rear-gable roof has collapsed, although enough of its material survives to see its original double form. There was an inner roof of wood boards covered in earth that rested directly on the stone walls and was supported in the center by log ridge-pole. Heavy 9'-wide fascia boards protected the edges where this roof met the masonry along the north and south walls. A second, more steeply pitched wood roof, possibly of later date, rose above the first roof. Its ridge-plank was supported at the ends of the building by vertical planks fastened to the fascia boards of the inner roof. A period photograph shows that this double-roof arrangement was in place during the mine's working years. It also reveals that the gable spaces between the first and second roofs were left open.<sup>60</sup> This design would have covered the building with a ventilated airspace lined with earth, possibly serving to insulate the interior from the extreme seasonal heat.

*Bunkhouse.* This single-story native-sandstone building was built as a bunkhouse in October and November 1907.<sup>61</sup> It is 60' long and 18' wide, has a pitched wood roof with gables to north and south, and contains three interconnecting rooms. It has no evident foundations, and the mortar in the walls may contain mine tailings as aggregate.<sup>62</sup> All rooms have plank floors and painted plaster covering the wall stone. All window and door openings have wood frames and wood lintels.

The building was renovated and redecorated sometime after 1947.<sup>63</sup> This work added two wood porches with roofs along the east and west wall, installed a kitchen with gas range in the middle room, built two closets in the south room, and inserted frame and gypsum board ceilings and fiberboard paneling throughout. Electrical wiring and running water were also added, the water piped (via lines that partly survive) from a tank on the hill opposite. A barbed-wire fence with gate was placed around the house and three cedar elm trees (*Ulmus crassifolia*) were planted as a screen along the line of the east wall.

Two small additions that now sit at each end of the house were probably erected at this same time. They are lightly built in wood and clad with galvanized metal panels. (The type of sheet metal used matches that in the modern roof on the east dugout.) The addition along

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<sup>60</sup> Photograph of Grand Gulch Mine, ca. 1912, Arizona State Library, Archives, and Public Records, History and Archives Division, Historical Photograph Collection, image no. 97-5067.

<sup>61</sup> Grand Gulch Mine Time Book, 1909-11, n.p., Washington County Library, St. George, Utah. The five men who built the bunkhouse were George Syphus, Ed Syphus, John Doherty, Bert Whitney, and Lafe [Lafayette] Barron.

<sup>62</sup> Mortier, *Parashant Historic Preservation Report*, 58.

<sup>63</sup> One of Belknap's seven photographs of Grand Gulch Mine shows the bunkhouse without porches, additions, and yard features.



the north wall is about 7' x 8' and has a sloping shed roof; its purpose is no longer known. The addition along the south wall, apparently used as a shower and laundry, is 8' x 18' and has a pitched roof over its larger eastern room and a flat roof over its smaller western room. An approximately 30"-wide concrete walkway runs along the east wall of the bunkhouse, connecting the south addition to the main door of the living spaces.

Most of these modifications, heavily deteriorated, were removed by National Park Service staff in 2010, although the additions and the porch roofs were retained and the roof over the entire building was relaid.

*Outhouse.* This small wood-frame privy sits on the hill above and between the headquarters and the bunkhouse. It has a wood-plank floor supporting it over a soil pit dug into the hill and contains a single seat and a sheet-metal urinal. It is missing most of its siding. Its date is unknown.

*Water-tank frame.* This structure, made of 6" x 6" timbers and posts, was the support for a water tank, no longer extant. It sits on the hill south of the headquarters building and measures about 8' x 12' x 6' high. Fragments of metal piping survive indicating it once connected to the bunkhouse and possibly to the headquarters as well. Its date of construction is unknown.

*Stone foundation.* An 8'-8" x 11'-3" rectangle of flat sandstone blocks set into the ground 136' southeast and up hill of the bunkhouse may have served as the foundation for a now lost structure, or it may simply have been a patio or terrace created for outdoor living when the mine was re-inhabited in the late 1950s.

*Powder house.* The roughly coursed sandstone front of the powder house, about 24' long and 9' high, screens a small man-made cave about 12' deep cut into a sandstone hillside 1,400' southwest of the bunkhouse. A thick layer of soil covers its wood roof, rebuilt in 2007 after a collapse.<sup>64</sup> A single doorway, retaining the original wood jamb and lintel but missing the door, leads into the interior, which is mounded with dirt dumped inside when the roof collapsed. The building's date of construction is unknown. In 1919, the mine had three magazines built of stone: a storage powder magazine, said to be 9' x 12'; a powder magazine for everyday use, 10' x 13'; and a carbide magazine for everyday use, also 10' x 13'. The locations of these three structures is not recorded. While the everyday magazines were likely to have been close to the workings, it is possible the existing powder house is an expansion or reconstruction of the storage magazine.<sup>65</sup> Whether it is or not, the earliest firm evidence of the powder house's existence is the General Land Office plat of the township surrounding the mine, which, although published in 1949, was based on a survey from 1940.<sup>66</sup>

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<sup>64</sup> Chuck Luttrell and Jim Allsop, memo to Jeff Bradybaugh and David Van Alfen, May 20, 2007, in PARA.

<sup>65</sup> "General Inventory for Grand Gulch mine," Jan. 31, 1919, NSM. It is also possible the existing powder house is an entirely different structure from the 9' x 12' storage magazine listed in 1919.

<sup>66</sup> "Plat of Township No. 34 North, Range No. 14 West, Gila and Salt River Meridian, Arizona," June 28, 1949, Bureau of Land Management, General Land Office Records, [www.glorecrecs.blm.gov](http://www.glorecrecs.blm.gov).

*Oil-change platform.* Built with 6" x 6" posts and beams supporting two parallel ramps separated by an open space and sitting along the slope leading from the headquarters area into the wash alley, this wood platform is presumed to have been used for changing oil and other vehicle maintenance. A ruined wood staircase rests at the foot of the platform. The date of the platform is unknown.

*Concrete slab 1.* This 30' x 60' concrete slab sits 70' northwest of the headquarters building. Its upper surface lies at grade along its south edge but is 3' above grade along the north edge due to the slope of the surrounding ground. It was laid in multiple layers and possibly also in multiple sections, creating the overall size and height that it now exhibits. Bolts cast into the concrete suggest the slab formed the foundation for one or more buildings. Its dimensions do not match those of any building listed on the 1919 general inventory of the mine. Although a barn or other large structure once stood in the vicinity of the bunkhouse and headquarters about where this slab now is, it is unknown if it had a concrete-slab foundation. Two cylindrical steel hoppers and a steel and brick furnace currently sit on top of the slab.

*Concrete slab 2.* This 20' x 30' concrete platform sits 101' west of slab 1 and 150' north of the bunkhouse. Wood planks and anchor bolts still fastened around its perimeter indicate it was probably the foundation for a building. Its dimensions do not accord with those of any building listed in the 1919 mine general inventory.

*Concrete slab 3.* This slab is one of many structural and equipment fragments that litter a large area along the western edge of the mining claim. It probably formed a foundation for equipment used for ore processing in the 1940s or 1950s.

*Dam.* A small, low dam, little more than a wall, stands immediately north of the main road into the mine, approximately 600' northeast of the headquarters building. It is lined and topped with sandstone blocks, but its interior material is unknown. It appears to have been constructed to prevent storm runoff from washing into an area of the tailings piles.

#### **D. Machines**

Fragments of many machines litter the Grand Gulch Mine site, but no complete mining equipment remains intact. The fragments are found mostly spread along the edge of the mesa west of the mine shafts, and in a few concentrated piles on the hill behind and to the west of the headquarters building. The equipment at the mesa's edge appears to have been used for ore sorting, milling, and chemical processing, and probably dates from after World War II. The equipment near the headquarters includes derrick, drill, hoist, and engine pieces. Historically such machines would have been adjacent to the mine shafts; their removal to the headquarters area is likely a product of the efforts to scrap the mine in 1961.

Two matching Euclid dump trucks have long been parked in front of the headquarters. Although manufactured before World War II, they are believed to have been brought to the

mine in the mid-1950s when the dumps were sorted and partially shipped away. They may also have been used to haul away old equipment and metal when the mine was scrapped.<sup>67</sup>

### Part III. Operations and Process

#### A. Operations

The hard-rock mining undertaken at the Grand Gulch Mine was done by hand with picks and shovels, assisted by blasting with powder and, by 1907 if not before, a handful of compressed-air drills.<sup>68</sup> The intensely physical nature of the work and the harsh environment of the desert site are implied in a letter Superintendent Callaway wrote to Walter Jennings in 1913:

Ralph Keate and another hobo dropped in here the other day wanting work so I put one in the raise and the other in the Drift on 200 level so I dont think I will half to keep them very long but if they can hold her down and do the work I will be glad to keep them as she is a tough proposition she is as tough as they are.

In an addendum written the next day, Callaway told Jennings, "One of the Hoboes quit this a.m. they usually stay 10 days but 3 was enough for him."<sup>69</sup>

#### Ore sorting

Because the mine's remoteness created high shipping costs, ore sorting was a key aspect of the mine's operations. All ore was carefully sorted by hand into graded dumps, and only that with a high enough market value to pay for its shipment was sent to market. Merle Frehner, a freighter, recalled, "[T]hey would slip these little rubber boot[s] over several of the finger[s] or otherwise they would wear them out on those sharp rocks." For many years, considerable quantities of low-grade ore were stockpiled in anticipation of eventual reductions in the hauling costs. In 1900, for example, an estimated 500 to 1,000 tons of 20 percent copper ore sat on the dumps, while the mining company shipped only loads averaging 40 to 49 percent. As the railhead moved closer to the mine, the lesser-grade dumps were progressively shipped away, but much remained. By 1911, more than 2,000 tons of 17–20 percent ore was stored at the mine, along with an estimated 15,000 tons of 6–8 percent "third class ore." Another report at the end of 1912 estimated that 8,000 tons of sorted ore awaited shipment.<sup>70</sup>

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<sup>67</sup> Milton Hokanson, email to the author, May 20, 2011.

<sup>68</sup> Hill, "Grand Gulch Mining Region," 46. Sam and Harry Gentry hauled a 3,200-lb air compressor, a 1,700-lb air receiver, and about 5,000 lb of pipe to the mine in October and November 1907. These shipments may indicate the installation of compressed-air drills at the mine at this time, or they may simply indicate the installation of additional or replacement equipment. See Grand Gulch Mining Co., purchase orders to S. B. Gentry, Oct. 20 and 31, 1907, and to H. Gentry, Nov. 3, 1907, all in PARA. A "Mine Inventory" dated Dec. 31, 1918, in NSM, lists 550 lb of powder, 5,200' of fuse, and 14 boxes of caps in stock at the mine at that time, while the "General Inventory" of Jan. 31, 1919, also in NSM, lists drills and air-compressor equipment.

<sup>69</sup> Callaway to Jennings, Dec. 14, 1913, NSM.

<sup>70</sup> Merle Frehner quoted in Belshaw and Peplow, *Historic Resources Study*, 130; "Riches of the Grand Gulch," *Deseret Evening News*, May 26, 1900, 7; "The Grand Gulch Mine," *Deseret Evening News*, Nov. 19, 1900, 2; "Grand Gulch Mine," *Washington County News*, July 6, 1911, 1; Jennings, "Grand Gulch Copper

## Smelting

Hoping to process its own ore on site, the Grand Gulch Mining Company built a smelting furnace near St. George in 1875. This did not meet the company's needs and seems to have been used for only about a year. In 1878, builders Morris & Evans of Salt Lake City, specialists in the construction of smelting works, built a reverberatory furnace at the mine itself, and the mining company hoped soon to build two more. Although the smelter was used successfully in 1878 and again in 1881, it does not seem to have worked overly well, for geologist James Hill noted in 1913 that its slag dumps had been shipped away to recover their remaining metal content.<sup>71</sup>

After the mine was reopened in 1899, the company consigned its ore to companies in and around Salt Lake City for smelting. The Conklin Sampling Works received a shipment in January 1900, and the American Smelting and Refining Company received another the following April. In 1904 the mine shipped ore to a smelter at Murray, Utah. In 1911, the company contracted with the Garfield Smelting Company of Garfield, Utah, to process all its ore until mid 1914, a contract it renewed upon expiration for another two years.<sup>72</sup>

Although its ore was consistently shipped to the Salt Lake Valley after 1900, the company regularly considered alternative smelting sites and reconsidered the idea of smelting at the mine itself. In 1900, management considered giving its smelting business to the Selby smelter near San Francisco – an incredible 600 miles from the mine. “The management of the company dislikes very much to take such steps, and deprive the local [i.e. Salt Lake City] smelters of the business, but with the long overland haul, coupled with the charges made by the railroads, the cost of transportation runs up into pretty stiff figures.” This idea was not pursued, but a few months later the company was looking at building a smelter somewhere along the Colorado or Virgin rivers. By the next year, the company was even looking at erecting a smelter at the mine's water source, Pigeon Spring, eight miles from the mine. These ideas continued to be investigated, but the company deferred construction in the hope that a railroad connection would be built “within striking distance of the mine” and thereby determine the best place to build a new smelter.<sup>73</sup>

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Mine,” 269; Pierre Schon, “Report of road conditions existing from St. Thomas, Nevada, to Grand Gulch Mine,” Dec. 24, 1912, NSM.

<sup>71</sup> Hill, “Grand Gulch Mining Region,” 42. For a contemporary description of the workings of reverberatory furnaces, see Edward D. Peters, *Modern American Methods of Copper Smelting* (New York: Scientific Publishing Co., 1887), ch. 12. In such furnaces, the heat of the fire is reflected back on the ore charge, rather than directly heating it, and a chimney is used to create the necessary draft rather than the bellows or blower used in a blast furnace.

<sup>72</sup> “Grand Gulch copper,” *Salt Lake Herald*, Jan. 3, 1900, 6; Invoice, Apr. 7, 1900, NSM, folder: Bills and receipts 1900; “Mines in the south,” *Salt Lake Herald*, Nov. 28, 1904, 6; J. M. Bidwell, Garfield Smelting Co., to W. P. Jennings, Nov. 24, 1911, and June 17, 1914, both NSM.

<sup>73</sup> “May go to Selby,” *Salt Lake Herald*, Apr. 19, 1900, 6; “Ore records broken,” *Salt Lake Herald*, June 2, 1900, 6; “Grand Gulch strikes,” *Salt Lake Herald*, Oct. 13, 1901, 6; “Grand Gulch election,” *Salt Lake Telegram*, Feb. 5, 1902, 3; “Mine and smelter building,” *Salt Lake Mining Review*, Feb. 15, 1902, 21; “Grand Gulch strike,” *Salt Lake Herald*, Nov. 20, 1902, 6; “Grand Gulch copper,” *Deseret Evening News*, Apr. 6, 1904, 6; “Mining below St. George,” *Salt Lake Herald*, Dec. 5, 1904, 6.

Even after the opening of the new railhead at Moapa, Nevada, in 1905 considerably reduced freight costs, the company made plans for a nearer smelter. In 1907, majority owner William McIntyre and associate David Kennedy purchased the Bonelli iron mine in Lincoln County, Nevada, reportedly “for the purpose of furnishing iron ore for fluxing purposes for the new smelter to be built on the Colorado river by the Grand Gulch Mining company.” Nothing came of these plans, either.<sup>74</sup>

**Water.** There is no natural water source at the Grand Gulch Mine, but, as Ivy Stratton told an interviewer years after working there, “The engine at the mine required a great deal of water, and of course, cooking, drinking, cleaning up, and laundry took a lot more, to say nothing of bathing.” Whatever water the operation needed was hauled in barrels by wagon once a day from springs about 8 miles by road to the southeast. If many men were at the mine, water was hauled twice a day.<sup>75</sup>

In 1874, the mining company described its two springs near the mine as Pigeon Spring and the Wolf Hole, the first said to be 8 miles east of the mine, the second, 6 miles east. Similarly, surveyor John Macfarlane noted in 1881 that the “nearest water to the Claim is about 8 miles away, and consists of two very small springs known respectively as Pigeon Spring and Woolf Hole Spring.” By 1909, the company was calling the two springs Pigeon and Jennings.<sup>76</sup> These springs are most likely the ones identified on modern maps as Upper Pigeon Spring, about 8.75 miles by road from the mine, and Lower Pigeon Spring, about 7.5 miles from the mine.<sup>77</sup>

Samuel Adams named Pigeon Spring after a flight of mourning doves he claimed alerted him and Richard Bentley to the existence of the spring during a homeward-bound trip along “an unexplored route” from the mine in the early 1870s. The company soon developed the spring and the Wolf Hole with pipes and reservoirs to collect the water. During the 1870s and 1880s,

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<sup>74</sup> *Salt Lake Mining Review*, Mar. 30, 1907, 4.

<sup>75</sup> Cox, *A Harsh Land and Proud*, 309, 313; Hill, “Grand Gulch Mining Region,” 41.

<sup>76</sup> Washington County Recorder Deeds (Silver Reef), Book J, 262–65; Macfarlane, field notes; “Tax list filed 1909–1910,” NSM, folder: “Misc Financial Papers 1.” The company again identified the two springs as Pigeon Spring and the Wolf Hole in Articles of Agreement, Feb. 12, 1877, Washington County Recorder Deeds (Silver Reef), Book L, 261.

<sup>77</sup> Upper Pigeon Spring is located in T33N, R13W, S2 and is about 600' off (and about 120' above) the road; Lower Pigeon Spring lies adjacent to the road in T34N R13W S33. The Wolf Hole near the mine should not be confused with the other Wolf Hole Spring, located some 17 miles south of the Utah/Arizona border along the road to the mine (now BLM road 1069).

Two additional springs lie near the mine. Coyote Spring (in T34N R13W S33) is about 1 mile north-northeast of Lower Pigeon Spring, but lies a mile off the road up Coyote Canyon. The lack of a developed road to this spring makes it unlikely to have been a regular source of water for the mine. Another “Pigeon Spring” appears on the 1924 General Land Office map of Township 33 about 2.5 miles south of the mine (in T33N R14W S4). It is depicted well off any road and separated from the mine by Pigeon Canyon. Its location does not accord with period descriptions of the Pigeon Spring used by the mine. It no longer appears on BLM or USGS maps of the area, but it could, perhaps, have supplied water to the nearby Savanic (Bronze L) and Cunningham mines when they were in operation.

the company also claimed Lynx (now Link), Garden, and Hidden springs, all some 25 to 30 miles from the mine in Hidden Canyon along the route from St. George.<sup>78</sup>

**Lumber.** Juniper and pinyon pine trees are the predominant woody vegetation in the vicinity of Grand Gulch, and the miners used them for fence posts and firewood. The nearest stands of large trees, however, were in the Parashant, the southern part of the Shivwits Plateau some 25 to 30 miles to the east. The mine purchased most of the dimensioned lumber it needed for buildings and mine cribbing from Thomas Gardner's sawmill at Mociac Spring, which Gardner began running around 1900 and continued to run off and on, sometimes in partnership with others, until the late 1910s. In 1907, lumber from Gardner's mill cost the mine \$25.00 per thousand feet; in 1913, \$30.<sup>79</sup>

## B. Technology

There is little record of power machinery at the mine during the years 1871 to 1882, beyond an engine and blower brought in by Samuel Adams in 1881, although the successful sinking of a 100' shaft would have required at least some form of windlass or whim for hoisting. When the Jennings family reopened the mine in 1899, they initially used a Buffalo whim for hoisting; this would have contained a vertical winding drum operated by horse or mule power. In 1901, the company purchased a 22-horsepower gasoline hoist from Fairbanks, Morse & Company, which was shipped to the mine on July 1, and was installed and working by the middle of September in a wood engine house adjacent to the mine's new double-compartment main shaft. The new hoist had sufficient cable and spindle capacity to serve a shaft 800' deep. A headframe was built over the shaft at the same time to work in conjunction with the hoist; as the *Salt Lake Herald* declared, "[T]he shaft is equipped with a gallows frame that would do credit to any of the big mines." This type of engine could burn gasoline, petroleum distillate, or crude oil – allowing the

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<sup>78</sup> Samuel Adams, "A Night of Horror," n.p.; Hill, "Grand Gulch Mining Region," 41; Washington County Recorder Deeds (Silver Reef), Book J, 262-65 and Book L, 261; "Supervisor's sale," *Mohave County Miner*, Dec. 12, 1886, 2.

<sup>79</sup> Cox, *A Harsh Land and Proud*, 312; PARA HSR draft, 133; Grand Gulch Mining Co., check to Thos. Gardner for lumber, July 16, 1907, Gordon Chappell collection, copy in PARA; Hill, "Grand Gulch Mining Region," 42. Letters in NSM that touch on lumber shipments from Gardner's mill to the mine include Thomas H. Gardner to S. R. Callaway, Jan. 26, 1911; Callaway to Jennings, Dec. 1, 1913; Callaway to Jennings, Apr. 14, 1914; and Callaway to Jennings, Apr. 21, 1914. A reference to one Carpenter cutting lumber for the mine at Gardner's mill appear in Callaway to Jennings, Dec. 1, 1913, and Callaway to Jennings, Feb. 2, 1914. See also purchase orders and checks to Gardner & Barnum for lumber, July 9, 1907, Gordon Chappell collection, copies in PARA.

In 1911, Gardner offered to sell his sawmill to the mining company for \$1,500: "I put in a new boiler and a very good Engine two years ago but it is to far away to be profitable to me and the price paid for hands and grain also paying for the timber in advance. . . . The forest Supervisor seems to think the timber is as thin as it should be with out cutting any more out and this means to move the mill or haul the logs about four miles and get the timber in what is known as Lake Flatt." The mine did not act on this opportunity, perhaps aware of what U.S. Forest Service ranger Martin McAllister noted in his diary after a July 1910 visit to the sawmill: "The mill & engine are a poor concern badly out of repair. Yard unkept and littered. Gardner and crew were sawing lumber all day." Gardner to W. P. Jennings, Mar. 20, 1911, NSM; Martin L. McAllister, *U.S. Forest Service Diaries, February 5, 1907 to Monday, June 30, 1919*, transcribed by Gail Carbiener, USDA Forest Service, Intermountain Region, July 2008, 157.

mine to use whichever fuel was available or affordable – and only required enough water to fill its recycling cooling system. Athole Milne recalled that the engine was heavy and reliable, and, in fact, it remained in use until the mine closed in 1919.<sup>80</sup>

The mining company also invested in compressed-air drills and an air compressor to run them, although the exact date of their installation is unknown. The gasoline hoist powered the air compressor, which Hill described in 1913 as a “10 by 10 inch” machine “capable of running three drills,” although other sources say it was a “two-drill” compressor. Hundreds of feet of pipe linked the compressor on the surface to the drills in the mine. A Sinclair drill was in use by 1909, and a model 3S Waugh sinking drill was purchased and a model 8C Waugh stoping drill repaired in 1911. The mine’s 1919 inventory lists all these drills, plus two A-35 Sergeant rock drills.<sup>81</sup>

In 1918, during the high copper market of World War I, the company bought new compressor plant equipment in order to “prosecute deeper work” in the mine. This investment included an Ingersoll-Rand duplex air compressor; a 50-horsepower Fairbanks, Morse & Co. semi-diesel oil-burning engine; and a 1,500-lb Galigher Machinery Company ore skip. This equipment cost \$8,988.15, plus \$1,267.65 to enlarge the engine house. The new machinery was probably hauled to the mine by freighter Harry Frehner.<sup>82</sup>

No intact mining machines survive at the site.

### C. Transportation

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<sup>80</sup> Eyring, *Journal of Henry Eyring*; “Back from Grand Gulch,” *Salt Lake Herald*, Mar. 14, 1900, 6; “Trade notes,” *Salt Lake Mining Review*, June 30, 1901, 22; “Plant for Grand Gulch,” *Deseret Evening News*, July 1, 1901, 6; “Savanic and Grand Gulch,” *Salt Lake Herald*, July 31, 1901, 6; “Grand Gulch strike,” *Salt Lake Herald*, Nov. 20, 1902, 6; “Savanic and Grand Gulch,” *Salt Lake Herald*, Sept. 21, 1901, 7; “Prospecting Hoist,” *Mines and Minerals* 22, no. 2 (Sept. 1901): 64; Athole Milne quoted in Cox, *A Harsh Land and Proud*, 310.

The 22-hp Fairbanks, Morse & Co. hoist was shop number 11661; Fairbanks, Morse & Co. to Grand Gulch Mining Co., Mar. 29, 1913, NSM.

<sup>81</sup> Hill, “Grand Gulch Mining Region,” 46; Horace J. Stevens, *The Copper Handbook*, vol. 10 (Houghton, Mich.: Horace J. Stevens, 1911), 880; W. B. Jennings to Fairbanks, Morse & Co., Dec. 28, 1909; John C. Taylor, Denver Rock Drill & Machinery Co., to W. P. Jennings, Apr. 18, 1911; Joseph C. Judd to Jennings, Aug. 6, 1911; C. Grindstone, Denver Rock Drill & Machinery Co., to Grand Gulch Mining Co., Oct 19, 1911, all NSM. The extent of the compressed air piping in the mine is revealed in “General Inventory for Grand Gulch mine,” Jan. 31, 1919, NSM.

<sup>82</sup> The 1919 “General Inventory” in NSM lists these machines as “new,” with the ore skip also being described as “not in place.” “Trade notes,” *Salt Lake Mining Review*, June 15, 1918, 41; *Salt Lake Mining Review*, Sept. 15, 1918, 25; “Grand Gulch shipping carload ore monthly,” *Mohave County Miner and Our Mineral Wealth*, Sept. 21, 1918, 2; “Around the mines,” *Millard County Chronicle*, Sept. 26, 1918, 3; “Dips, spurs and angles,” *Salt Lake Mining Review*, Sept. 30, 1918, 41; “General Balance Sheet,” Dec. 31, 1918, NSM, folder: “Annual Reports for 1917-1918”; Weed, *The Mines Handbook*, vol. 15 (1922), 283. Frehner reference in A. D. Hopkins, “Wagon freight business made anything else look easy,” *Las Vegas Review-Journal*, May 12, 2005.

Transportation was the greatest obstacle to successful operations at the Grand Gulch Mine. Roads through the difficult desert terrain had to be built and maintained, and the nearest railroad depot was never closer than 45 miles away. The development of railroads was key to the economic viability of the mine. In fact, distance to a railhead had a direct bearing on the quality of ore the mine could economically ship to market. Before 1905, only ore averaging more than about 45 percent copper per ton would produce sufficient profit to recover its shipping costs. The opening of the Salt Lake Route to Moapa, Nevada, in 1905, cut the mine's wagon-hauling distance in half, and ore as low as 35 percent copper could be shipped. A branch line to St. Thomas, Nevada, that opened in 1912 brought the railroad as close as it would ever come to the mine, and 15 to 20 percent ore began to move. The company estimated its shipments during 1912 had increased about 100 percent over the year before, all because of improved transportation.<sup>83</sup> Only in the 1950s, with modern trucks, could the long-stockpiled dumps of low-grade ore at the mine be shipped away for processing, by which time the mine had essentially been tapped out. Those same trucks allowed the mine to be scrapped in the early 1960s.

The stages of transportation development from the mine are as follows:

*1874–1878: Wagon hauling to St. George, then to Salt Lake City.* Initially, Samuel Adams and his associates used pack horses and existing Indian trails to access the mine, but, by September 1873, they had cleared a wagon road south from St. George. It took freighters about a week to drive their teams from St. George to the mine and back, a trip of about 80 miles each way. The mine's ore was mostly smelted in St. George, and the bullion created plus any surplus ore were shipped overland to Salt Lake City, 300 miles to the north, for sale.<sup>84</sup>

*1881–1882: Wagon hauling to St. George, then to the railhead at Milford.* When the mine reopened in 1881, it took freighters an additional four or five days to haul their loads the final 100 miles north from St. George to the Utah Central Railway depot at Milford, opened as part of the Utah Southern Railroad to Salt Lake City in 1880.<sup>85</sup>

*1899–1905: Wagon hauling to St. George, then to the railhead at Modena.* Just as the mine was being reopened in 1899, a shortline, the Utah and Pacific, was completed from Milford to Modena, Utah, about 65 miles north of St. George, and the mine began to ship its ore to Salt Lake City this way, at a cost of \$25 a ton to get the ore to Modena and an additional \$6 to take it on to Salt Lake.<sup>86</sup>

The expense of this long haul frequently led company managers to seek alternative transportation options. During 1900, president and general manager Thomas Jennings explored the possibility of opening a road west from the mine down to Grand Wash and

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<sup>83</sup> "Mohave County Production," *Mohave County Miner*, Jan. 11, 1913, 3.

<sup>84</sup> Samuel Adams, "A Night of Horror," n.p.; "Territorial dispatches," *Deseret News*, Sept. 10, 1873, 9; Cox, *A Harsh Land and Proud*, 312; "Local and other matters. From south," *Deseret News*, May 10, 1876, 8.

<sup>85</sup> Cox, *A Harsh Land and Proud*, 312; "Copper," *Ogden Daily Herald*, Sept. 22, 1881, 2.

<sup>86</sup> "Grand Gulch shipment," *Deseret Evening News*, Dec. 2, 1899, 8; "Riches of the Grand Gulch," *Deseret Evening News*, May 26, 1900, 7.



then south to Pierce's Ferry on the Colorado River, and from there to Chloride, Arizona, a stop on the Arizona and Utah Railroad. Hauling to Chloride would have reduced the wagon haul from about 145 miles to about 90 miles but would have introduced the need for a ferry to cross the river. (The *Deseret Evening News* optimistically calculated this route at 65 miles, but this was the straight-line distance between the two places.) Alternatively, Jennings looked at hauling to the Colorado and then to Hackberry, Arizona, on the Santa Fe Railroad, a slightly shorter run of about 85 miles. Jennings expected a southern route to save \$10 a ton on haulage and \$5.50 a ton in railroad freight charges, possibly allowing lower-grade ore to be shipped to market and justifying a new road's \$3,000-\$4,000 expense. A haul to Chloride or Hackberry would also have required the company to send its ore to smelters in the east or in California, such as the Selby smelter near San Francisco that Thomas Jennings once suggested to reporters.<sup>87</sup>

1905-1912: *Wagon hauling to St. Thomas, then to the railroad at Moapa.* The idea of building a southerly freight road was obviated by the development in late 1900 and 1901 of plans to construct a railroad linking Salt Lake City and Los Angeles. As soon as the San Pedro, Los Angeles and Salt Lake Railroad was completed in spring 1905, the mining company began shipping its ore to the depot at Moapa, Nevada, about 70 miles by road from the mine. This change required the improvement or construction of a westerly road from Grand Gulch to the farming community of St. Thomas, Nevada, 45 miles away, whence freighters followed the Muddy River valley northwest a final 28 miles to Moapa.<sup>88</sup>

1912-1919: *Wagon hauling to railhead at St. Thomas.* In May 1912, a branch railroad opened linking Moapa and St. Thomas, reducing the mine's wagon haul to 45 miles. Regular service was only maintained over this line during the cantaloupe season (May through October, with peak production in July), but this does not appear to have impacted the mine's ability to order cars for shipping ore when needed. Once this branch line opened, all shipments from the mine headed to market over it until the mine closed in fall 1919.<sup>89</sup>

The government of Nevada granted a franchise to Walter P. Jennings and partners H. E. George of Los Angeles and Harry Gentry of St. Thomas for a railroad from Moapa to the

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<sup>87</sup> "Southern copper mines," *Deseret Evening News*, Feb. 14, 1900, 6; "Activity in the south," *Deseret Evening News*, Mar. 3, 1900, 6; "75 per cent copper," *Salt Lake Herald*, Mar. 4, 1900, 6; "Back from Grand Gulch," *Salt Lake Herald*, Mar. 14, 1900, 6; "May go to Selby," *Salt Lake Herald*, Apr. 19, 1900, 6; "Riches of the Grand Gulch," *Deseret Evening News*, May 26, 1900, 7.

<sup>88</sup> Historians Mike Belshaw and Ed Peplow, Jr, wrote in 1980 that "Undoubtedly there was traffic between the mine and St. Thomas during the [mine's] early years, but no record of this has come to light." Based on this possibility, they felt the mine probably only had to improve an existing road to begin freighting via St. Thomas. All that is known for certain is that, in anticipation of increased farm and mine traffic from St. Thomas to the new railhead at Moapa, a new road was built between Overton (just north of St. Thomas) and Moapa in early 1905 that reduced the hauling distance by four or five miles, but the mine had already started hauling to Moapa on the old Muddy Valley road before this new one was ready. Belshaw and Peplow, *Historic Resources Study*, 76, 166; "New road to Moapa," *Salt Lake Herald*, Mar. 31, 1905, 7.

<sup>89</sup> J. H. Manderfield, San Pedro, Los Angeles, and Salt Lake Railroad Co. traffic department to Grand Gulch Mining Co., Apr. 23, 1912, NSM; Hill, "Grand Gulch Mining Region," 39.

Grand Gulch Mine in April 1907. Their plan was to build the 25-mile stretch between Moapa and St. Thomas first – to ease shipment through the agriculturally active but seasonally muddy Muddy Valley – then to extend the line the remaining distance to the mine. This branch line was still being planned in 1910, when the *Salt Lake Herald* predicted that its opening was “only a question of months, as the farmers have just agreed to fall to and help do the grading down the valley.” Work continued during 1911, when rising costs led the Overton Chamber of Commerce to ask the mining company to donate \$1,000 toward its construction. That fall, the mine stopped shipping ore beyond St. Thomas in anticipation of the line’s completion, and at least 200 tons stacked up at St. Thomas before a two-cents-a-ton increase in the price of copper led Walter Jennings in January 1912 to order Superintendent Callaway to hire teams to move the ore to Moapa for shipment.<sup>90</sup> In the end the line was completed with money from the Salt Lake Route, and the reduction it brought to the mine’s overall freight expenses allowed the Grand Gulch Mining Company to begin shipping its dumps of 16 to 20 percent ore to market. The mine shipped about 210 tons of this “second-class” ore, worth about \$8,400, over the Moapa to St. Thomas branch line in July 1912, and there was enough left on the dumps the following December to keep twelve to fifteen wagon outfits employed.<sup>91</sup>

1913, ca. 1915–1919, 1940s–1961: *Truck hauling*. In early 1913, the mining company purchased a 37-hp, 6-1/2-ton-capacity Saurer truck to see if mechanization could reduce the mine’s freighting expenses. During 1912, Walter Jennings had entertained sales pitches for a petroleum-burning tractor from the M. Rumely Engine & Thresher Company of Denver and for a gasoline truck from the International Motor Company. He decided to explore the purchase of the latter after Pierre Schon, the motor company’s Kansas City branch manager, personally visited the mine, travelled the road from St. Thomas, and declared glowingly, “Based on all records made by Saurer trucks in similar service, I will not be disappointed by the performance of a Saurer truck in the Grand Gulch mine, as conditions are as good if not better than in some cases where Saurer trucks have made a success.” Compared to team haulage rates of \$12.50 a ton, Schon calculated a truck could haul the mine’s ore to St. Thomas for \$3.49 to \$5.40 a ton.<sup>92</sup>

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<sup>90</sup> “Extension planned to Grand Gulch mines,” *Salt Lake City Inter-Mountain Republican*, Apr. 24, 1907, 7; “New road in Nevada,” *Salt Lake Herald*, Apr. 24, 1907, 13; “Activity in Gold Butte region,” *Salt Lake Mining Review*, Apr. 30, 1907, 9; “Grand Gulch ships \$10,000 ore,” *Salt Lake Herald*, Nov. 12, 1910, 12; Samuel Pixton to W. P. Jennings, June 8, 1911, NSM; “Grand Gulch shipping,” *Washington County News*, Jan. 4, 1912, 1; “The Grand Gulch,” *Mohave County Miner*, Jan. 6, 1912, 3.

<sup>91</sup> “New branch line taps rich district,” *Salt Lake Telegram*, May 3, 1912, 3; “Moapa line open,” *Beaver City Weekly Press*, May 24, 1912, 1; “Mines of the county,” *Mohave County Miner*, June 8, 1912, 3; “New road reduces haul to 45 miles,” *Mohave County Miner*, Aug. 17, 1912, 1; “Grand Gulch and vicinity mines,” *Salt Lake Herald*, Dec. 27, 1912, 12.

<sup>92</sup> “Grand Gulch Mine in more rich ore,” *Washington County News*, May 22, 1913, 1; “Mines of the county,” *Mohave County Miner*, Dec. 14, 1912, 3. George D. Shields, M. Rumely Engine & Thresher Co., to W. P. Jennings, May 31, 1912; Shields to GG Mining Co., June 15, 1912, June 20, 1912, and July 6, 1912; Pierre Schon, “Report of road conditions existing from St. Thomas, Nevada, to Grand Gulch Mine,” Dec. 24, 1912, all NSM.

The Saurer truck had a custom-built dumping body mounted on a standard chassis. On the maker's recommendation, the dumping mechanism was omitted to save weight, as the truck would only need to dump its load once during each 90-mile round-trip, and a simple derrick was supplied, to be set up near the Virgin River, to tilt the body when needed. The truck's chassis was built in Plainfield, New Jersey, and its body in Kansas City, Missouri. The whole was assembled in Kansas City in January and February 1913 and shipped to St. Thomas by rail on March 1, 1913.<sup>93</sup>

The road to St. Thomas was fixed up specifically to improve its surface for truck operations, but the vehicle's performance was mixed, nonetheless. While the truck could make the round trip from St. Thomas to the mine and back in 20 hours (at an average speed of 4-1/2 mph), which compared favorably to the five-and-a-half days needed by the wagon teams, it burned a great deal of fuel, quickly wore through tires, and broke down frequently. Because the truck could not ford the Virgin River, a chute had to be set up on the east side of the river where the truck was offloaded. A contractor, W. F. Murphy, then hauled the ore with horse teams across the river and over the remaining two miles of road to the St. Thomas depot. During the truck's first month in operation, it ran 500 miles, consuming 300 gallons of gasoline, 35 gallons of petroleum distillate, and about 17 gallons of oil, all to carry 10 tons of ore and put in a week's work hauling material to repair the road. Problems were encountered with the steering crank (which broke on the third trip out), the radiator, the springs, the fan belt, and the hand throttle, and the inner rear tires wore out, mostly because of the rough and sandy road. These difficulties were compounded by problems with the hand-picked driver Schon had sent out from Kansas City.<sup>94</sup> Walter Jennings's complaint provides a window into the temperament and mechanical acumen needed to work in the desert,

I have come to the conclusion that the man Schon sent to run the truck is not just the man we want. He is not familiar with roughing it enough to handle the truck in this kind of a country. . . . Forty five miles is a long stretch of country and a driver should be able to make simple repairs on the road – camp out if necessary – not get excited and be more or less resourceful. He should be capable of taking care of himself as well as understanding his car thoroughly. [C. L.] McCallum, our driver, seems lacking in nearly all these essentials. He may get use to roughing it and seems willing to try but he is anything but resourceful and don't handle his tools like a man who claims to be a mechanic. He is excitable and nervous and while he has pretty good grit he lacks judgment.<sup>95</sup>

The driver was let go after a month. The mine continued to use the truck with a local driver through the spring and summer, but discontinued the experiment in the fall because of

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<sup>93</sup> Pierre Schon to P. J. Moran, Jan. 30, 1913; Schon to Jennings, Jan. 31, 1913; Schon to Jennings, Mar. 5, 1913, all NSM.

<sup>94</sup> "Grand Gulch Mine in more rich ore," *Washington County News*, May 22, 1913, 1; Albert Murphy to W. P. Jennings, June 30, 1913; P. J. Moran to Pierre Schon, Mar. 28, 1913; Jennings to Schon, Apr. 20, 1913, all NSM.

<sup>95</sup> W. P. Jennings to P. J. Moran, Apr. 14, 1913, NSM.

continued mechanical and tire problems.<sup>96</sup> Throughout this time, the company continued to hire horse teams to carry supplies and mail to the mine.

By 1915, it seems the company had returned to using trucks, although no information has been found about them. When a bridge was completed over the Virgin River outside St. Thomas in April 1915, the *Washington County News* reported that its "steel structure . . . enables the big trucks of the Grand Gulch company to haul ore from that mine direct to the railroad, instead of having to shift the loads from the trucks to teams at the river." The road between the mine and the town was improved at the same time, and the bridge further reduced the cost of hauling, allowing a lower grade of ore to be shipped than had been possible previously.<sup>97</sup>

The ore removed from the mine in the 1940s and 1950s was undoubtedly taken out by truck, although again nothing concrete is known. The route driven by this date is also not certain, as the town of St. Thomas was submerged under the waters of Lake Mead in the late 1930s and ceased to be viable shipment point.

### **The Roads**

The historic road from St. George to the mine began along the track now largely followed by modern BLM road 1069. About 19 miles south of St. George the road went up Quail Hill by way of the Mokaac (or Quail) Dugway, turning southwest after Wolf Hole. Heading through St. George Canyon to Hidden Canyon, it passed Lynx (Link), Garden, and Hidden Springs on its way past Poverty Mountain through Parashant Wash to Pigeon Canyon. This canyon carried the road west past Pigeon Spring to the mine. As far as can be determined, this route, probably with minor variations, has consistently been used to link the mine to St. George from the 1870s to the present.

Geologist James Hill described the road from St. Thomas that the mine began using in 1905:

The road crosses Virgin River by a ford 2 miles east of St. Thomas, beyond which an ascent of 1,300 feet in 16 miles along the bottom of a narrow canyon [Mud Wash] carries it to the summit of Bitter Springs Pass over the Virgin Mountains. The road continues on the south bench of Black Canyon [Black Wash] to a point about 2 miles from Grand Wash, which is crossed at either the Willow Spring or the Pakoon Well crossing. For about 6 miles east of the crossing the road passes over the low bench of Grand Wash to the base of the Grand Wash Cliffs, 1,250 feet high, which are ascended by a tortuous but well-constructed grade, up a narrow canyon that opens to the north. The mine is about 2 1/2 miles south of the place where the road reaches the top of the first line of cliffs, but to avoid a deep canyon a detour of 4 miles is made to reach the camp.<sup>98</sup>

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<sup>96</sup> Jennings to Pierre Schon, Apr. 20, 1913; Callaway to Jennings, July 13, 1913 [postscript dated July 16], both NSM. Hill, "Grand Gulch Mining Region," 41.

<sup>97</sup> "Mining on the Strip," *Washington County News*, Apr. 22, 1915, 1; "Bridging the Virgin River," *ibid.*, 8.

<sup>98</sup> Hill, "Grand Gulch Mining Region," 41.

Pierre Schon found in December 1912 that the first two miles of road leading out of St. Thomas were easy and solid, crossed only by a few irrigation ditches, but he encountered about a half mile of quicksand near the Virgin River and found the river bed to be quicksand also.<sup>99</sup> Harry Howell, a St. Thomas freighter, described the unpredictable river crossing.

The freighters never knew just how they would find the old Virgin River. Sometimes the water would be deep on one side of the stream, the next time they would find it all running against the opposite side of the river, or they might find it a running in the center of the channel. As the river changed its course it left soft peaks and bars of treacherous quicksand. This made it so the loaded freight outfits had to drop the trail wagons and pull only part of their load across the river. They would make two or three trips to get their loads across the stream. When there was a flood in the river the outfits were tied up on the banks of the stream for days at a time waiting for the high water to run down so they could make the crossing.<sup>100</sup>

After crossing the river, the track through Mud Wash was 20 miles of winding gravel, uphill at about a 3 percent grade. "The walls on either side are very steep," Schon wrote, "and some places the passage through the canyon is very narrow." Historians Mike Belshaw and Ed Peplow described how, after crossing the Virgin Mountains, "the freighters came to a red sandstone valley where outgoing crews cached hay and grain in pockets high out of reach of cattle. To identify their stores, the teamsters carved or painted their names on the sandstone."<sup>101</sup> The road passed only a few water sources: Red Bluff Spring (which Hill called Bitter Springs), Mud Well, and, depending upon the way one chose to cross Grand Wash, either Willow Spring or Pakoon Well. The first two springs were only good for watering horses because of the strongly purgative minerals in the water. The round trip from St. Thomas to the mine took about a week.<sup>102</sup>

Walter Jennings wrote in 1911 that "the roads, though long, are kept in good condition and are better than most freight roads of shorter length."<sup>103</sup> In fact, the road to St. Thomas was maintained largely at the company's expense, and it routinely hired the same men who did its hauling to work on the road.<sup>104</sup> In a typical report, Callaway wrote to Jennings in 1913, "I sent

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<sup>99</sup> Pierre Schon, "Report of road conditions existing from St. Thomas, Nevada, to Grand Gulch Mine," Dec. 24, 1912, NSM.

<sup>100</sup> Harry E. Howell, *Expressions of Harry Howell*, quoted in Belshaw and Peplow, *Historic Resources Study*, 126.

<sup>101</sup> Pierre Schon, "Report of road conditions existing from St. Thomas, Nevada, to Grand Gulch Mine," Dec. 24, 1912, NSM; Belshaw and Peplow, *Historic Resources Study*, 128.

<sup>102</sup> Walter R. Averett, *Beyond the Ranges* (Grand Junction, Colo.: W. R. Averett, 1997), 97, 99; Hill, "Grand Gulch Mining Region," 41. Other sources say trip took 5-1/2 or 6 days: Hopkins, "Wagon freight business made anything else look easy," *Las Vegas Review Journal*, May 12, 2005.

<sup>103</sup> Jennings, "Grand Gulch Copper Mine," 269.

<sup>104</sup> References to work on the road appear in NSM in Sam B. Gentry to W. P. Jennings, May 16, 1910; Gentry to Jennings, Oct. 18, 1910; Gentry to Jennings, Mar. 11, 1912; Callaway to Jennings, May 21, 1913; Gentry to Jennings, June 16, 1913.

down to St Thomas to see if we could get a team to come out and fix the road around the red nole [sic] this side of mud which is in a bad shape and they said they thought Jess O'Donnell would come out and fix it. . . . I have the Co. team and two men down fixing the road across pagoon [Pakoon]. I expect them back tonight."<sup>105</sup> In 1911, the Mohave County Board of Supervisors granted the mine's request to keep the road taxes it collected from its employees and spend them on repairs to the road, an arrangement that was repeated in 1913.<sup>106</sup> This money probably formed part of the \$6,000 the company invested in improving the road in 1912, rebuilding about twelve miles of it in the process.<sup>107</sup>

### Freighting

St. George residents Wallace B. Mathis, John Sturzenegger, and James Pectol ran stage or jitney service for the mine after the turn of the century, carrying passengers and supplies to and from St. George. The service took two or three days in each direction, and the mine paid between \$5 and \$7.70 per passenger. Ivy Stratton recalled "they made the trip whenever more men or supplies were needed."<sup>108</sup>

Before 1905, the mine hired St. George teamsters, farmers, and farm laborers to haul ore. After the switch to a Nevada railhead in 1905, the mine began to rely on farmers from St. Thomas and its surrounding communities to work as freighters, "when not busy putting in or harvesting their crops." The very first summer the mine was shipping via St. Thomas, however, the farmers found better paying work, and the mine was forced to suspend operations for a few months for lack of freighters.<sup>109</sup> To prevent this from happening again, the company supplemented its seasonal hiring by contracting the St. Thomas general merchandise dealer Harry Gentry to run freight for the mine. The company also came to use its own buckboard to run supplies and mail in what Walter Jennings was able to characterize by 1911 as the mine's "own stage line." Ivy Stratton, who ran this wagon for a time, recalled leaving Grand Gulch every Tuesday, camping at Willow Spring overnight, and then returning on Wednesday.<sup>110</sup>

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<sup>105</sup> Callaway to Jennings, June 25, 1913, NSM.

<sup>106</sup> Ross H. Blakely to Grand Gulch Mining Co., Apr. 14, 1911; F. L. Hunt to W. P. Jennings, June 10, 1913, both NSM.

<sup>107</sup> Schon, "Report of road conditions existing from St. Thomas, Nevada, to Grand Gulch Mine," Dec. 24, 1912; Jennings to Schon, Apr. 20, 1913, both NSM.

<sup>108</sup> Milton Hokanson, Interview with Wallace "Wally" and Reed Miles Mathis, Jan. 24, 2005, transcript in PARA; Cox, *A Harsh Land and Proud*, 312. A notice for John Sturzenegger taking two men and a load of supplies to the mine appears in *Washington County News*, Mar. 12, 1908, 8. Discussion of Mathis running passengers to the mine appears in Callaway to Jennings, Dec. 1, 1913, and Callaway to Jennings, Dec. 6, 1913, both NSM. Prices of \$5, \$6, and \$7.50 appear on Grand Gulch Mining Co., purchase orders to John Sturzenegger, June 1, June 11, July 1, and July 19, 1907; Grand Gulch Mining Co., purchase orders to Jas. Pectol, Sept. 11, 1910 and Dec. 19, 1913; all Gordon Chappell collection, copies in PARA.

<sup>109</sup> List of ore freighters, June 25, 1900, NSM, folder: Misc. financial papers, May 1900–Oct. 1910; Jennings, "Grand Gulch Mine," 269; "Mining notes," *Salt Lake Herald*, July 25, 1905, 6; "Mining notes," *Salt Lake Herald*, Sept. 7, 1905, 6; "Dixie's fine copper," *Salt Lake Herald*, Dec. 31, 1905, 51.

<sup>110</sup> "Overton," *Washington County News*, Feb. 27, 1908, 5; "Mines of the county," *Mohave County Miner*, Mar. 21, 1908, 3; "Grand Gulch still shipping," *Washington County News*, Mar. 26, 1908, 1; Jennings, "Grand Gulch Copper Mine," 269; Cox, *A Harsh Land and Proud*, 312.

The freighters furnished their own wagons and draft horses as well as their own hay, grain, food, and water for both driver and horses. It took one bale of hay and two sacks of oats per day to provide for ten horses. The mine kept a certain amount of oats and hay on hand to supply jitney and freight drivers who needed some.<sup>111</sup>

The usual freighting outfit was an eight-horse team pulling three wagons, but six- and ten-horse outfits were also used. Typically, the outfits travelled in pairs, to allow the horses from each team to assist the other team on particularly steep hills. These outfits were called "jerkline" teams, after the single jerk rein the driver used to direct the leading horses. Each team hauled between eight and twelve tons, at rates in 1908 of \$16 to \$18 a ton and in 1913 of \$10 a ton. The mine was paying \$13.50 a ton in June 1916, when teams were short.<sup>112</sup>

Wagons and or teams were occasionally lost to mechanical failures, accidents on the steep grades, or washouts from sudden storms.<sup>113</sup>

The ore was not typically shipped loose but was tied into sacks at the mine to prevent losses from spillage during transport. The ore in these sacks was left at the railroad depot until enough to fill a car was on hand, at which time the ore would be emptied into the car and the sacks returned to the mine for reuse. A reporter for the *Salt Lake Herald* noted in 1910,

Sometimes upwards of 100,000 pounds of the ore are loose and dumped in sacks on the platform at Moapa, and when the through passenger trains stop there the tourists, attracted by the bright colors of the azurites and malachites, vie with each other to see who may steal the choicest specimens. In this way hundreds of pounds, doubtless of the rich ores, are lost to the company.<sup>114</sup>

Walter Jennings complained less about losing ore to tourists than about losing a great many empty sacks to damage and theft, prompting the railroad's agent at Moapa to reassure him at

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<sup>111</sup> Merle Frehner quoted in Belshaw and Peplow, *Historic Resources Study*, 131-33. Surviving receipts in Gordon Chappell's collection (copies in PARA) show not only large shipments of hay and oat to the mine, but also deductions from amounts owed to various wagon drivers for their use of these supplies.

<sup>112</sup> "Overton," *Washington County News*, Feb. 27, 1908, 5; "Bunkerville," *Washington County News*, Mar. 5, 1908, 1; Hill, "Grand Gulch Mining Region," 41; "Teams wanted," *Washington County News*, June 22, 1916, 8. William Averett described a jerkline freight team: "[T]he two horses next to the wagon, called the wheelers, were hitched to a short tongue. The next two horses were the pointers, and they steered the wagon; if the team had more than eight horses, there could be several sets of pointers. The sixes were next in front of the pointers, and, in an eight-horse team, the leaders were the next pair. All the horses in front of the wheelers were hitched to a [draft-]chain that ran between the horses." Averett, *Beyond the Ranges*, 98.

<sup>113</sup> Averett, *Beyond the Ranges*, 99.

<sup>114</sup> "Grand Gulch ships \$10,000 ore," *Salt Lake Herald*, Nov. 12, 1910, 12.

one point, "I have got your ore sacks all tied up in good shape now and will send them out on the first team so the hobos will not untie them and use them for beds."<sup>115</sup>

#### D. Workers

The Grand Gulch Mining Company employed both men and women to keep the mine in operation. Men were hired as engineers, miners, ore sorters, timbermen, teamsters, blacksmiths, muckers, topmen, carmen, and water boys. Women were hired as cooks and dining-room help. The earliest known surviving payroll, from December 1904, lists fourteen employees and gives the cooks' and water boy's wages as \$1.00 per day. The topman and carmen earned \$1.50 a day, and the miners, timberman, and engineer earned \$2.00. The company allowed the cooks free board, but charged everyone else \$1.00 a day. By December 1906, after a change in ownership, the company paid its miners, muckers, ore sorters, and teamster \$3.00, the timberman and engineer \$3.50, and the blacksmith \$4.00. The cooks received \$35.00 per month, prorated, while the superintendent was paid \$150.00 per month, not prorated. Everyone, save the cooks and superintendent, continued to be charged about \$1.00 a day for board.<sup>116</sup>

The number of men and women employed at the mine fluctuated over time. A surviving time book covering a thirty-two month window from January 1909 to August 1911 lists between six to twenty-two people working at the mine at any given time; as Superintendent Callaway, who kept the book, is never listed, these numbers should be adjusted to a low of seven and a high of twenty-three. Working with this correction, the average number of workers per month during this period was seventeen; the median number was eighteen and one-half. In all but two months—February and March 1910—the mine had fourteen or more employees on site.<sup>117</sup>

Worker numbers quoted in newspaper accounts suggest a similarly sized force worked the site before 1909. There were twelve men there in December 1899, seventeen in April 1900, and fifteen in October 1908. During the 1910s, the number of workers generally increased. Geologist James Hill counted fifty men at work during a November 1913 visit, and a newspaper count four months later found thirty men. There were seventy-five working in June 1916—the largest number documented—but only sixty men the following summer. It is unclear if this and other numbers from press reports count the women who consistently worked at the mine throughout its existence.<sup>118</sup>

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<sup>115</sup> Quote from J. A. Enger to W. P. Jennings, Oct. 12, 1909, NSM. For other references to sacks being ordered or damaged, see W. B. Jennings to Repps Bros., Dec. 23, 1909; Jennings to Enger, Dec. 23, 1909; S. R. Callaway to W. B. Jennings, May 15, 1910, all NSM. When the mine ran out of bags in 1910, Superintendent Callaway started having the ore placed in barley sacks; Callaway to Jennings, May 29, 1910. In another letter, Callaway says the sacks are 25" long by 15" wide, but it is not clear if he means the regular ore sacks or the temporary barley sacks; Callaway to Jennings, June 5, 1910, NSM.

<sup>116</sup> Grand Gulch Mining Co. payrolls for December 1904 and December 1906, Gordon Chappell collection, copies in PARA.

<sup>117</sup> Grand Gulch Mine Time Book, 1909–11, n.p., Washington County Library, St. George, Utah.

<sup>118</sup> "Grand Gulch shipment," *Deseret Evening News*, Dec. 2, 1899, 8; "Ariona [sic] copper fields," *Salt Lake Herald*, Apr. 12, 1900, 6; "Dips, spurs and angles," *Salt Lake Mining Review*, Oct. 15, 1908, 17; Hill, "Grand Gulch Mining Region," 42; "Grand Gulch opens \$100 copper ore," *Washington County News*, Mar. 12,



Many relatives worked together at the Grand Gulch Mine. Geologist Hill noted that all the workers he counted in 1913 were from St. George, Utah.<sup>119</sup> As far as can be ascertained from federal census records, virtually all of the seventy-one individuals listed in the 1909–11 time book were from Utah, and the majority were from St. George.<sup>120</sup> At least two-thirds of the people named in the book were related to others named in the book. For example, superintendent Samuel R. Callaway, whose wife and children lived in Provo, Utah, supervised his brother-in-law Julius C. Keate (employed as an engineer), his nephew Ross Keate (an ore sorter), and his son R. W. Callaway (probably an ore sorter) at the mine during this period. Other family groups included Heber Barron and his sons Frank and Lafayette (called Lafe); John, J. T., and Peter Nielson; Wilford, Louis, and Oliver Bleak; Joseph and Oliver Stratten; William W. McArthur and his son Arthur McArthur; Gilbert P. Hardy and his wife Mattie; David J. and Nellie Moss; Charles and Emma Carpenter; Susie Pulsipher and her son Harvey (her daughter Rene had worked at the mine in 1907); William Faucett (or Fawcett) and two of his daughters, Maida and Ruth (later his son William, Jr., came out, after the daughters had gone home); Will Pearce and his wife Ida (later his brother Lamar came out); and Joseph Empey, Jr., and his sister Bessie (later brothers William and Clifford came out). A less obvious family connection linked engineer Joseph C. Judd and timberman Matthew Gray, who was Judd's sister's brother-in-law.<sup>121</sup>

Other female employees are known beyond those listed in the 1909–11 time book. The *Washington County News* noted in April 1908 that “Mrs. Caroline Myers and daughter Carrie left for Grand Gulch Tuesday. They will have charge of the boarding house at the mine there.” Mrs. Elliot Snow traveled from Panaca, Nevada, via St. George to join her husband at the mine in the

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1914, 1; “Grand Gulch listed,” *Salt Lake Telegram*, June 6, 1916, 13; “Grand Gulch camp being cleaned up,” *Washington County News*, Aug. 9, 1917, 1.

<sup>119</sup> Hill also described the entire workforce as “white.” At least one employee, cook Susie Pulsipher, is known to have been American Indian, and her daughter Rene and son Harvey, who also worked at the mine, were at least one-half Indian. Tellingly, the mining company asked the Mohave County, Arizona, assessor about the tax liability of “half-breed Indians” in April 1911, when Harvey Pulsipher was on the payroll; F. L. Hunt to W. P. Jennings, May 13, 1911, NSM. Hill, “Grand Gulch Mining Region,” 42; Cox, *A Harsh Land and Proud*, 313; Grand Gulch Mining Co. payroll for July 1907, Gordon Chappell collection, copy in PARA; Grand Gulch Mine Time Book.

<sup>120</sup> Virtually everyone associated with the mine in the 1909–11 time book is listed as a Utah resident in the 1910 federal census, despite the fact that the time book positively locates many of them at the mine, in Arizona, on census day. This reveals the strength of family and community bonds in predominantly Mormon southern Utah and suggests that the mine was an extension of the LDS farm-settlement patterns identified by geographer Herbert E. Gregory: “The farmer lives on a town lot, which constitutes his garden and orchard, and goes back and forth to his dry land or irrigated tract at various distances and directions from home. Likewise, stockmen live in the villages and only in the summer season occupy wagon camps or cabins where their sheep and cattle may receive closer attention.” Herbert E. Gregory, “Population of Southern Utah,” *Economic Geography* 21, no. 1 (Jan. 1945): 29–30.

<sup>121</sup> Family relationships established through research in the federal census schedules for Washington County, Utah, for 1900, 1910, and 1920. Census research also revealed that Malcolm Pymm, brother of John Pymm, foreman for prominent regional cattle baron Preston Nutter, worked at the mine for a time; Grand Gulch Mining Co. payroll for April 1910, Gordon Chappell collection, copy in PARA.

fall of 1916.<sup>122</sup> Lydia Stevens, who worked as a waitress at the mine in the 1910s, remembered the cooking of colleague Margaret Averett, who started in May 1911. "I'll never forget the good raisin pies that she made," Stevens also recalled. She continued,

I washed dishes, made cakes and set the bale and helped with everything that had to be done. The table was full of men at mealtimes, and we watched the water men come and go. . . . We worked seven days a week, but our evenings were free. There was a small library there, and I read books.<sup>123</sup>

Athole Milne, who worked at the mine at the same time, remembered that "most of the workers stayed out there for six months at a time and had to furnish their own barbering, entertainment, etc." In his opinion the food was "wonderful," in no small part because the mine "had the privilege of sending a couple of men out on the range and killing a beef whenever desired." Callaway would report the kill to the animal's owner, turn in the hide, and pay the rancher for the meat.<sup>124</sup> The mine bought beef from a variety of area ranchers over time, including Preston Nutter, Wallace Mathis, and John Sturzenegger.<sup>125</sup> Callaway complained in 1910 that Sturzenegger, whom he called Stutz, "was so busy with his cattle that he could not get time to bring us in a beef so I got him to kill one and I went up, and stayed over night and fetched it down next morning."<sup>126</sup> Three years later, Callaway reported that acquiring beef "takes 1 1/2 days to go and get it and we have to pay 9 c [a pound] . . ." <sup>127</sup>

Aside from beef, the mine's employees subsisted on dried and canned foods shipped in from a diverse range of suppliers in St. George, St. Thomas, and Salt Lake City. They had limited access to fresh fruit and vegetables, although potatoes, onions, and, from 1908, cantaloupes grown in the Moapa Valley, were consumed when available.<sup>128</sup> They also had fresh eggs from the "little chickens" Superintendent Callaway kept at the mine. He also kept, as he wrote Walter Jennings

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<sup>122</sup> "Local and general news," *Washington County News*, Apr. 2, 1908, 4; *Washington County News*, Nov. 16, 1916, 1.

<sup>123</sup> Cox, *A Harsh Land and Proud*, 317.

<sup>124</sup> Milne also specifically remembered Maggie Averett's raisin pies, noting, "She was a wonderful cook"; Cox, *A Harsh Land and Proud*, 310-11.

<sup>125</sup> Grand Gulch Mining Co., purchase order to Preston Nutter, Nov-Dec. 1899; check to "Walace Mathews" [Wallace Mathis] for beef, Feb. 14, 1910, both NSM. Purchase orders to John Sturzenegger for beef, June 1, June 11, July 1, July 19, 1907; check to Wallace Mathis for beef, July 13, 1907; purchase orders to Wallace Mathis for beef, Aug. 18, Sept. 11, 1910; all Gordon Chappell Collection, copies in PARA.

<sup>126</sup> On this jaunt, Callaway "laid awake most all the latter part of the night watching the Comet [i.e., Halley's Comet][;] it was the morning of the 18th[;] it has showed up grand in the east of morning but in the evenings the moon shines to bright to see it very good." S. R. Callaway to W. R. Jennings, May 22, 1910, NSM.

<sup>127</sup> Callaway to Jennings, June 30, 1913.

<sup>128</sup> "California cantaloupes," *Market Growers Journal*, June 3, 1908, 4.

in 1910, "6 little pigs and I think I will have about 20 more pigs pretty soon. I have contracted Six pigs to Wallace [sic] Mathis as soon as they get large enough."<sup>129</sup>

The mine's connection to the broader community of residents in the Arizona Strip is demonstrated by a Thanksgiving meal hosted at the mine in 1910. According to a newspaper report,

Wallace Mathis, who recently returned from the vicinity of the Grand Gulch mine, brings word that the miners employed at the gulch had a splendid time Thanksgiving day. Supt. S R Callaway, of the Grand Gulch mine invited every cattleman and anybody else who happened to be near that isolated spot to come in and partake of the dinner, which was an exceptionally good one. And they had candy, nuts, oranges and apples, and lots of other good things.

Mr. Calloway [sic] has expressed the intention of having a similar feast on Christmas day and other holidays.

It is such things as this that lessens [sic] the hardship of being so far from home and kin on these occasions, and the mine management is to be commended for thus remembering its employees.<sup>130</sup>

#### **D. End Product**

With some exceptions during the mine's early years, the ore from the Grand Gulch Mine was shipped to smelters outside Salt Lake City for reduction to copper bullion. This metal was then sold to eastern refiners who made it into a wide variety of alloys and materials for manufacturing and industrial purposes, particularly copper wire for the nation's rapidly expanding power, light, and communications infrastructures. In 1881, the Salt Lake City agent for Pope, Cole & Company, owners of the Baltimore Copper Works, purchased a shipment of Grand Gulch copper. In 1900, J. C. Griffith, the Salt Lake representative of Chicago Copper Refining Company, bought metal from Grand Gulch and shipped it to the company's works in Blue Island, Illinois. No other confirmed buyers have been found, but many are likely.<sup>131</sup>

Two sources give composite totals for production from the mine over time. When the Grand Gulch Mining Company was first listed with the Salt Lake Stock and Mining Exchange, it released figures stating that from the fall of 1899 to mid 1916, the mine had sent 10,273 tons of ore to market for a net return of \$670,109.48. In 1952, Bureau of Mines commodities specialist Paul Luff calculated that the mine shipped 15,701 tons of ore between 1901 and 1951, yielding

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<sup>129</sup> S. R. Callaway to W. R. Jennings, May 22, 1910, NSM. Invoices, receipts, and correspondence about supply purchases appear throughout the NSM collection. See also an inventory dated Dec. 31, 1918, that details all the mine's food stores at that time.

<sup>130</sup> "Had good Thanksgiving," *Washington County News*, Dec. 1, 1910, 1.

<sup>131</sup> "Copper," *Ogden Daily Herald*, Sept. 22, 1881, 2; "Grand Gulch shipment," *Salt Lake Herald*, May 11, 1900, 6. Another reference to the mine shipping "a large amount of copper" to Baltimore over time appears in "Dixie and its wealth," *Salt Lake Tribune*, July 5, 1896, 5.

6,651,610 pounds of copper, 24,349 ounces of silver, and 715 pounds of lead. (See Appendix II for Luff's numbers.)<sup>132</sup>

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<sup>132</sup> "Grand Gulch listed," *Salt Lake Telegram*, June 6, 1916, 13; Paul Luff to A. J. Martin, March 31, 1952, DMMR. Luff's numbers appear to form the basis for matching numbers given in Lane, *Mineral Investigation*, 5.

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**Appendix I:**  
**Production Statistics for Grand Gulch Mine,**  
**Mohave County, Arizona, 1901-1951<sup>133</sup>**

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)
1901	387	—	1,935	371,520	—
1902	398	—	1,991	383,318	—
1903	—	—	—	—	—
1904	—	—	—	—	—
1905	50	—	153	30,226	—
1906	460	—	1,157	201,490	—
1907	946	—	2,937	506,766	—
1908	538	—	1,998	333,029	—
1909	502	—	1,890	311,475	—
1910	710	—	2,840	503,496	—
1911	344	—	464	215,175	—
1912	1,152	—	1,332	430,864	—
1913	1,562	—	1,256	512,234	—
1914	1,049	—	2,172	487,997	—
1915	823	—	1,176	451,189	—
1916	3,159	—	862	853,705	—
1917	2,417	—	927	642,483	—
1918	931	—	406	277,500	—
1919	184	—	644	99,286	—
1920-41	—	—	—	—	—
1942	36	—	105	18,379	305
1943	27	—	59	11,958	336
1944	—	—	—	—	—
1945	—	—	—	—	—
1946	10	—	21	3,889	—
1947	—	—	—	—	—
1948	4	—	10	1,187	—
1949	9	—	11	3,812	—
1950	—	—	—	—	—
1951	3	—	3	632	74

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<sup>133</sup> Statistics from U.S. Department of the Interior, Bureau of Mines, Statistics Branch, Salt Lake Section. Quoted in Paul Luff, letter to A. J. Martin, March 31, 1952, DMMR.

**Appendix II:  
 Value of Property at Grand Gulch Mine,  
 1909, 1910, 1913<sup>134</sup>**

	1909	1910	1913
Improvements on mining claim	\$1,000.	\$1,000.	\$1,000.
Mining machinery	1,500.	1,500.	1,000.
Engine			500.
Improvements at Pigeon Spring	50.	50.	
Improvements at Jennings Spring	50.	50.	
Pigeon and Jennings Springs			50.
Assay outfits			10.
Furniture	100.	100.	75.
Lumber	500.	250.	100.
Merchandise / goods	50.	50.	75.
Tools	150.	150.	150.
Buggies	2 - 100.	2 - 100.	2 - 100.
Wagons	2 - 150.	2 - 100.	2 - 100.
Dump truck			none given
Work horses	4 - 200.	4 - 200.	2 - 125.
Harnesses and saddle	50.	50.	2 & 1 - 50.
Grain			50.
Hay			50.
Swine	8 - 40.	6 - 30.	11 - 55.
Poultry	30 - 7.50	60 - 15.	100 - 25.

<sup>134</sup> "Tax list filed 1909–1910" and "Tax list returned for 1913," both NSM.

**Appendix III:  
Shareholders of the Grand Gulch Mining Company  
and their dividend payments, ca. 1900<sup>135</sup>**

T. W. Jennings	\$238.95
F. W. Jennings	186.05
Jas. A. Jennings	190.05
Irene M. Jennings	219.70
Martha B. Jennings	186.80
Jane Jennings Eldredge	186.80
M. C. J. Farlow	186.70
Priscilla P. Jennings	186.70
Mrs. P. P. J. Riter	186.80
W. P. Jennings	186.70
J. E. Jennings	188.95
Linda Judd Woolley	43.90
Richard Bentley	1.00
John Adams	5.00
Water E. Dodge	.80
Thos. J. Jones	11.50
Lavina Woolley	1.00
Mrs. J. S. Hyde	5.00
Isaac Jennings	1.00
Jos. C. Bentley	.10
A. A. Whitehead	1.00
Sarah L. Thurston	7.10
Artimesia Seegmiller	7.10
M. M. Snow	7.10
E. B. Snow	7.10

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<sup>135</sup> "Received from the Grand Gulch Mining Co.," [tally sheet], ca. 1900, NSM, folder: "Bills, Receipts, n.d."

**Appendix IV:**  
**Buildings and Structures at Grand Gulch Mine, January 1919<sup>136</sup>**

Engine House (40' x 40' frame)  
Distillate House  
Ore House  
Blacksmith Shop (22' x 17', stone)  
Storage powder magazine (9' x 12', stone)  
Powder magazine for everyday use (10' x 13', stone)  
Carbide magazine for everyday use (10' x 13', stone)  
Carpenter Shop (20' x 16', frame)  
3 tent frames on hill  
Ore bin (18' x 21')  
Ore bin (25' x 24')  
Ore shed (24' x 19')  
Ore platform (24' x 23')  
3 tent houses with tar paper roofing (12' x 12')  
3 tent houses with tar paper roofing (10' x 12')  
Tent frame (12' x 14')  
4 tent frames (10' x 12')  
6 tent frames (8' x 10')  
Wash house with paper roofing (14' x 10', lumber)  
Bunk house with three rooms (60' x 18', stone)  
Chicken run (284' perimeter, 7' high)  
Four-room chicken house (14' x 36')  
Buggy house (14' x 13')  
Barn (21' x 20')  
Barn (19' x 20')  
Hay and grain house (33' x 12')  
Oil house (6' x 6', lumber)  
Vegetable cellar (13' x 19', stone)  
Meat cellar (16' x 20')  
Kitchen, 2 dining rooms, and store (80' x 24', stone)  
Office (19' x 15', stone, with screen porch 6' x 15')  
5 tent houses with paper roofs (12' x 14')  
Tent house with paper roof (10' x 12')  
Iron water tank, 450 gallons

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<sup>136</sup> "General Inventory for Grand Gulch Mine for Machinery, Tools, Supplies, etc.," Jan. 31, 1919, NSM, folder: "Misc Financial Papers 2."

Figure pages

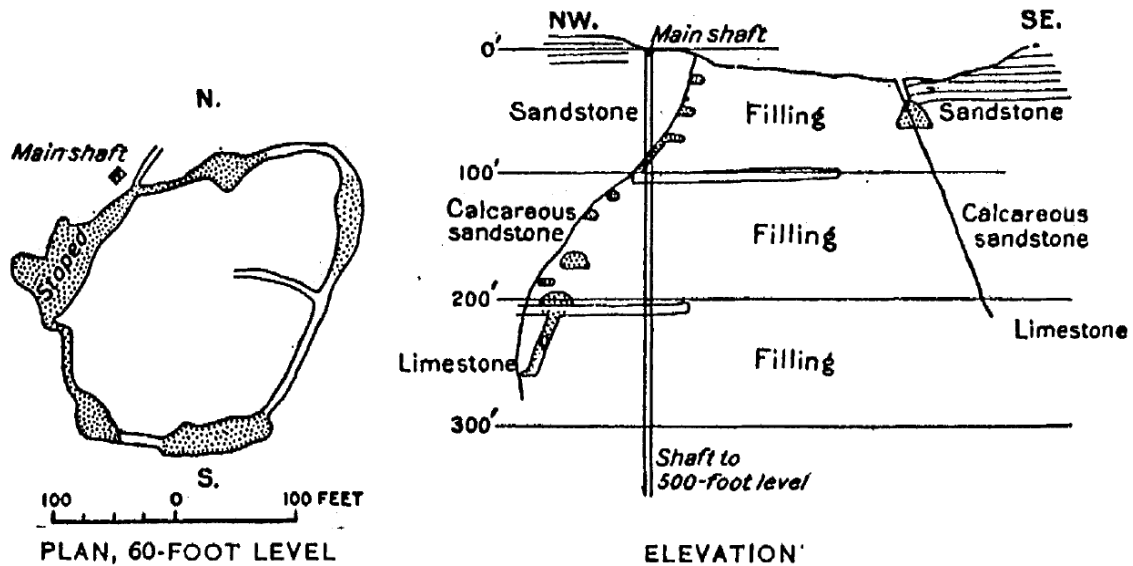


FIGURE 9.—Plan and elevation of the Grand Gulch mine, Mohave County, Ariz.

Fig. 1. This plan and section show the workings at Grand Gulch Mine in 1913. Digging followed the edge of roughly pear-shaped mass of breccia (marked "filling") approximately 200' to 300' across and about 230' deep. From James M. Hill, "The Grand Gulch Mining Region, Mohave County, Arizona," in *Contributions to Economic Geology 1913, Part I. Metals and Nonmetals except Fuels*, edited by F. L. Ransome and Hoyt S. Gale (Washington, D.C.: G.P.O., 1915), p. 47.





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Fig. 2. Advertisement for Fairbanks, Morse & Co. showing a gasoline hoisting engine similar to the one the Grand Gulch Mining Co. purchased in 1901. From the *Salt Lake Mining Review*, September 30, 1901, p. 8.