

ORPHAN LODE MINE

(Orphan Mine)

Grand Canyon National Park

North of West Rim Road between Powell Point and Maricopa Point,
South Rim

Grand Canyon Village vicinity

Coconino

Arizona

HAER AZ-67

AZ-67

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service

U.S. Department of the Interior

1849 C Street NW

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HISTORIC AMERICAN ENGINEERING RECORD

ORPHAN LODGE MINE (ORPHAN MINE) HAER NO. AZ-67

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Location: Grand Canyon National Park, North of West Rim Road between Powell Point and Maricopa Point, Grand Canyon Village vicinity, Coconino County, Arizona, in the SW quarter of section 14, Township 31 North, Range 2 East, Gila and Salt River Meridian, UTM: 12; 396442 mE, 3992235 mN (at headframe)

Date of Construction: Mining claim originally filed February 8, 1893. There was major development between 1953 and 1969.

Designer: Unknown

Builder: Development occurred sporadically from the 1890s until the 1960s. Original builders unknown. Centennial Contractors was involved in rebuilding the headframe after the 1961 collapse.

Present Owner: The National Park Service

Present Use: None

Significance: The Orphan Lode Mine site has been determined an eligible site for listing in the National Register of Historic Places (NRHP). The Orphan Mine is significant because it is associated with "events that have made a significant contribution to the broad patterns of our history" (1). With the discovery of uranium deposits, the mine was further explored and developed between 1953 and 1969, and was "one of the leading producers of high-grade uranium ore on the Colorado Plateau and of some of the richest uranium ore in the United States. Thus, the mine played an exceptionally important role in the development of the nation's nuclear capabilities during the Cold War" (2).

The Orphan Lode Mine (usually referred to from hereon as the Orphan Mine) has a long history, reaching back to the 1890s. The site has included copper mining, uranium mining, and a resort that changed hands numerous times over the years. For a number of years the resort and mine existed side by side, but eventually the vacation lodging was demolished and removed, and uranium mining—the activity that the site has become best known for—was the only activity on the property. Though the portion of the site located at the edge of the south rim of the Grand Canyon where most mining-related activities on the rim occurred (known as the Upper Yard) is fenced-off and is not accessible to the general public, an existing trail between Maricopa Point and Powell Memorial passes by it, and the Upper Yard is visible from both Maricopa Point and Powell Memorial, with the headframe towering over the surrounding piñon and juniper trees. Some of the lower workings far below the rim are visible from Maricopa Point. Today the lower workings can only be reached on foot, accessed by a minimum two hour very difficult and potentially dangerous off-trail hike from Bright Angel Trail (3).

Because of its historical significance, the Orphan Mine has been determined eligible for listing in the NRHP under Criterion A and Criterion Consideration G. In addition, the Upper Yard has been determined eligible for listing in the NRHP under Criterion D. Much of the following background on the site and the headframe was taken from a 2002 Orphan Mine report by RMC Consultants (4), and discusses uranium mining in the area, a discussion necessary for placing the Orphan Mine in a larger context, and therefore illustrating the great importance of the mine (5). Following the uranium background is a history that outlines the physical development of the mine as it relates to the Upper Yard.

History of Uranium Mining on the Colorado Plateau

A German chemist, Martin Klaproth, discovered uranium in 1789, but the radioactive nature of uranium was not discovered until 1896 by Henri Becquerel (6). The first discovery of uranium in the United States was in 1871 by Dr. Richard Pierce. He found uranium in pitchblende deposits in the Central City Mining District, Gilpin County, Colorado. Dr. Pierce shipped 200 pounds of Central City pitchblende to London for research into its use in steel fabrication and pigments for dyes, inks, and stained glass. Ore was reportedly used by Ute and Navaho peoples on the Colorado Plateau as a pigment (7). Commercial uranium mining is a relatively recent development, with most of the exploration and mining taking place in the twentieth century. The history of uranium mining in the United States can be divided into five periods (8), which are discussed in the following section.

First Uranium Period (1871-1905)

The first period spans the years 1871-1905 (9). Early uses of uranium were as a glass and ceramic additive, the uranium giving these materials green and yellow coloration. Near the end of this period in 1898, Pierre Curie, Marie Curie, and G. Belmont isolated radium from pitchblende. In the same year, uranium was discovered in ores from the Uravan mining district of western Colorado and in Grand County, Utah (10). Uranium ores contain the closely related elements of radium and vanadium (11).

Second Uranium Period (1905-1925)

The period from 1905-1925 is referred to as the radium period, and it is during this time that the mining and milling of uranium ores for radium expanded across the Colorado Plateau, particularly in western Colorado and eastern Utah (12). After the discovery of radium by the Curies, the demand for radium increased as a treatment for cancer and for luminous paint. Luminous paint was used on watch dials and other instruments. In World War I, luminous paint was used on riflescopes, allowing the scopes to be calibrated at night. Factory workers painted the luminous dials by hand and became the first known people to suffer the effects of radiation poisoning. Vanadium, which is used as a steel alloy, was also being mined at this time, but the boom in vanadium production did not occur until the 1930s (13).

Uranium mining was concentrated in a 30-mile wide strip in western Colorado and eastern Utah (14). The mining of carnotite ores for radium, and secondarily vanadium, expanded rapidly. The uranium ore mines on the Colorado Plateau led the world in production until 1921 when uranium-rich pitchblende was discovered in the Belgian Congo (15). By 1925, the mining of uranium ores on the Colorado Plateau had dwindled to a very low production (16).

Third Uranium Period (1925-1945)

The period from 1925-1945 is characterized by vanadium mining and milling. In 1925, mining of carnotite ore for the extraction of uranium, radium, and vanadium was at low point. Vanadium use decreased as the demand for steel dropped after World War I (17). Most of the carnotite was mined for its uranium content, and small mills were operating near Naturita and Slick Rock, Colorado and in the Dry Valley and Henry Mountains areas of Utah. In 1936, vanadium production expanded due to an increasing demand for steel products. Demand increased greatly with the onset of World War II and the designation of vanadium as a strategic mineral (18). In 1928, only the United States Vanadium Corporation was producing vanadium (19). By 1935, most of the mines that had closed after the radium boom had reopened. Over the next decade, vanadium production continued to expand over the Colorado Plateau, but was primarily limited to Colorado and Utah.

The end of this period witnessed the beginning of government intervention into the strategic minerals market. In 1942, the federal government established the Metals Reserve Company (MRC) to encourage the production of vanadium and other strategic minerals. The U.S. Bureau of Mines and U.S. Geological Survey began to conduct mapping and exploratory drilling throughout the Colorado Plateau in an effort to help expand production (20). The MRC was shut down in February of 1944 as the demand for steel in World War II diminished. Perhaps the most important federal government intervention into the mining and milling of uranium was the establishment by the U.S. Army Corps of Engineers of the Manhattan Engineering District (MED) in 1942. This agency, commonly referred to as the "Manhattan Project," was established to develop atomic weapons and procure raw materials, principally uranium, to be used in the production of weapons. The MED established the Union Mines Development Corporation (UMDC) as a subsidiary of Union Carbide Company to facilitate the

procurement and development of uranium for use in atomic weapons (21). The UMDC set up offices in Grand Junction, Colorado to coordinate uranium development efforts on the Colorado Plateau (22).

Fourth Uranium Period (1945-1967)

The period from 1945-1967 is often called the government-uranium period (23). This period spans the Cold War and is characterized by the intervention of the federal government in the uranium market, the discovery of new uranium deposits, and the subsequent uranium boom across the Colorado Plateau. This also includes most of the period when the Orphan Lode Mine was mined for uranium ore. In 1946, the MED was replaced by the newly created Atomic Energy Commission (AEC), which continued the wartime strategic mineral program of its predecessor. The stated purpose of the AEC was to develop a domestic uranium industry and stockpile enough uranium for America's defense needs (24). Efforts to procure uranium in the years after World War II involved the reprocessing of vanadium mill tailings, and "massive prospecting effort[s] . . . from the Colorado Plateau to the entire western United States and, to a lesser extent, the eastern states" (25). In 1948, the AEC established an ore-purchasing program and set up 12 purchasing stations at various locations across the Colorado Plateau (26). In 1951, the base price for uranium was raised and production bonuses were added as a further incentive.

By 1952, uranium development was limited by the fact that most AEC geologists and prospectors believed that uranium on the Colorado Plateau was restricted to carnotite deposits, which had been the target of earlier radium and vanadium mining (27). In 1950, Charlie Steen, an unemployed geologist from Texas, set out to locate uranium deposits in southeastern Utah. In early July of 1952, Steen drilled through 14 feet of dirty gray strata before his drill bit broke off at 197 feet below the surface. Disappointed, he visited a local acquaintance, who passed a Geiger counter across the dirty gray material for fun. The needle pegged off the scale (28). Steen's discovery occurred in the Lisbon Valley of eastern Utah, where he went on to establish the Mi Vida Mine. Another discovery was made in northwestern New Mexico in 1950. Paddy Martinez, a Navaho shepherd, had picked up some interesting looking rocks in the Haystack Mountains near Grants. Analyzed at a later date, these rocks turned out to be uranium ore and started what became the Laguna and Ambrosia Lakes mining districts (29). These discoveries touched off a uranium boom across the Colorado Plateau. Stock market speculation was rampant and money poured into mining ventures in Colorado, Utah, New Mexico, and Arizona (30).

In the mid-1950s, nearly 2000 prospectors were searching for uranium deposits, and mill towns like Moab, Utah expanded rapidly to support the mining and milling operations (31). During the 1950s, new mills or converted vanadium processing mills were established to process uranium in locations throughout Utah, Arizona, New Mexico, and Colorado. Mills were also established to process uranium in areas other than the Colorado Plateau including Idaho, Missouri, Oregon, Texas, and Wyoming (32). It is not clear how many mines on the Colorado Plateau were exploited for uranium ore, but estimates range from between 500 and 800 to nearly 1300 on the Navajo and Hopi reservations alone (33). In Arizona, most of the uranium mines were located in the

Monument Valley, Four Corners, Chinle, Oraibi Wash, Winslow, and Cameron/Tuba City areas (34). The richest uranium deposits in Arizona are in breccia pipes. Breccia pipes are naturally occurring funnel or tube shaped formations that are filled with fragmented bits of rock that are “cemented” together. Thirteen breccia pipes in Arizona have been identified as containing uranium ore and another 40 have a high potential for containing ore (35). Of the 13, six have been mined for uranium, including the Orphan Lode (36). The Grand Canyon was unusual because the ore occurred “within a vertical, nearly circular breccia pipe which . . . has a mean diameter of approximately 230 feet . . . to a mean diameter of 400 to 500 feet” (37).

In 1957 ore reserves had grown to such an extent that the AEC announced that “it was no longer in the government’s interest to expand uranium concentrate production” (38). In 1962, the AEC began to scale back the procurement program and asked producers to defer delivery until 1967. Further adjustments in the program postponed additional deliveries until 1970. In 1970, the AEC ended the procurement program altogether, and uranium mining and milling became subject to the forces of the open market (39). The AEC ended the procurement program because a viable uranium industry had been developed and the nation’s stockpile of uranium for defense purposes was more than adequate.

Fifth Uranium Period (1967 – Present)

The commercial uranium period from 1967 to the present is characterized by the closing and consolidating of mines and mills, and the acquisition of uranium properties by larger companies (40). After the AEC ended the buying programs and price guarantees, most uranium mining was undertaken by private companies to support the growing nuclear power industry. The nuclear power industry did not develop as predicted in earlier years, and Canadian and Australian sources of uranium competed with American, resulting in a reduction in the number of mines and mills on the Colorado Plateau. The boom that had started in the 1950s went bust in the 1980s. Finally, this period is characterized by environmental cleanup through the Uranium Mill Tailings Remedial Action Project (UMTRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA—the Superfund law), and ongoing efforts to compensate those who worked in mines and mills for radiation caused illnesses (41).

History of the Orphan Lode Mine

Located at and below the edge of the south rim of the Grand Canyon, the mine was first worked at the end of the nineteenth and beginning of the twentieth centuries (42). The mining claim included land above the rim, and the rest of the claim extended “down the precipitous and desolate canyon walls to the north end of the claim some 1,100 feet below the rim” (43). The Orphan Mine is significant because of the role it played during the post World War II – Cold War era. With the discovery of uranium deposits, the mine was explored and developed between 1953 and 1969. The Orphan Mine became one of the leading producers of high-grade uranium ore on the Colorado Plateau, and of some of the richest uranium ore in the United States. Thus, the mine played a significant role in the development of the nation’s nuclear arsenal during the height of the Cold War (44). Furthermore, the Orphan Lode had many unique characteristics that made it an ideal

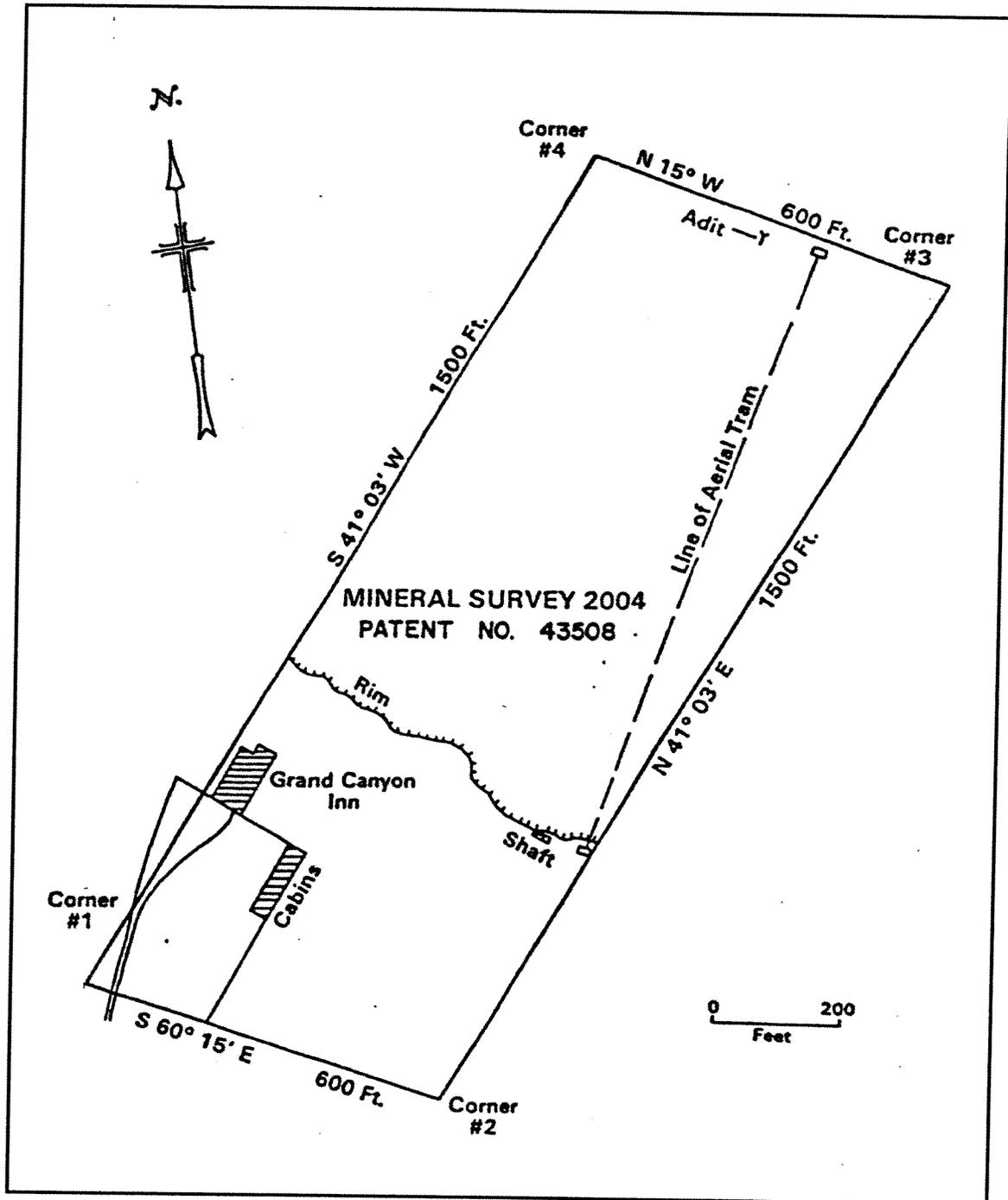
location “to test the various hypotheses proposed for the source and means of concentration of uranium in sediments of the Colorado Plateau” (45).

The Orphan Lode Mine began as a copper mine. After the gold mining frenzy had subsided in California in the mid-nineteenth century, miners cast their gaze east and many traveled to Arizona in search of precious metals (46). Gold was found in a number of rivers and creeks, and silver was discovered near Tombstone and Crown King. By 1888, silver and gold became secondary to copper in Arizona. Copper prices rose and copper was discovered in larger quantities, thus leading to a copper boom in Arizona in the 1880s.

Prospecting had occurred in the Grand Canyon as early as the late 1860s, but the Canyon’s extreme remoteness and harsh environment prevented large-scale mining for a number of years (47). In 1891, Daniel Hogan and Henry Ward were prospecting in the Grand Canyon, following the Colorado River, a river well known for having gold and copper deposits along its banks. There, between present day Maricopa Point and Powell Memorial lookouts, they found an outcrop of copper minerals 1,100 feet below the Grand Canyon rim at the base of the Coconino sandstone. On February 8, 1893, Hogan and Ward filed a mining claim on what would eventually become the Orphan Lode Mine, so named because Hogan was an orphan (48). Approximately six acres of the claim are on the canyon rim, the remainder is in the canyon itself (Figure 1). The two men made improvements on the site over the next 10 years.

By the early twentieth century, Ward sold his interest in the mine to Charles J. Babbitt, although Hogan seemed to be the one who was the most actively involved in activities at the mine (49). For many years, improvements at the mine did not include any sort of lodging at the lower workings, so Hogan camped on the rim, and accessed the lower workings via a rough trail, which included ladders, ropes, and steps cut into the rock. In January of 1905, John F. Hesse, the Deputy Mineral Surveyor, surveyed the improved mine site and determined that the claim contained 20.26 acres (which was found to be incorrect when resurveyed in 1961. The claim actually totaled 20.64 acres [50]). The claim was then patented in March 1906 to Hogan and Babbitt. Development at the mine consisted of a shaft and several adits and tunnels at the location in the canyon below the rim. Development on the rim was limited to two small corrugated metal buildings, and a barn. Shortly after the patent was granted, President Theodore Roosevelt issued two executive orders, which would serve to protect the natural beauty of the Grand Canyon. These Executive Orders made the Grand Canyon first a game reserve, then a national monument. These designations protected the Canyon in a number of ways, one of which was to prohibit prospecting and mining within the Canyon, except in areas that already had a patented claim. In February 1919, Grand Canyon National Park was established through an act of Congress. In August that same year, the newly formed National Park Service (NPS) took over the management of the park from the Forest Service.

Figure 1 – Early Mineral Plat of the Orphan Mine (51).



As the early twentieth century progressed, Hogan, a resident of Flagstaff, continued his mining activities, although in a more limited fashion (52). During this time he had several different partners, but Hogan remained the most actively involved partner in all of these partnerships. A 1951 survey of Hogan's original workings indicated that at the upper workings there was a

small pit about 5 feet deep . . . [at the] middle working . . . about 80 feet lower than the upper working . . . the main adit trended south 20° W for about 25 feet, and a 15 foot working branched from the main adit near the portal . . . The lower working was in the lowest outcropping . . . about 150 feet lower . . . [with] an adit [that] extended S. 55° – 50° W for 45 feet, then turned sharply and extended S. 28° E for 25 feet (53).

Hogan's copper mine was only worked sporadically over the years, and yielded small quantities of copper and even smaller amounts of silver and gold, which were impractical and cost prohibitive to ship for processing in small quantities and were difficult to get from the source area below the rim to the Upper Yard (54). There were numerous copper mines in other places in Arizona, as well as Utah and Montana, that were far more accessible, productive, and profitable (55). A photograph from 1931 shows the mine site and a sign which read "The Only Land on Rim for Sale – See Owner on ground or Ed Hamilton at Rowe Well" indicating that Hogan attempted to sell his property.

After about 45 years of limited mining success, Hogan set aside several acres for tourism in the southwestern corner of the upper workings, near the rim. To the concern of Park Superintendent Minor R. Tillotson, in the spring and summer of 1936 Hogan shifted his efforts to developing the tourist accommodations, and he converted the barn on the property to a tourist lodge called the Grand Canyon Trading Post (56). Over the next three years Hogan expanded the development to include the lodge; a power plant; a dugout storeroom; a garage; seven wood-frame stucco cottages; a large stucco structure containing garages, rest rooms, and a laundry; a 10,000 gallon water cistern; a septic tank; and a field drain. Water pipes and electric power lines were also installed (57). A dirt road led to the resort from West Rim Drive (58). What would later become the Upper Yard of the Orphan Mine was located to the east of the tourist development; two of the framed stucco cabins were also located in this area of the mine. The NPS regarded Hogan's resort—the only private property on the rim of the Grand Canyon—as a visual distraction and a nuisance. It could be seen clearly from the viewing areas at both Powell Memorial and Maricopa Point. Hogan sold his claim, including the resort, to Bertha Jacobs in August of 1946. She leased out the tourist facility, but did not attempt any mining. In 1951, the surface rights to the property were sold to David and James Barrington, who renamed the facility the Kachina Lodge. The Barringtons, unable to make a profit, withdrew from their contract with Jacobs in early 1954, and Jacobs then sold the property to William and Viola Grant later in 1954, who renamed the lodge the Grand Canyon Inn. Improvements to the property in 1954 included constructing a swimming pool near the rim and surfacing the access road from West Rim Drive with asphalt (59). The tourist resort remained in operation on this portion of the site until the 1960s (60).

In 1951, amateur prospectors discovered that the area where Hogan had stockpiled his copper ore was radioactive (61). This discovery led to the Orphan being examined by Harry Granger of the U.S. Geological Survey. He found that the Orphan contained high-grade uranium deposits. Jacobs leased the mineral rights to several small mining companies, but the difficult location of the mine (62) below the rim prevented the under-financed companies from developing the mine. In 1953, Jacobs leased the mine to Golden Crown Mining Company, a subsidiary of Western Gold and Uranium, Inc. (Western Gold) of New York City. Subsequent analysis of the ore body concluded that the Orphan uranium deposit was one of the 25 largest uranium deposits in the United States (63). The uranium boom across the Colorado Plateau had begun just a year earlier, and the high-grade uranium deposits were attracting investment capital.

In 1955, the company began exploratory drilling and mapping of the Hogan workings, and in February of 1956 began to improve the Upper Yard site; it erected a three-tower aerial tram to transfer men, material, and ore between the lower workings and the rim. The tramway elements on the rim included an elevated wood control and dump tower, and a hoist house and ore bin. The tram was soon determined to be inefficient, so it was replaced by a new one in May of 1956 that was powered by a 20 horsepower electric motor (64). The new tram was able to haul 800-pounds of material at a time, and took only four minutes to make the trip between the lower and upper workings. On productive days, the tram could move 45 tons of ore.

The first shipment of uranium ore was sent to the AEC ore buying station in Tuba City, Arizona on April 25, 1956. No processing of ore was conducted at the mine. The ore was trucked to Tuba City for processing by the G.L. Gibbons Trucking Company of Cameron, Arizona, and to several other locations in Utah, New Mexico, and Colorado. In November of 1956, Golden Crown acquired both the mineral rights and surface rights to the entire Hogan claim, and the Orphan Mine became the "only active mining operation within the boundaries of Grand Canyon National Park" (65).

Developments that took place in the Upper Yard in the later 1950s included construction of a number of corrugated metal buildings with cement slab foundations or concrete footings. These buildings included a lab building, warehouse, mess hall, recreation building, office, core house, timber and framing sheds, shop, and ore loading facilities. A 60,000-gallon water tank was built near the West Rim Drive access road, and an Atlas Copco air compressor was installed near the tramway tower. Two stucco cottages in the northwest portion of the yard were used as residences for the Assistant Mine Superintendent and another family. These cottages were two of the original tourist cabins built by Hogan. A Western Gold map of the Upper Yard in 1960 showed 23 buildings, including shops, a warehouse, office, geology department, and hoist house.

There was no room on the surface of the claim near the adit for disposal of mine waste, and the NPS did not allow for mine waste disposal on Park land, so some of the waste rock was used to backfill mined out areas underground (66). According to an article in the January 1959 issue of *Mining World*, waste rock from outside was brought in and disposed of this way (67).

By 1958, it became apparent that even the new tramway was limiting production. To increase production, a vertical shaft from the rim was needed to transport men, materials, and ore in and out of the mine. A 1,590-foot deep shaft was constructed from the canyon rim to the lower mine workings (68). The shaft had two hoisting compartments and a manway. An 80-foot high steel structure headframe was constructed above the shaft. The vast quantity of waste rock and dirt was taken and disposed of at a location offsite that Western Gold leased from the Forest Service. The Park Service also purchased some of the waste to use inside the Park for railroad and road grades. The aerial tram was not used to hoist ore after the shaft was completed, although the tram remained in use for several more years to transport men and material and provide emergency access to the lower mine area in the canyon. Perhaps as a result of the more efficient means of moving ore and men, the mine produced 3,072 tons of ore during the first quarter that year (69). This ore contained 30 tons of uranium that had an average grade of over 95%, which was four times higher than the national average. The mine was by far the top producing uranium mine in northwestern Arizona during the 1950s and 1960s, producing over 100 times more uranium than any other mine in the region (70).

Western Gold obtained a special use permit from the NPS in July of 1958 in order to build 2 ½ miles of roadway within the park (71). The new road linked the mine to the Atchison, Topeka & Santa Fe railroad. This provided easy access to the rail lines that could deliver ore shipment to mills located offsite in New Mexico.

The people who worked at the Orphan Lode Mine, with the exception of a few individuals, did not live at or adjacent to the mine; the limited size of the claim meant that the miners had to live elsewhere. As the mine's operations continued to grow, Western Gold established a mobile home park, known as Western Village, in nearby Tusayan to house its workers (72). Western Gold provided transportation to its employees to and from Western Village and the job site.

It appears that by 1960 the facilities in the Upper Yard were fully developed. At its peak in the mid-1960s, the mine employed approximately 100 workers, working two shifts a day (73). Subsequent modifications to the site were made as needed to repair or replace facilities. The only major new development on the site was the construction of a truck repair facility for the Gibbons Trucking Company in the area just to the south of the stucco cottages in the early 1960s. In December of 1961, the ore bin on the headframe collapsed, causing several hundred tons of ore to fall back down into the shaft (74). Repair costs were \$25,000 to \$30,000 and the mine ceased production for several months while the headframe was repaired. In addition, portions of the mine were largely mined out by late 1961, and the grade of ore from other portions of the mine was decreasing (75). By January of 1962, the ore stockpile on the surface of the mine was completely depleted, and the shipment of ore from the mine to the Tuba City mill consequently ceased. The lack of ore forced the Tuba City mill to close in May of that year (76). Western Equities, which had merged with Western Gold in 1961, believed that it had the legal right to mine ore outside the boundaries of the claim under NPS land (77). The entire situation became very controversial, and an act of Congress was required to settle the dispute. During this time Western Gold was even accused of "political blackmail" when it threatened to build an 800 room hotel which would literally "stair step" down the

edge of the rim and have a large swimming pool at the bottom. Western Gold proposed building the hotel if it was not granted permission to mine beyond the limits of its original claim under Park Service land (78). The proposal was enough to convince Congress to give the Orphan Mine bill the attention that Western Gold thought it deserved. On May 28, 1962 President John F. Kennedy signed Public Law 87-457 giving Western Equities the right to mine ore under park lands adjacent to the claim (79). The law included provisions that 1) all mining would be underground, 2) the aerial tram would be discontinued after two years, 3) the Orphan claim mineral rights and all remaining retained surface rights would be transferred to the federal government after 25 years (1987), 4) Western Equities could operate the Grand Canyon Inn until the end of 1966, at which time it would revert to the National Park Service, and 5) after 1966, Western Equities would have surface rights to only three acres in the southeastern part of the claim and no structures on the property could be over two stories in height.

Mining resumed at the Orphan in November of 1962 (80). Between 1963-66, production at the Orphan was at some of its highest levels, but in 1966, production levels dropped dramatically, and almost 60% of the uranium came from Park Service land that year (81).

In 1966, Western Equities changed its name to Westec Corporation. Following its bankruptcy declaration in 1966, Westec sold its Orphan Mine rights to Cotter Corporation in 1967, and Cotter Corporation operated the mine from 1967-69. They shipped the ore by rail to their mill in Cañon City, Colorado. The mine shut down in April of 1969; Cotter cited the depressed uranium market and high freight charges as the reasons (82). All of the useable equipment at the mine was transferred to the Cotter Schwartzwald uranium mine near Golden, Colorado. The mine site above the rim deteriorated and was, as the Park Service stated, “‘an ugly intrusion’ on ‘the park landscape’” (83).

The price of uranium unexpectedly spiked in the 1970s, enough so to merit a feasibility study by Cotter Corporation in order to determine if it would be financially lucrative to reopen the mine (84). Mine development costs, coupled with high shipment costs plus tighter environmental regulations, made reopening the mine unfeasible, and the mine never reopened. In 1981, Cotter sold its Western Village housing site and the mining claim to Republic Mining Enterprises, Inc. from Seattle Washington. Republic Mining did little with the mine claim, and the Orphan Mine rights reverted to the NPS in 1987. During its uranium production years (1956-1969), the Orphan Mine produced approximately 495,000 dry tons of ore which contained approximately 4.26 million pounds of uranium oxide (85).

Features at the Orphan Mine Upper Yard

In 1967-68, the NPS demolished and removed all of the structures from the lodge property (86). In 1988, the NPS removed most of the Upper Yard structures, leaving only the headframe, compressor building, and numerous concrete foundations. The following 22 features have been recorded in the Upper Yard at the Orphan Mine (87):

Feature 1

Feature 1, a rectangular concrete foundation with an attached cinderblock room on the southwest corner, may have originally been a house, but during the mining days served as the mine superintendent's office and the Engineering Office (88).

Feature 2

Feature 2, a rectangular concrete foundation, was originally the geology lab and later in the 1960s was used as a changing room for the miners (89).

Feature 3

This feature, rectangular concrete building foundation remains, served as the mining office and the Superintendent's office (90).

Feature 4

This feature, a square concrete slab-on-grade foundation, was the timber shed and the carpentry shop and a small changing room (91).

Feature 5

Feature 5 is a large concrete pad and is the remains of the building that housed the headframe hoisting mechanism. In the center of the pad are two spools and support structure from the winch mechanism. Directly to the east of the spools is the mount for an electric motor. The winch brakes and reduction gear are still present, but the rest of the hoisting equipment has been removed (92).

Feature 6

Feature 6 is a rectangular concrete pad that was formerly the mine warehouse (93).

Feature 7

This feature, a rectangular concrete pad, was used as a holding area for ore that was waiting to be loaded onto trucks (94).

Feature 8

Feature 8 is the remains of Gibbons Garage and consists of a square concrete pad and a square asphalt pad located immediately adjacent to each other on the west side of the Upper Yard (95).

Feature 9

Feature 9 is an underground concrete vault that may have been part of the hotel septic system leach field for the hotel prior to the mine development in the 1950s (96).

Feature 10

This feature, a form-poured concrete vault, is located just below the rim and was a septic tank (97).

Feature 11

Feature 11 is the remains of a truck scale (98). The scale consists of a rectangular concrete foundation.

Feature 12

Feature 12 is the headframe and associated shaft, shaft collar, and concrete foundation. These will be discussed in detail below (99).

Feature 13

Feature 13 is a mount for the compressor radiator used to cool the air compressor in the metal shed to the east (Feature 14) (100).

Feature 14

Feature 14 is a wood frame, corrugated metal shed that houses the air compressor (101).

Feature 15

Feature 15 includes three concrete pads and an earthen platform located along the east fence just south of the rim and the compressor shed (Feature 14). Collectively this area comprises the mechanical and electrical shops and at one time was the location of the aerial tram tower and hoist house (102).

Feature 16

This feature is a water tank located over the rim of the Canyon and immediately northeast of the headframe (103).

Feature 17

This feature, a depression, and berms made of sandstone, earth, and cinder blocks, is the remains of a small house and served as the residence of Assistant Mine Superintendent, Bob Hartman (104).

Feature 18

This feature is possibly a garden plot (105).

Feature 19

This feature was the location of one of the hotel's tourist cottages that was later converted for use by the mine. Today it consists of a burned area that is slightly dug out and bermed (106).

Feature 20

This feature is a concrete pillar, and is the remains of a core grinder mount used to process geologic samples (107).

Feature 21

Feature 21 is most likely the remains of a mount for the aerial tramway support system (108). Nothing remains but five iron posts secured in the rock just over the edge of the Canyon rim.

Feature 22

Feature 22 is a storage area for vent pipe used in the mine (109).

Project Drawings

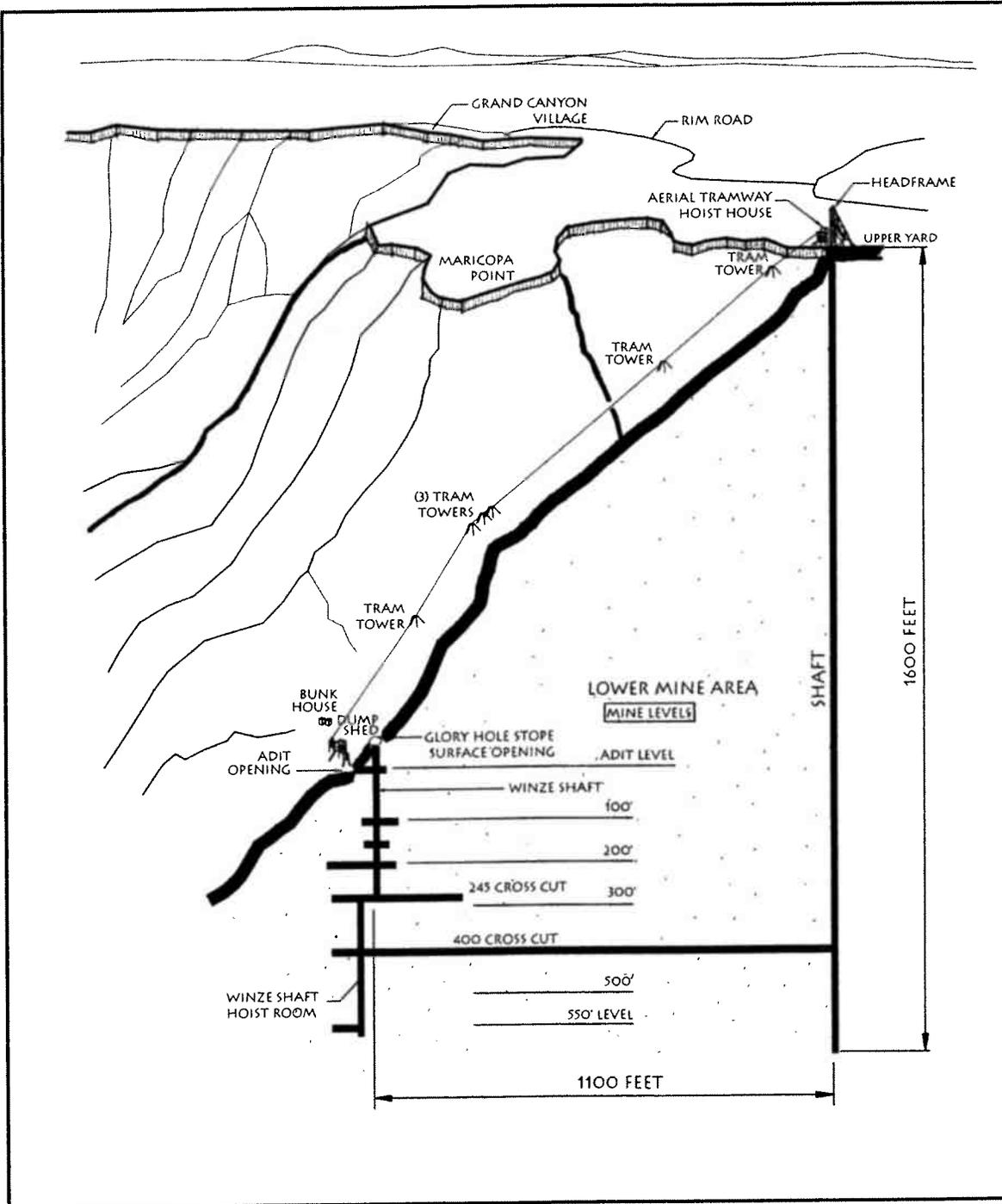
Two drawings were prepared for this report illustrating the relationship of the Upper Yard features to the mine features located below the canyon rim and the geologic formations. These drawings follow this section. Since no fieldwork was conducted on the features below the rim, the mine section drawings were produced using the information from the Castagne book (110), as well as a geological drawing provided by the NPS. The drawings are as accurate as that information allows them to be.

The canyon is drawn in perspective beyond the section. The topography is interpreted from Google Earth software, so it is reasonably accurate, although it has been simplified graphically. A very limited amount of rendering was done just to convey the mine's Canyon setting.

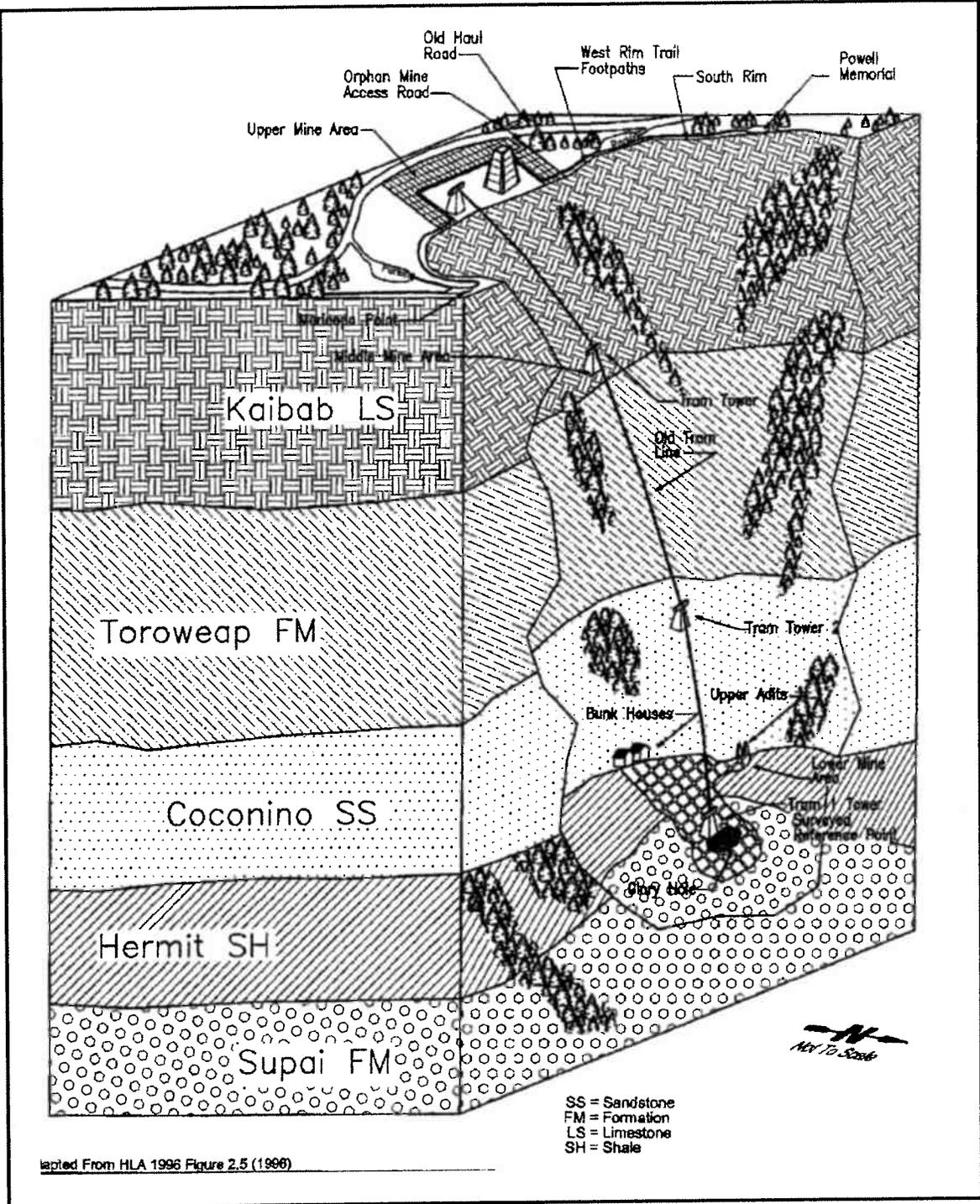
The vantage point for Drawing 1 is looking towards Maricopa Point. This vantage point was chosen so that the drawing would show the relationships between the headframe, hoist house, tram towers, bunk house, glory hole, adits, the shaft, and the primary cross cuts, at a vertical scale of 1,600 feet.

drawing deposited in field notes - not done
to Sec. of Interior Standards

Drawing 1 - Orphan Lode Mine Section Looking Southeast



Drawing 2 – Representation of the Canyon Wall and Orphan Mine Features



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