

**GEOLOGY AND PRODUCTION  
HISTORY OF THE MITCHELL BUTTE  
URANIUM-VANADIUM MINE,  
NAVAJO COUNTY, ARIZONA**

by

Wilhain L. Chenoweth  
Consulting Geologist, Grand Junction, Colorado

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416 W. Congress, Suite #100, Tucson, Arizona 85701

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## INTRODUCTION

The Mitchell Mesa Mine was developed on the rim of an isolated mesa within the Monument Valley Navajo Tribal Park in Navajo County, Arizona. This park, established by the Tribal Council on July 11, 1958, is composed of 29,817 acres of spectacular red rock mesas, buttes, monoliths and spires. At the time it was created, mining was not prohibited within the park.

Mitchell Mesa is named for a prospector, who, together with his partner Merrick, were killed in this area in 1880. The prospectors, looking for a rich silver mine, had repeatedly disregarded warnings not to trespass in the valley. Both men were shot near Mitchell Butte, but Merrick lived long enough to make his way to the butte that bear his name (Baars and others, 1973).

Due to the difficult access to the top of the mesa, the ore deposit was not exploited until 1962, 1965-1966. Since this was late in the U.S. Atomic Energy Commission's (AEC) ore-procurement program (1947-1970) very little information was developed about this small mine. Recently, some information was located in the AEC files stored at the Department of Energy's Grand Junction Projects Office in Grand Junction, Colorado. This report summarizes what is known about the Mitchell Mesa uranium-vanadium mine.

## LOCATION AND LAND STATUS

The Mitchell Mesa Mine was located on Mitchell Mesa within the Monument Valley Navajo Tribal Park. This mesa is approximately seven miles southeast of Gouldings, Utah (Figure 1). Within the park, Mitchell Mesa forms the divide between the Outer Valley and the Inner Valley (Figure 2). The mesa is ringed by sheer cliffs, except at the southern edge where a talus slope extends from just below the mesa top to the valley floor.

Access to the foot of the mesa was by dirt roads within the park. A rough jeep trail was built up the talus slope on the south side of the mesa to reach the mesa top. On the Mitten Buttes 7.5' quadrangle topographic map (U.S. Geological Survey, 1988) only a small working on the east side of the reentrant is shown. The main mine was to its west at latitude 36° 57' 45", longitude 110° 06' 33".

The mine was within the Navajo Indian Reservation. Mining permits and leases were issued by the Navajo Tribal Council and approved by the Bureau of Indian Affairs (BIA), U.S. Department of Interior. Mining permits could be obtained by individual Navajos only. Permit holders could assign the mining rights to another individual or a company; like the permits, these assignments had to be approved by the Tribal Council and the BIA. Leases could be issued directly by the BIA. Permits were issued for a 2-year period and could be renewed for an additional 2 years.

Leases were issued for periods up to 10 years. No more than 960 acres of tribal land could be held by any one company or individual. Both the permittee and the tribe received royalties from ore production. Based on the mine value of the ore, the tribe received between 10% and 20% royalties and the permittee between 2% and 5% royalties.

In addition to mining permits, the tribe issued drilling and exploration permits. These permits were good for 120 days and were not renewable.

## **GEOLOGIC SETTING**

The Organ Rock Formation of the Permian Cutler Group forms the floor of the Inner Valley. It is a reddish-brown, poorly sorted siltstone with some white to buff very fine-grained, silty sandstone lenses of fluvial origin. The Organ Rock is 650 to 700 feet thick in Monument Valley. Approximately 350 feet of the upper part of the formation is exposed around the foot of Mitchell Mesa.

The spires, buttes and mesas that give Monument Valley its name are formed by the Permian De Chelly Sandstone of the Cutler Group which overlies the Organ Rock Formation. The De Chelly is a grayish - yellow to tan, massive, crossbedded, fine - grained, quartz sandstone of eolian origin. It is commonly stained red by wash from the overlying Moenkopi Formation. In the area of Mitchell Mesa, the DeChelly Sandstone is approximately 450 feet thick. Where the De Chelly is protected from erosion by overlying units it forms unscalable vertical walls. Southeast of Mitchell Mesa, three spires of De Chelly, known as the Three Sisters (Figure 3) are one of the points of interest in the Tribal Park.

Overlying the De Chelly Sandstone is the Triassic Moenkopi Formation. It is composed of reddish-brown to dark red siltstone and fine-grained sandstone of tidal flat origin. On Mitchell Mesa the Moenkopi forms a small slope between the De Chelly and the overlying Shinarump Member of the Chinle Formation. The Moenkopi is approximately 100 feet thick on Mitchell Mesa.

The Shinarump Member of the Triassic Chinle Formation forms the caprock of most of the buttes and mesas in the Monument Valley. It is a light -gray, crossbedded, fluvial quartz sandstone with interbedded conglomerate lenses. The Shinarump on Mitchell Butte is approximately 50 feet thick, except where channels have been cut into the underlying Moenkopi Formation; here the member is as thick as 120 feet.

The uranium - vanadium ore deposits in Monument Valley are in the basal portion of the Shinarump Member of the Upper Triassic Chinle Formation. Channels are scoured into the underlying Middle Triassic Moenkopi Formation. One of these ore - bearing channels occurs on Mitchell Mesa and is exposed at four separate locations (Figure 3).

This channel is 350 feet wide and has a depth of 75 feet at the location where the mine was developed. It is filled with light gray to buff, massive, coarse-grained sandstone that grades into conglomeratic sandstone with clay pebbles. Silicified fossil wood was present in the outcrop, as was some carbonaceous plant material.

Tyuyamunite (a calcium uranium vanadate) was the principal ore mineral on the outcrop. Unidentified vanadium minerals also were present. Also identified, but seen in small amounts, were torbermite (a copper uranium phosphate), malachite and azurite. Calcite and limonite were common in the mineralized exposure (Witkind and Thaden, 1963).

The ore deposit was completely oxidized and the AEC classified the ore as "carnotite type, high vanadium, low lime". Due to the high vanadium content, the ore was shipped to the mill at Shiprock, New Mexico, which paid for vanadium, instead of nearby mills at Mexican Hat, Utah or Tuba City, Arizona.

Geologic studies of the channels in Monument Valley by Young and others (1964) indicate that the channel containing the Mitchell Mesa deposit can be projected to the northwest to connect with a channel on Oljeto Mesa which contains several large mines (Chenoweth 1991).

## **PRODUCTION HISTORY**

The uranium - bearing exposures on Mitchell Mesa were brought to the attention of the AEC in June 1951 (Chester and Cutter, 1951). Harry A. Binale of Gouldings, Utah had claimed the top of Mitchell Mesa with an unnumbered Navajo Tribal Mining Permit (MP). Due to increased prospecting on the Reservation, the Tribal Council began issuing numbered permits in May 1952. Binale was issued MP-32 on May 1, 1952. This permit included 98.41 acres covering a narrow strip of land across the center of the mesa and 3.92 acres on Rock Door Mesa, south of Gouldings.

The mining rights to MP-32 were assigned to Harry Goulding on May 2, 1952. Goulding tried to interest various mining companies in the exposures but was not successful. He dropped his assignment on June 11, 1953. No doubt many mining companies examined the exposure during the uranium boom of the 1950's, but there was no mining due to the remote location and the lack of access to the mesa top.

During their 1951-1952 investigation of the uranium deposits of the Arizona portion of Monument Valley for the AEC, Witkind and Thaden (1963) of the U.S. Geological Survey examined the exposures on Mitchell Mesa. They recommended a geophysical survey to determine the channel dimensions and 15,000 feet of diamond core drilling to test the channel for uranium deposits. Also recommended was a road to be built up the mesa for access for equipment (Witkind and Thaden, 1954). None of these recommendations were approved by the AEC.

In November 1960, a new mining permit, MP-549, was issued to Harry A. Binale for the same 98.41 acres on Mitchell Mesa. The assignment of the mining rights to the permit to Curtis W. Jones was approved by the BIA on March 16, 1961. Jones built a rough jeep trail

up the mesa where a pack trail had been and did a small amount of drilling behind the mineralized outcrop. Late in 1961, Jones reported to the AEC that he had located 1,500 tons of ore with an average grade of 0.28 percent  $U_3O_8$ .

Jones drove an west-heading drift into the ore body from the rim of the mesa. During January through March, 1962 he shipped a total of 421.25 tons of ore averaging 0.23 percent  $U_3O_8$  and 2.60 percent  $V_2O_5$  to the mill at Shiprock, New Mexico operated by Kerr - McGee Oil Industries, Inc. (Table 1). These shipments were labeled the Mitchell Butte Mine although Mitchell Butte is a separate feature from Mitchell Mesa (Figure 2). Jones' operation was apparently not economic as he abandoned the mine in the spring of 1962 and the mining permit expired in November 1962.

On October 26, 1964, Harry A. Binale was issued a new mining permit, MP-597, for the same 98.41 acres on Mitchell Mesa. The assignment of the mining rights to this permit to Robert Shriver, of Blanding, Utah, was approved by the BIA on March 2, 19623. Shriver began operations at the mine in the spring of 1965. He constructed a small airstrip on Mitchell Mesa so he could fly his small plane to and from the mine site.

Mr. Shriver was killed on October 26, 1965, when the small ore hauler (scootcrete) he was driving went over the ore bin and crashed to the valley floor, 400 feet below. The accident took place in 1965 not 1962 as listed in Baars and others (1973). During 1965, a total of 976.80 tons of ore averaging 0.11 percent  $U_3O_8$  and 1.58 percent  $V_2O_5$  (Table 1) were shipped to the mill at Shiprock, New Mexico now operated by Vanadium Corporation of America.

After his death, an administrator took over Shriver affairs, shipped the developed ore, and removed the mining equipment. Shipments to Shiprock in early 1966, totalled 366.14 tons of ore averaging 0.12 percent  $U_3O_8$  and 0.96 percent  $V_2O_5$  (Table 1). The mine was closed and abandoned in the spring of 1966.

## SUMMARY

During the two periods the mine was operating, a total of 1,764.19 tons of ore averaging 0.14 percent  $U_3O_8$  and 1.71 percent  $V_2O_5$  were mined and shipped (Table 1). All of the uranium concentrate produced from the ore was sold to the AEC. Vanadium recovered at Shiprock was sold to the steel industry.

The mine workings followed the base of a Shinarump channel for over 200 feet in west, northwesterly direction into the mesa. Thin ore, two feet and less, and a difficult access made the Mitchell Mesa Mine a less than economic operation.

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## Tables

Table 1. Ore production from the Mitchell Mesa Mine. Navajo County, Arizona.

YEAR	SHIPPER	TONS OF ORE	Pounds U <sub>3</sub> O <sub>8</sub>	% U <sub>3</sub> O <sub>8</sub>	Pounds V <sub>2</sub> O <sub>5</sub>	% V <sub>2</sub> O <sub>5</sub>
1962	C.W. Jones	421.25	1,900.6	0.23	22,572.4	2.68
1965	Robert Shriver	976.80	2,212.8	0.11	30,807.0	1.58
1966	Robert Shriver	366.14	911.9	0.12	6,999.0	0.96
<b>Mine Total</b>		1764.19	5,025.3	0.14	60,378.4	1.71

Source: Unpublished ore-production records, U.S. Atomic Energy Commission, Grand Junction, Colorado.

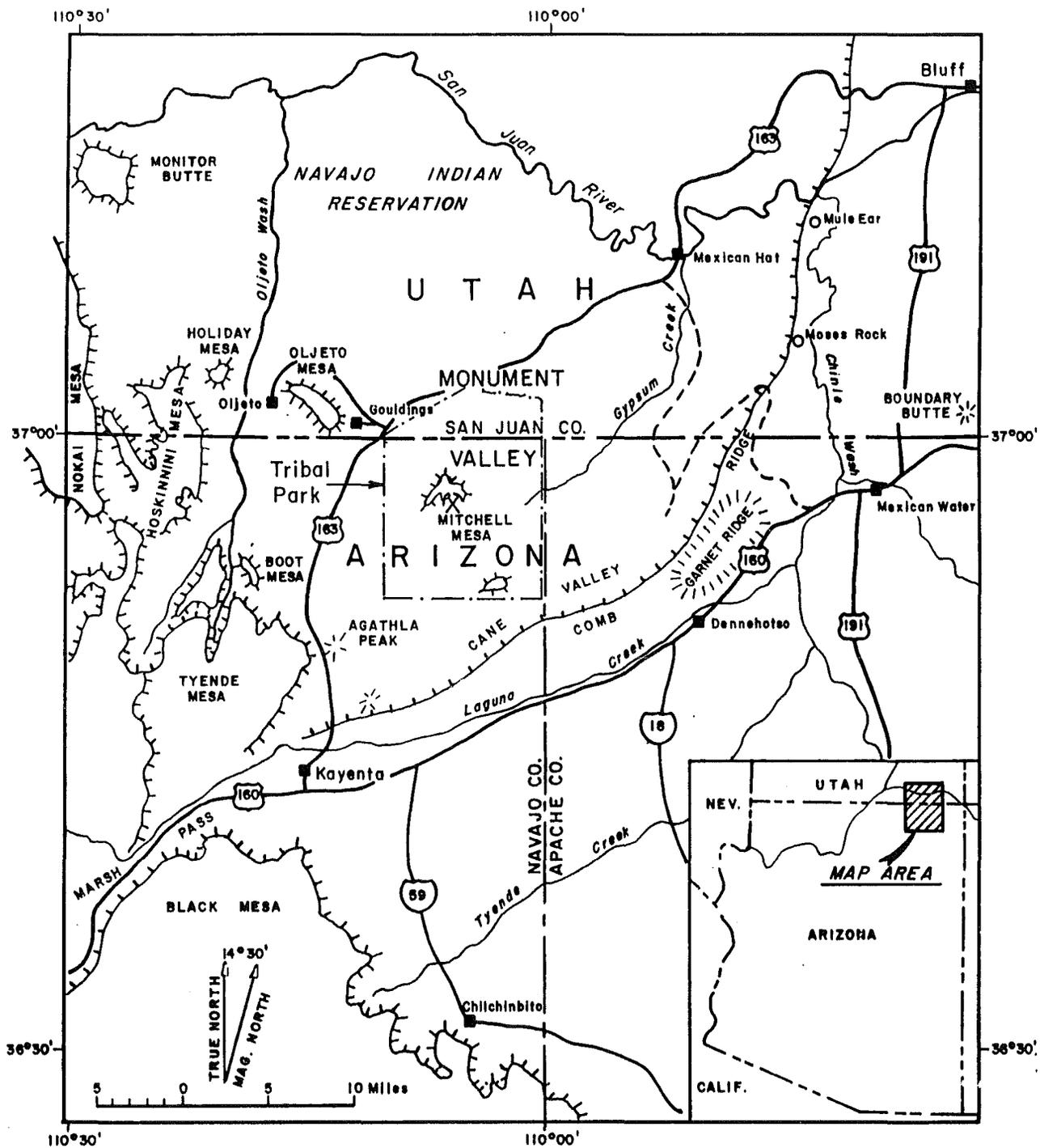


Figure 1. Index map of Monument Valley, Arizona - Utah showing the location of the Mitchell Mesa uranium-vanadium mine.



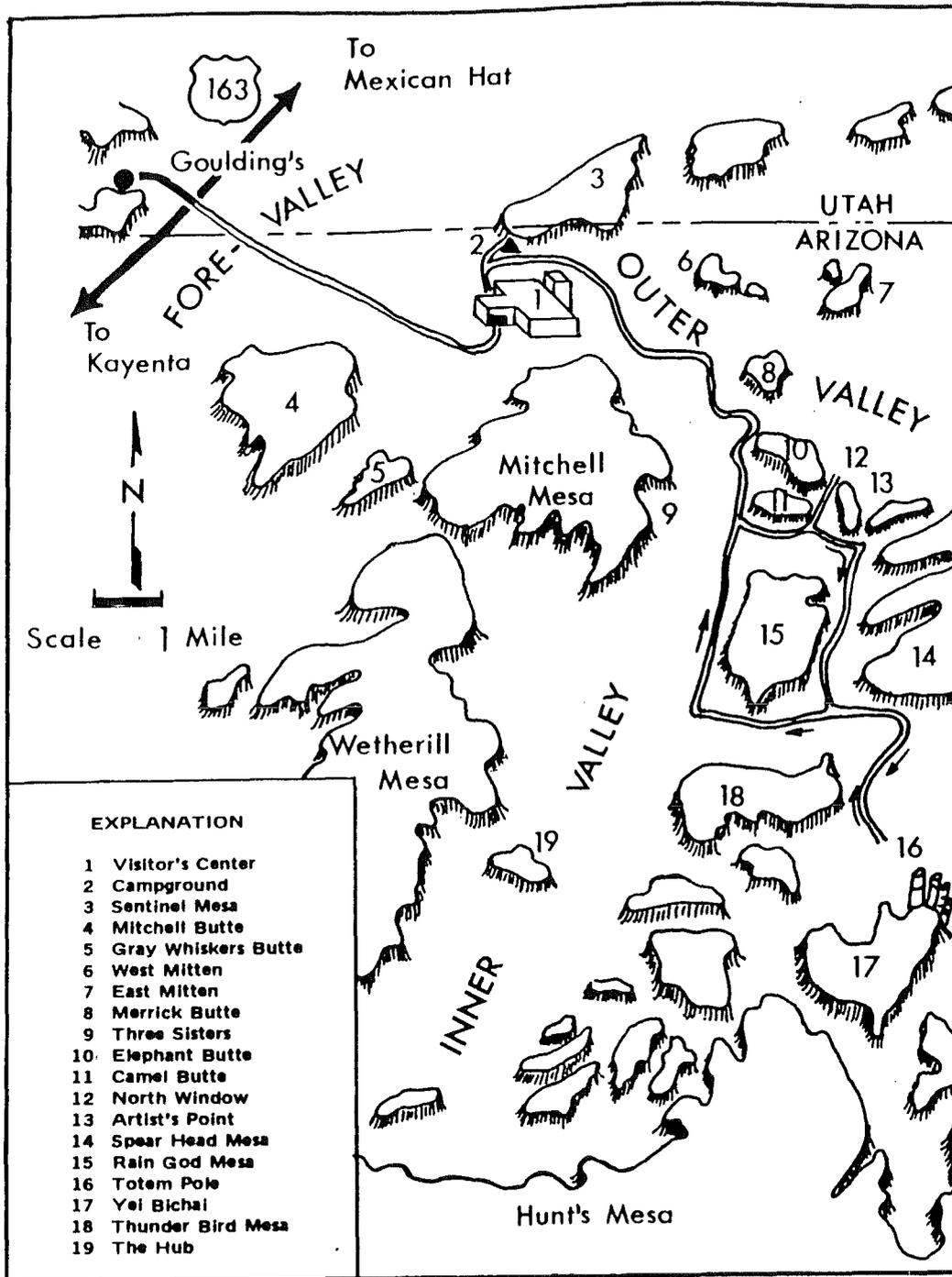
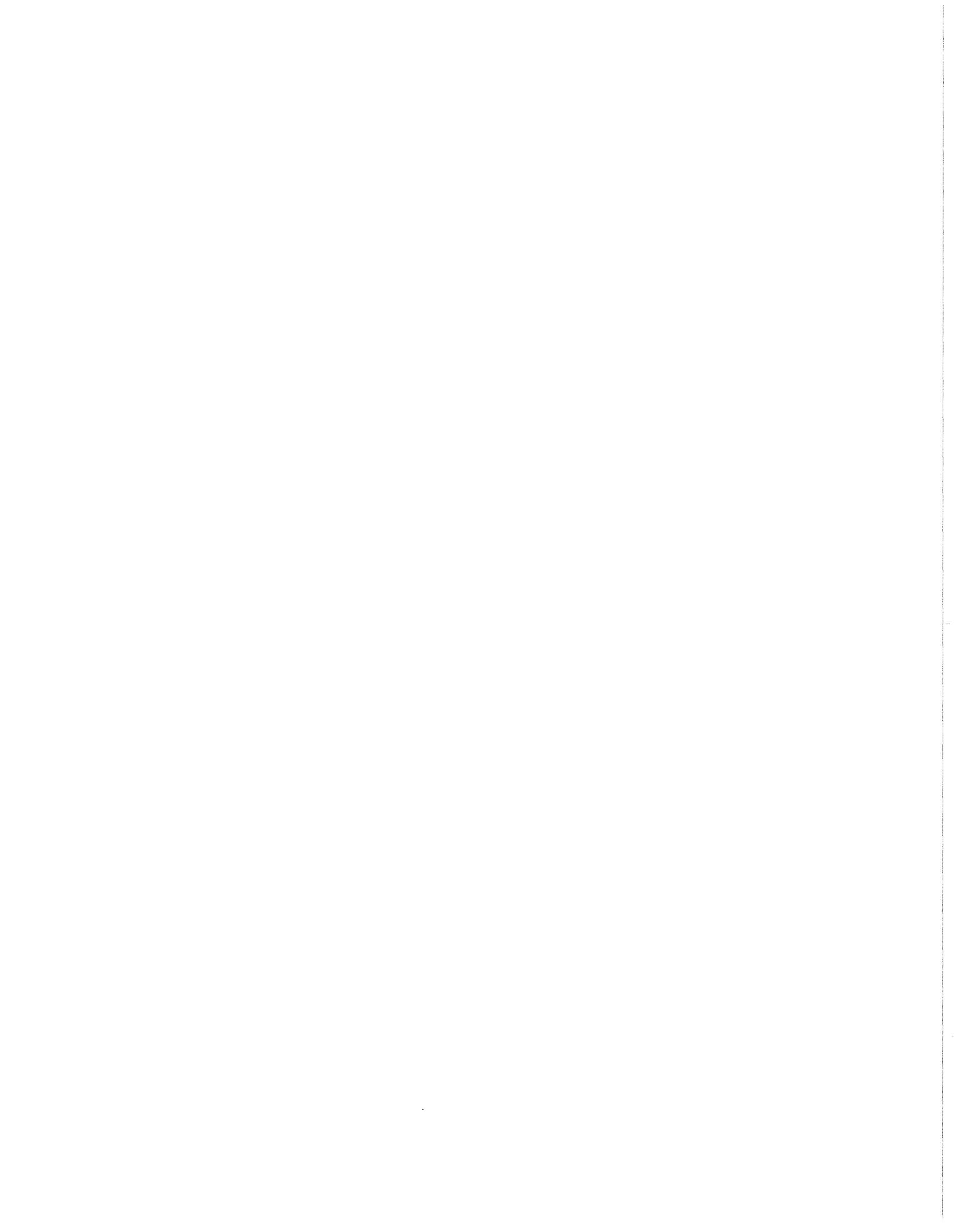


Figure 2. Generalized map of the features of Monument Valley Navajo Tribal Park (Baars and others, 1973).



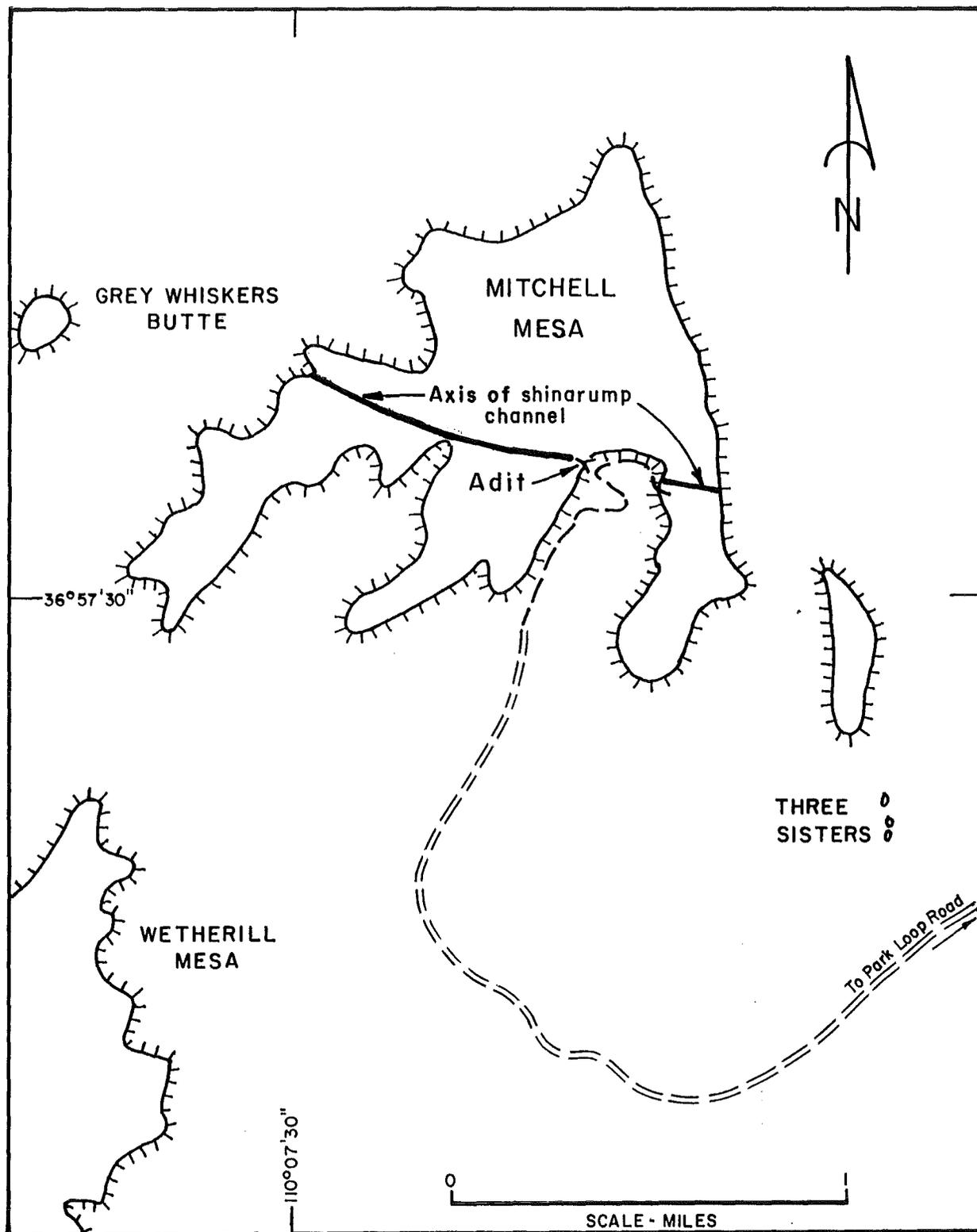


Figure 3. Map of Mitchell Mesa showing shinarump channel and location of mine.

