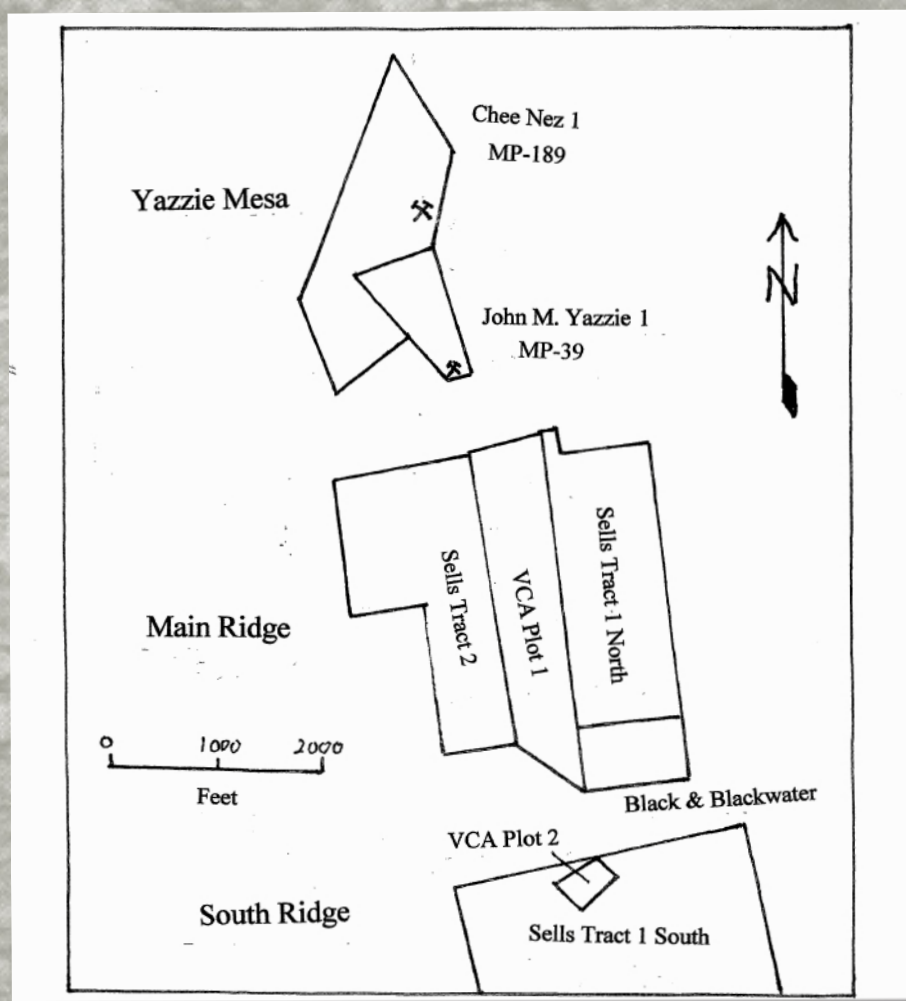


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ARIZONA GEOLOGICAL SURVEY

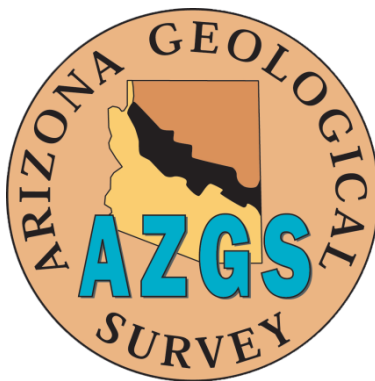
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The Exploration and Production History of the Uranium-Vanadium Mines on Yazzie Mesa, Monument Valley, Apache County, Arizona

August 2011

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Note: Originally prepared for the Arizona Department of Mines and Mineral Resources
and the Navajo Abandoned Mine Lands Reclamation Project



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INTRODUCTION

Yazzie Mesa is a small mesa north of Vanadium Corporation of America's (VCA) 1943 Monument No. 2 lease in northwestern Apache County, Arizona. This lease was originally mined for vanadium, but beginning in 1947 was mined for both uranium and vanadium. In 1950, two local Navajos, John M. Yazzie and Chester Tso obtained Navajo Tribal Mining Permits (MPs) on Yazzie Mesa on the northern trend of the Monument No. 2 ore deposit. Mr. Tso's MP was never developed and it was dropped. Chee Nez later acquired that area. The report documents the production history of the Yazzie and Nez mines.

Location

Yazzie Mesa, a name accepted by the U.S. Board of Geographic names, is shown on the Rooster Rock topographic quadrangle (USGS, 1988) north of the Monument No. 2 open at the center of the right-hand margin of the quadrangle. The Monument No. 2 mine area is located in the extreme northwestern area of Apache County, Arizona (Figure 1). The mine is in the Cane Valley on the eastern flank of the Monument Uplift. Access to the mine area was via a 19-mile dirt road that headed south from U.S. Highway 163 one mile south of the bridge over the San Juan River at Mexican Hat, Utah. Another access road went from the mine, over Comb Ridge, and connected to U.S. Highway 160 near Mexican Water, Arizona.

Land Status

The area of the Monument No. 2 mine is located within the Navajo Indian Reservation. Mining permits were issued by the Navajo Tribal Council and approved by the Bureau of Indian Affairs (BIA), U.S. Department of the 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.

Previous Studies

The geology and mineralogy of the Monument No. 2 area have been described by Witkind and Thaden (1963). The mining and upgrading of the ore at the Monument No. 2 mine is given in a guidebook on uranium deposits of the western United States (AEC, 1959). Gregg and Evensen (1989) mapped the underground workings of the Monument No. 2 and adjacent mines and described the early mining history of the area. Chenoweth (2011 a, b) has described the mining on the Mining Permits contiguous with VCA's lease.

Sources of Information

Most of the information presented in this report was obtained while the author was employed by the U.S. Atomic Energy Commission (AEC) and succeeding agencies: the U.S. Energy Research and Development Administration and the U.S. Department of Energy. Information on the Mining Permits and the Lease was obtained from the Navajo Tribal Mining Department, Window Rock, Arizona.

Early activities on the two properties, on Yazzie Mesa, were found in two AEC reports (1960 a, b) located in the National Archives. The AEC ore production data in Tables 1 and 2 is now in the National Archives, Rocky Mountain Region, Denver, Colorado, Record Group 434-00-287. In these records, pre 1954 production is not separated by year. Details of this early production is from U.S. Geological Survey (USGS) royalty check reports to the Navajo Indian Service (Allport, 1951, 1952, 1953).

GEOLOGIC SETTING

The Monument No. 2 ore deposit is in the basal Shinarump Member of the Triassic Chinle Formation. The Shinarump here is unusually thick, filling a large and deep erosional depression in the underlying Moenkopi Formation and, at the deepest point, extending down through the Moenkopi to the Permian De Chelly Sandstone. The Monument No. 2 ore deposits are in a short channel or scour that strikes N.18°W. and is about 2 miles long. It ranges in width, in its central part, from 400 to 700 ft and has been cut 50 ft into the underlying strata. The northern end of the scour is on Yazzie Mesa where the John M. Yazzie No. 1 and the Chee Nez No. 1 mines were located.

The host rock is "trashy", cross-bedded, conglomeratic sandstone, containing considerable clay and fossil wood. The wood is partly carbonized, but much has been replaced by silica, tyuyamunite, limonite or uraninite.

The principal ore minerals are tyuyamunite and carnotite; others include the oxides montroseite, uraninite, navajoite and the hydrous oxides becquerelite and fourmarieite; the vanadates rauvite, volborthite, steigerite, hewettite and corvusite; the silicate uranophane; the phosphate tobernite; and the arsenate metazerunerite. For additional details on the ore occurrences and mineralogy the reader is referred to a report by Witkind and Thaden (1963).

VANADIUM CORPORATION OF AMERICA'S LEASE

During the 1940s, the carnotite deposits in the Four Corners area were being sought for their vanadium content, used to harden steel. As the result of a find by Luke Yazzie in Cane Valley, the Office of Indian Affairs advertised an exploration lease sale for carnotite and related minerals on July 21, 1943. The area in Apache County, Arizona, was described as follows: "beginning at a point south 32°28' east, 28,949.78 feet from mile post 227 on the Utah-Arizona line and running thence north 25°00' east one mile; thence east one and one quarter miles; thence south 25°00' west one mile; thence south one and one quarter miles; thence west one and one

quarter miles; thence north one and one quarter miles to the point of beginning, containing approximately 1,845 acres.”

When the bids were opened on August 3, 1943, Vanadium Corporation of America (VCA) was the only bidder with a bonus bid of \$3,000.00. Lease I-149-IND-6204 with VCA was executed on August 6, 1943, effective September 23, 1943, for a period of ten years. The lease was named Monument No. 2 by VCA.

On March 6, 1944, the exploration lease was reduced to a permanent operating lease with two plots (claims) totaling 42.09 acres selected to be retained. Plot 1, about 39 acres, covered the mineralized Shinarump channel on the Main Ridge, and Plot 2, about 3 acres, covered the projection of the channel on South Ridge (Figure 2).

During the period October 1943 through January 1946, small underground mines and open pits produced 489 tons of ore containing 13,737 pounds of V_2O_5 (Chenoweth, 1985). This ore was processed at the vanadium mill at Monticello, Utah, operated by VCA.

JOHN M. YAZZIE’S MINING PERMIT

On April 11, 1950, an unnumbered Navajo Tribal Mining Permit was issued to John M. Yazzie, of Kayenta, Arizona, for some land on the mesa north of VCA’s Plot 1 of their Monument No. 2 lease (Figure 2). The Navajo Tribal Mining Department, at Window Rock, Arizona, had trouble determining where the permit was located, so Mr. Yazzie had VCA engineers survey and map it. The permit was determined to contain 11.644 acres (see appendix). Mr. Yazzie also had VCA build a 2.5 mile access road to the property.

In 1951, the AEC drilled 333 holes totaling 8,931 feet on Yazzie Mesa. This drilling discovered 630 tons of ore averaging 0.19 percent U_3O_8 on the Yazzie permit (AEC, 1960 a).

Mr. Yazzie formed a partnership with his friend Thomas Clani of Teec Nos Pos Arizona to mine the ore. Mr. Clani operated a small mining company and was mining uranium-vanadium ore in the Carrizo Mountains in northeastern Apache County, Arizona in the late 1940s, early 1950s. The initial shipment from the permit was on November 24, 1951 from a rim cut. This 9.89 ton shipment averaged 0.25 percent U_3O_8 and 3.50 percent V_2O_5 . After the surface ore was depleted, underground mining commenced where the AEC drilling had located some ore. Figure 3 is a map of the underground mine as of June 2, 1952.

On May 26, 1952, the mining permit was reissued on No. 39. Clani and Yazzie continued to make shipments from the underground mine until 1954. Mr. Yazzie could not read or speak English. All the paperwork for the AEC to collect the \$35,000.00 “new discovery” bonus was done by Thomas Clani and stamped with John M. Yazzie’s thumbprint (AEC, 1960 a).

The mining rights to the permit were assigned to the Spencer Uranium Company of Salt Lake City in 1954. Spencer continued to operate the underground mine until early 1957. In 1955, the mining permit was reissued as MP-288, with Yazzie and Clani as joint owners. Also in 1955, some 590.38 tons of ore averaging 0.17 percent U_3O_8 and 0.49 percent V_2O_5 were shipped by

Spencer and identified on Lease No. 1 (Table 1). Bureau of Indian Affairs records at Window Rock, Arizona confirmed this ore came from MP-288. Total production from this Mining Permit was 2,538.71 tons averaging 0.35 percent U_3O_8 and 0.80 percent V_2O_5 (Table 1).

Ore shipments in 1951 and 1952 went to the mill at Durango, Colorado, operated by VCA and to the AEC ore-buying station at Monticello, Utah. With the road over Comb Ridge improved by the AEC, shipments in 1953 through 1957 went to the AEC ore-buying station at Shiprock, New Mexico. The Monticello ore-buying station also received some ore in 1956 and 1957.

CHESTER TSO'S MINING PERMIT

In 1950, Chester Tso was issued an unnumbered Mining Permit for ground contiguous with the west and north sides of John M. Yazzie's permit. On May 26, 1952 this permit was reissued as Navajo Tribal Mining Permit No. 33. There is no record of development or mining on this permit and it expired on May 26, 1954.

CHEE NEZ'S MINING PERMIT

On September 22, 1954, Chee Nez was issued Navajo Tribal Mining Permit No. 189 for the ground formerly held by Chester Nez. This permit covered 40.1 acres (see appendix).

The mining rights to Chee's permit were approved to Bee-Sho-Shee Mining Company of Shiprock, New Mexico on November 19, 1954. The company did 3,990 feet of wagon drilling and discovered a small orebody about 1,350 feet north of the John M. Yazzie No. 1 Mine. The average drill hole depth was 50 ft. Bee-Sho-Shee rim stripped 100 ft of barren rock on the mesa rim and then drove a 70 ft long adit into the orebody. The ore averaged 2 to 3 ft in thickness.

An initial shipment of 43.73 tons of ore was made to the AEC ore-buying station in Shiprock, New Mexico in May 1955. This shipment averaged 0.37 percent U_3O_8 and 1.16 percent V_2O_5 . Bee-Shu-Shee continued mining through 1955.

In 1956, Bee-Sho-Shee contracted with Mex Air Uranium Company of Blanding, Utah to mine the remaining ore for a 10 percent royalty. This mining continued until February 1957 when all the economic ore had been exhausted. Additional drilling had negative results. When the mine closed in 1957 it had produced 638.22 tons of ore that averaged 0.30 percent U_3O_8 and 1.22 percent V_2O_5 (Table 2).

LATER DEVELOPMENTS

On July 20, 1959, VCA modified their original 1943 lease to include the adjacent mining permits held by individual Navajos. These permits include the following:

Yazzie Mesa

Amendment Plot A

Chee Nez MP-189

John Yazzie and Thomas Clani MP-288

Main Ridge

Amendment Plot B-1

Cato Sells MP-55 Tract No.2

Amendment Plot B-2

Cato Sells MP-55 Tract No. 1 North

Jessie Black and Harvey Blackwater MP-47

South Ridge

Amendment Plot C

Willie Waters MP-188

(formerly Cato Sells MP-55 Tract No. 1 South)

The amended lease would later be known as VCA's Mining Unit No. 66 (Figure 4) for the AEC's allocation program that began in 1962. Any ore produced from these former mining permits would now be credited to the Monument No. 2 mine. When VCA amended the lease they apparently reduced the size of the Chee Nez MP to approximately 15 acres (Figures 2, 4).

An AEC geologist examined the John M. Yazzie mine on May 25, 1960 (AEC, 1960 a). He noted that the VCA was planning to strip a portion of the area for feed for their upgrader plant. The open pit shown on Yazzie Mesa on the Rooster Rock quadrangle (USGS, 1988) is probably the site of the VCA stripping.

SUMMARY

The ores purchased at the AEC ore-buying stations were processed at the adjacent mills. The mill at Monticello, Utah was operated by contractors for the AEC, and the mill at Shiprock, New Mexico was operated by Kerr-McGee Oil Industries until 1963. All the uranium recovered at these two mills and at the VCA mill at Durango, Colorado was purchased by the AEC.

Vanadium recovered at the Durango mill was sold to the steel industry. Vanadium was recovered at the Monticello mill up to April 1, 1956. The vanadium that was recovered was later sold by the AEC at auctions or transferred to the General Services Administration. At Shiprock, Kerr-McGee did not recover uranium (Albrethsen and McKinley, 1982).

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APPENDIX

Legal Descriptions of Mining Permits No. 39 and 189

MP-39 – John M. Yazzie

Beginning at a corner which is north 0° 26 minutes 39 seconds east 726.96 feet from the northwest corner of plot No. 1 of V.C.A. Lease No. 6204 (Monument #2); thence south 79 degrees 10 minutes 30 seconds west 183.08 feet to the southwest corner; thence north 44 degrees 18 minutes 30 seconds west 1187.97 feet to the northwest corner; thence north 67 degrees 36 minutes 30 seconds east 731.68 feet to the northeast corner; thence south 16 degrees 55 minutes 30 seconds east 1143.84 feet to the southeast corner, and point of beginning, containing approximately 11,644 acres, Apache County, Arizona.

MP-189 – Chee Nez

Beginning at Corner No. 1, an X Mark in sandstone with rock monument; being Corner of John M. Yazzie claim; then S. 57 degrees 01' E. 733.0 feet to Corner No. 2 an X Mark in sandstone with rock monument; then S. 49 degrees 03' W. 861.8 feet to Corner No. 3, an X Mark in sandstone with a rock monument; thence N. 26 degrees 14' W. 889.1 feet to Corner No. 4, an X mark with rock monument; thence N. 18 degrees 41' E. 2122.0 feet to Corner No. 5, an X Mark in sandstone; thence S. 40 degrees 46' E. 419.0 feet to Corner No. 6, an X mark in sandstone with rock monument, MKD Corner No. 4 Chester Tso; thence S. 31 degrees 30' E. 489.0 feet to Corner No. 7, an X Mark in sandstone with rock monument MKD Corner No. 3 Chester Tso; thence S. 7 degrees 21' W. 844.6 feet to Corner No. 8, an X mark in sandstone with rock monument being corner of John M. Yazzie claim; thence S. 67 degrees 59' W. 725.2 feet to Corner No. 1, point of beginning containing 40.1 acres.

Source: Navajo Tribal Mining Department, Window Rock, Arizona.

Table 1. Ore Production John M. Yazzie No. 1 Mine, Monument Valley, Apache County, Arizona.

YEAR	OPERATOR	TONS OF ORE	POUNDS U ₃ O ₈	% U ₃ O ₈	POUNDS V ₂ O ₅	% V ₂ O ₅
1951	Clani & Yazzie	64.59	661.60	0.47	1,369.59	1.06
1952	Clani & Yazzie	516.00	5,455.56	0.53	11,453.77	1.11
1953	Clani & Yazzie	265.35	3,836.00	0.72	6,333.78	1.19
1954	Clani & Yazzie	237.74	835.25	0.18	2,964.42	0.62
1954	Spencer Uranium	198.98	1,459.85	0.37	2,108.88	0.53
1955*	Spencer Uranium	590.38	1,994.58	0.17	5,735.96	0.49
1955	Spencer Uranium	364.14	1,719.38	0.24	5,406.97	0.74
1956	Spencer Uranium	256.44	1,479.66	0.29	4,512.46	0.88
1957	Spencer Uranium	65.09	221.97	0.17	816.00	0.63
TOTAL		2,558.71	17,663.85	0.35	40,701.43	0.80

*Shipped as Lease No. 1

Source: Unpublished AEC and USGS records

Table 2. Ore Production Chee Nez No. 1 Mine, Monument Valley, Apache County, Arizona.

YEAR	OPERATOR	TONS OF ORE	POUNDS U ₃ O ₈	% U ₃ O ₈	POUNDS V ₂ O ₅	% V ₂ O ₅
1955	Bee-Sho-Shee	583.24	3,728.64	0.32	14,149.85	1.21
1956	Mex Air Uranium	41.45	199.47	0.24	1,081.09	1.30
1957	Mex Air Uranium	13.53	73.88	0.27	403.31	1.49
TOTAL		638.22	4,001.19	0.31	15,634.25	1.22

Source: Unpublished AEC records

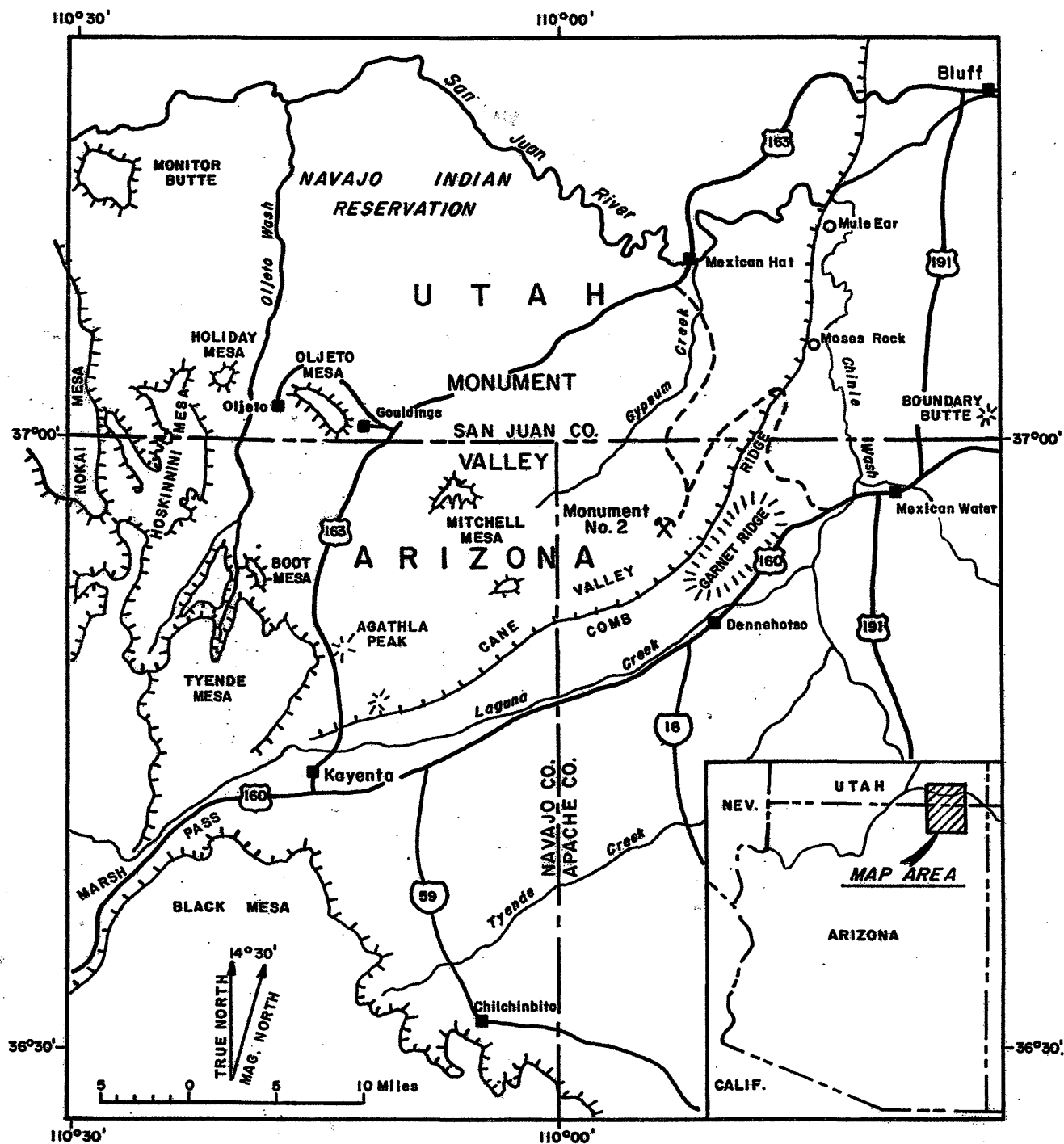


Figure 1. Index map of the Monument Valley area showing the location of the Monument No. 2 mine.

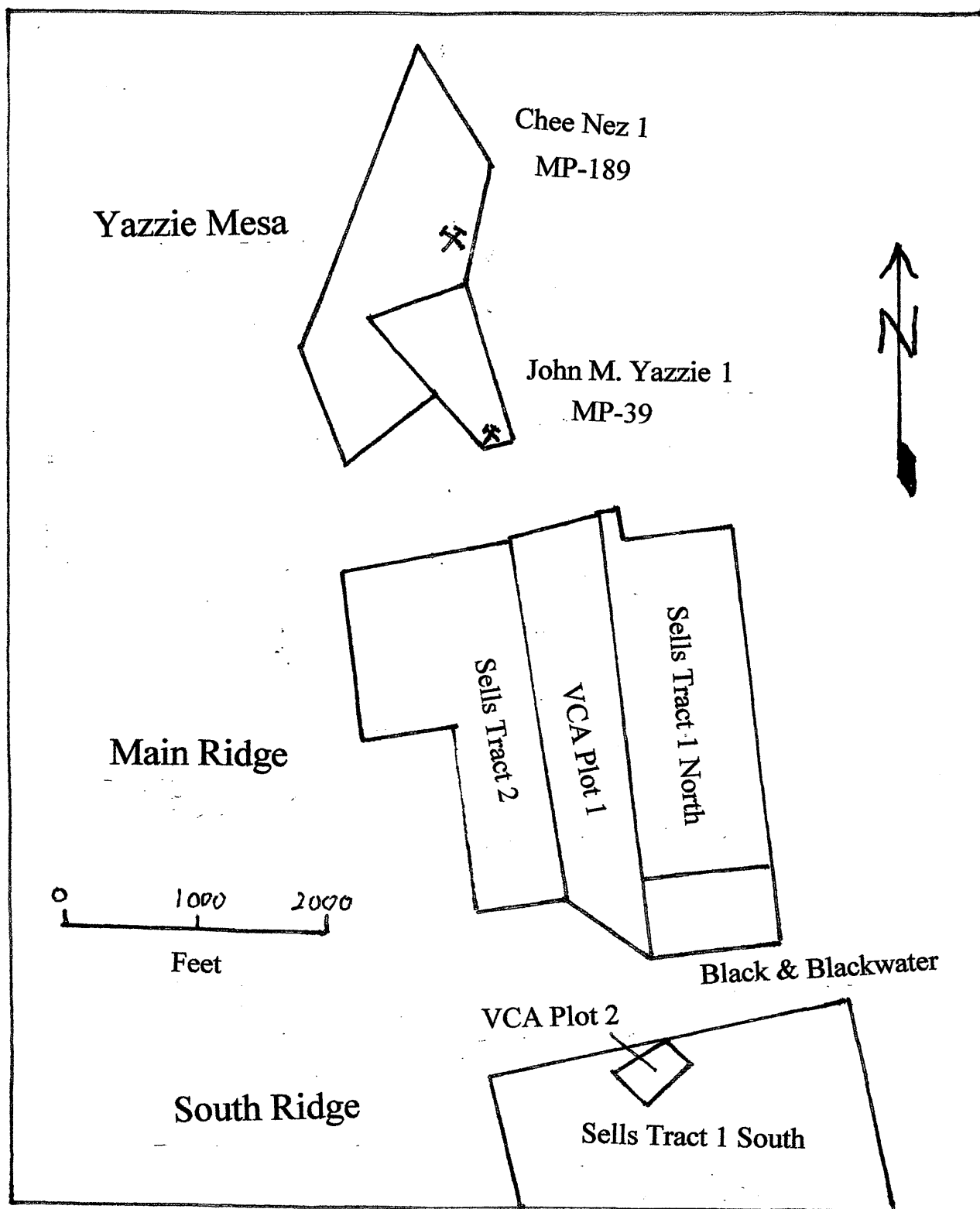


Figure 2. Map of MP-39 and 189 showing the relationship to VCA's lease and other MP-39 (AEC 1960 b).

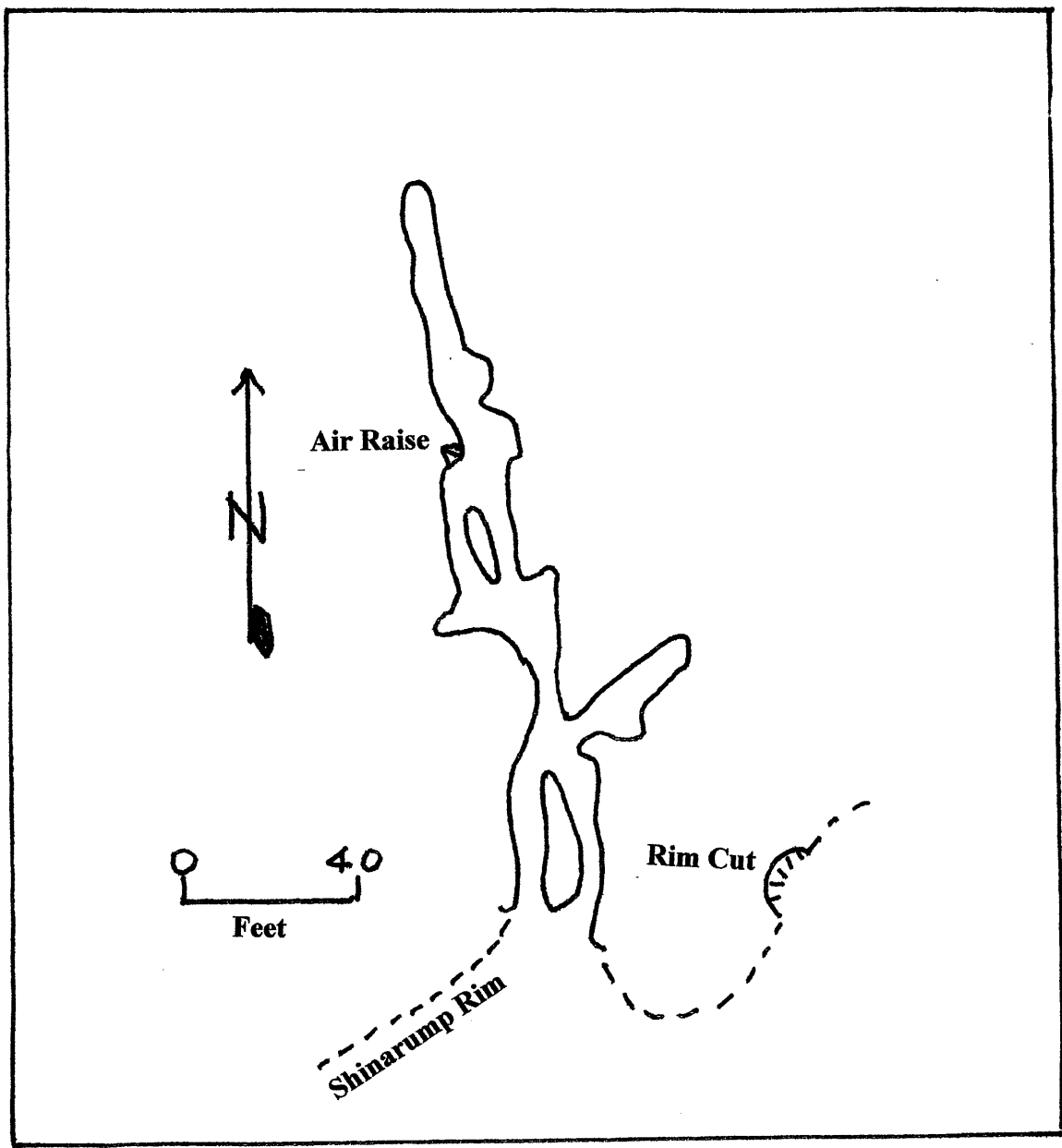


Figure 3. Map of the underground mine on MP-39 as of June 2, 1952 (AEC, 1960 a).

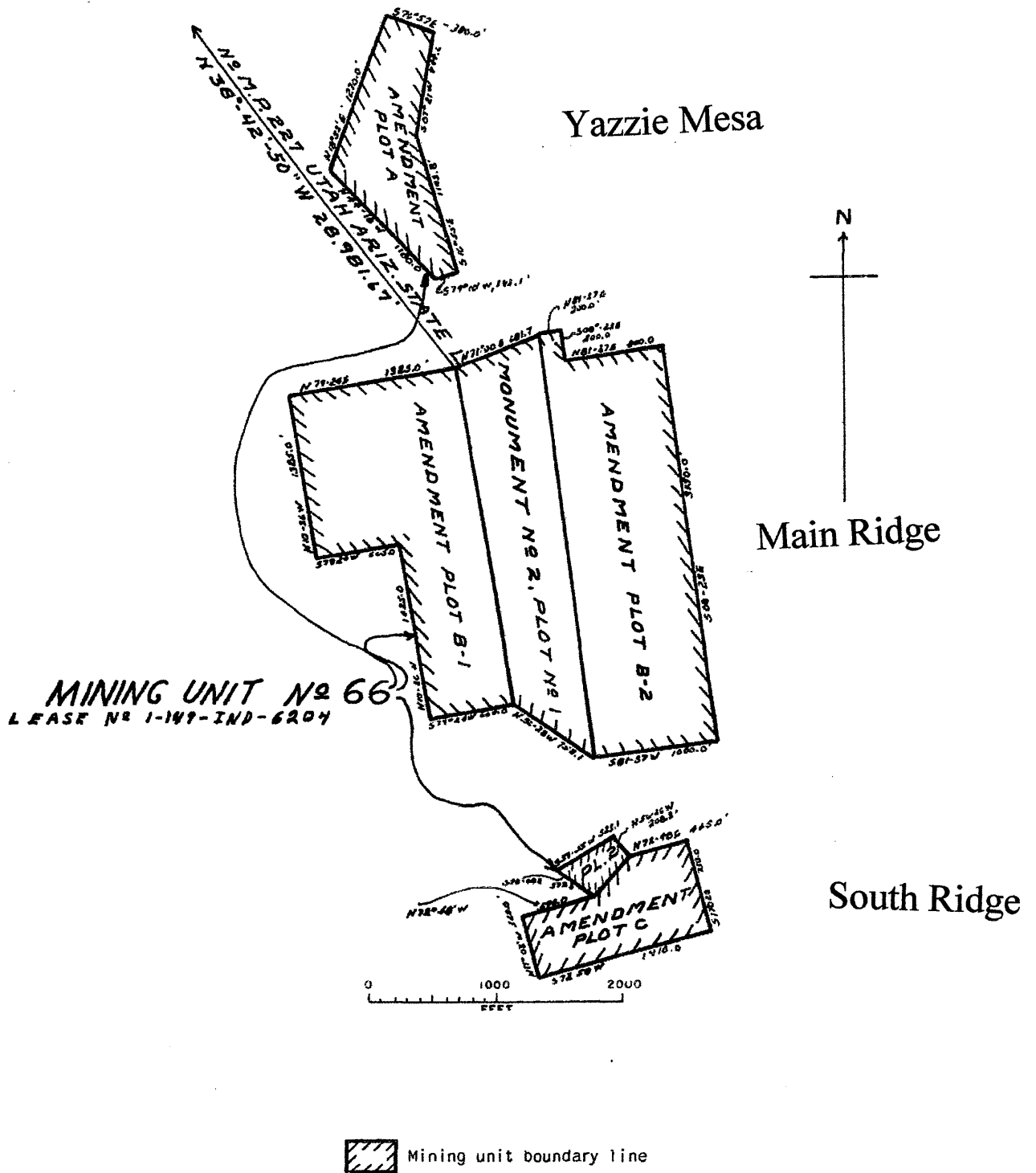


Figure 4. Map of the Monument No. 2 Lease, Amended. From AEC files.