

**GEOLOGY AND PRODUCTION HISTORY
OF THE FERN NO. 1 URANIUM MINE
NAVAJO COUNTY, ARIZONA**

by

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INTRODUCTION

The Fern No. 1 Mine was located by exploration drilling on Atene Mesa in the Oljeto syncline area of Navajo County, Arizona. The Fern ore body was the south extension of previous located ore bodies on a Utah State School Section within the Navajo Indian Reservation. It had the distinction of producing the largest tonnage (7,584 tons) of high-grade ore (0.77% U₃O₈) of any uranium mine in Monument Valley.

Information and an early map of the mine were recently located in the Atomic Energy Commission (AEC) records at the Department of Energy's (DOE) Grand Junction Projects Office. The DOE permitted me to copy the information for the Arizona Geological Survey.

LOCATION AND LAND STATUS

The Fern No. 1 Mine was approximately 2.5 miles south of Oljeto Trading Post in Navajo County, Arizona (Figure 1). On the Boot Mesa 7.5' quadrangle topographic map (U.S. Geological Survey, 1988) the portal of the mine is shown at 36° 59' 48" north latitude and 110° 18' 32" west longitude.

The mine was located 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; these assignments also 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 Fern No. 1 ore deposit was located by exploration drilling on Atene Mesa. This small mesa, astride the Arizona-Utah boundary, is on the eastern side of Oljeto syncline, which is between the Organ Rock anticline to the west and the crest of the Monument Uplift to the east. The mesa is capped with rocks of the

Shinarump Member of the Upper Triassic Chinle Formation. Rocks of this formation dip approximately 3 degrees to the southwest into the syncline (Witkind and Thaden, 1963). A thin mantle of dune sand covers the bedrock on the southern portion of the mesa.

The ore body at the Fern No. 1 mine was formed in a channel deposit in the basal portion of the Shinarump Member of the Chinle Formation. The channel, scoured into the underlying Moenkopi Formation of Lower Triassic age, was filled with medium-to-coarse-grained sandstone and conglomerate. Carbonaceous plant materials, including fossil logs, were abundant in the channel sediments. The channel, as determined by the examination of drill hole information, is about 200 feet wide with a depth of approximately 40 feet. In the vicinity of the ore body the channel trends N15° W. Drill hole logs indicated the ore was at a depth of 200 feet, with an average thickness of 5 feet. Some drill holes penetrated ore as thick as 21 feet. The deposit was unoxidized because of a perched water table in the Shinarump. Water flowed into the mine workings at the approximate rate of 50 gallons per minute. Uraninite was the principal uranium mineral. Copper sulfides such as chalcocite, bornite and chalcopyrite were also present in the ore.

Just north of the state line, in the SW1/4, SE1/4 Section 36, T.43S.,R.14E., ore bodies at the Radium Hill and Utah No. 1 mines occur in the same channel. The Fern No. 1 ore body is the southern extension of the Radium Hill deposit. The two mines in Section 36 produced a total of 12,776.09 tons of ore with an average grade of 0.34 percent U₃O₈ during 1955-57, 1961-62 (Chenoweth, 1990).

Geologic studies of the channels in Monument Valley by Young and others (1964) indicate that the channel continuing the Fern No. 1 and the Section 36 ore deposits, on Atene Mesa, was traced, by drilling, across the mesa and no other ore bodies were found.

EXPLORATION AND PRODUCTION HISTORY

In March 1955, Leonard Redhouse of Kayenta, Arizona was issued Navajo Tribal Mining Permit MP-285. This permit included four parcels named the Fern 1 through 4, and totaled 599 acres. MP-285 was immediately south of Section 36, T.43S.,R.14E. in San Juan County, Utah. This section is a Utah School Section, and not part of the Navajo Indian Reservation.

Redhouse acquired the mining permit since exploration drilling by the Texas Mining Company had discovered a uranium ore body in the SW1/4,SE1/4 of the section (Chenoweth, 1990). J. L. Foutz and

Oscar Thomas, of Farmington, New Mexico, became interested in the Fern claims and the assignment of the mining rights to them was approved on August 8, 1955.

Foutz and Thomas drilled 230 holes with a total footage of 27,000 feet, all non-core. This drilling located 10,000 tons of high grade ore on the Fern No. 1 claim, immediately south of the Arizona-Utah state line (AEC unpublished records).

Having located an ore body, Foutz and Thomas contracted with Western Mine Supply Company of Monticello, Utah to mine the ore. This firm drove a 380-foot long decline, with a minus 18° declination to reach the south end of the ore body (Figure 2). The initial ore shipment was made to the AEC ore-buying station at Monticello, Utah in June 1956. At Monticello the AEC assayed and paid for the vanadium (V_2O_5) content of the ore, in addition to the uranium content. A modified room and pillar mining method was used at the Fern No. 1.

Production in 1956 was 3,597.60 tons of ore with average grades of 0.91 percent U_3O_8 and 0.47 percent V_2O_5 (Table 1). When AEC engineers examined the mine in December 1956 then noted that workings of the Radium Hill mine in Section 36 had broken into the workings of the Fern No. 1 mine at the state line, improving the ventilation in both mines.

Mining continued in 1957 with 4,004.34 tons of ore averaging 0.64 percent U_3O_8 and 0.27 percent V_2O_5 shipped to Monticello (Table 1). The latest shipment was received in June, 1957. When the mine was examined by AEC geologists in November, 1957, they found the mine abandoned and the portal of the incline caved shut. After closing the mine, Foutz and Thomas canceled the assignment of their mining permit, and Leonard Redhouse allowed his mining permit to expire. During the time Foutz and Thomas controlled the mine, it produced 7,584.02 tons of ore averaging 0.77 percent U_3O_8 and 0.37 percent V_2O_5 (Table 1); the largest tonnage of high grade ore ever produced in the Monument Valley area.

In August 1960, Leonard Redhouse was issued MP-545 which covered the same 599 acres as his original MP-285. The assignment of the 135 acres of the Fern No. 1 parcel was approved to A and B Mining Company of Moab, Utah on March 15, 1961. At about the same time, A and B acquired a Utah State lease on Section 36 (Chenoweth, 1990).

A and B reopened the two mines on Section 36 and the Fern No. 1, and began cleanup mining (pulling pillars etc.), using G and G Mining Company of Moab, Utah as a contractor. A mine inspectors visit to the Fern No. 1 in June 1961, noted five men underground and one man on the surface. The last shipment from the Fern No. 1 was made in August 1961. During 1961, A and B and its contractor, shipped 1,998.41 tons

averaged 0.26 percent U_3O_8 and 0.41 percent Cu to the mill operated by Texas Zinc Minerals Corporation at Mexican Hat, Utah (Figure 1). This mill recovered copper from the uranium ores in the Monument Valley and White Canyon, Utah districts.

Mining continued at the Utah No. 1 and the Radium Hill mines in Section 36 until the spring of 1962 (Chenoweth, 1990). A and B canceled the assignment of MP-545 on April 10, 1962 and the mines have been inactive since that time.

Total production from the Fern No. 1 mine was 9,582.43 tons with an average grade of 0.66 percent U_3O_8 . The copper content of 1,998.41 tons averaged 0.42 percent Cu and the vanadium content of 7,584.02 tons averaged 0.37 percent V_2O_5 (Table 1). All of the uranium concentrate produced from the Fern No. 1 ore was sold to the AEC. Copper recovered at Mexican Hat was sold to a smelter in Arizona. The vanadium recovered by the AEC mill at Monticello was sold to the steel industry by the AEC.

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Table 1. Ore production from the Fern No. 1 Mine, Navajo County, Arizona

| YEAR | SHIPPER | TONS OF ORE | POUNDS U ₃ O ₈ | % U ₃ O ₈ | POUNDS V ₂ O ₅ | % V ₂ O ₅ | DELIVERY POINT |
|------|------------------|-----------------|---|------------------------------------|---|------------------------------------|---------------------------|
| 1956 | Foutz and Thomas | 3,579.68 | 65,302.49 | 0.91 | 33,830.00 | 0.47 | Monticello |
| 1957 | Foutz and Thomas | <u>4,004.34</u> | <u>51,123.84</u> | <u>0.64</u> | <u>21,714.60</u> | <u>0.27</u> | Monticello |
| | Subtotal | 7,584.02 | 116,426.33 | 0.77 ^{1/} | 55,544.60 | 0.37 | |
| 1961 | G and G Mining | 420.58 | 1,477.89 | 0.18 | | | Mexican Hat ^{2/} |
| 1961 | A and B Mining | <u>1,577.83</u> | <u>8,798.52</u> | <u>0.28</u> | | | Mexican Hat ^{2/} |
| | Subtotal | 1,998.41 | 10,276.41 | 0.26 | | | |
| | Mine Total | <u>9,582.43</u> | <u>126,702.74</u> | <u>0.66</u> | | | |

^{1/} Some AEC ore production summaries indicate that Foutz and Thomas shipped a total of 8,486 tons with an average grade of 0.75% U₃O₈. This number was used by Scarborough (1981, p.219) in his compilation and hence the 902 ton difference. I could find no information to support the larger number.

^{2/} Ores shipped to Mexican Hat averaged 0.42 percent copper

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

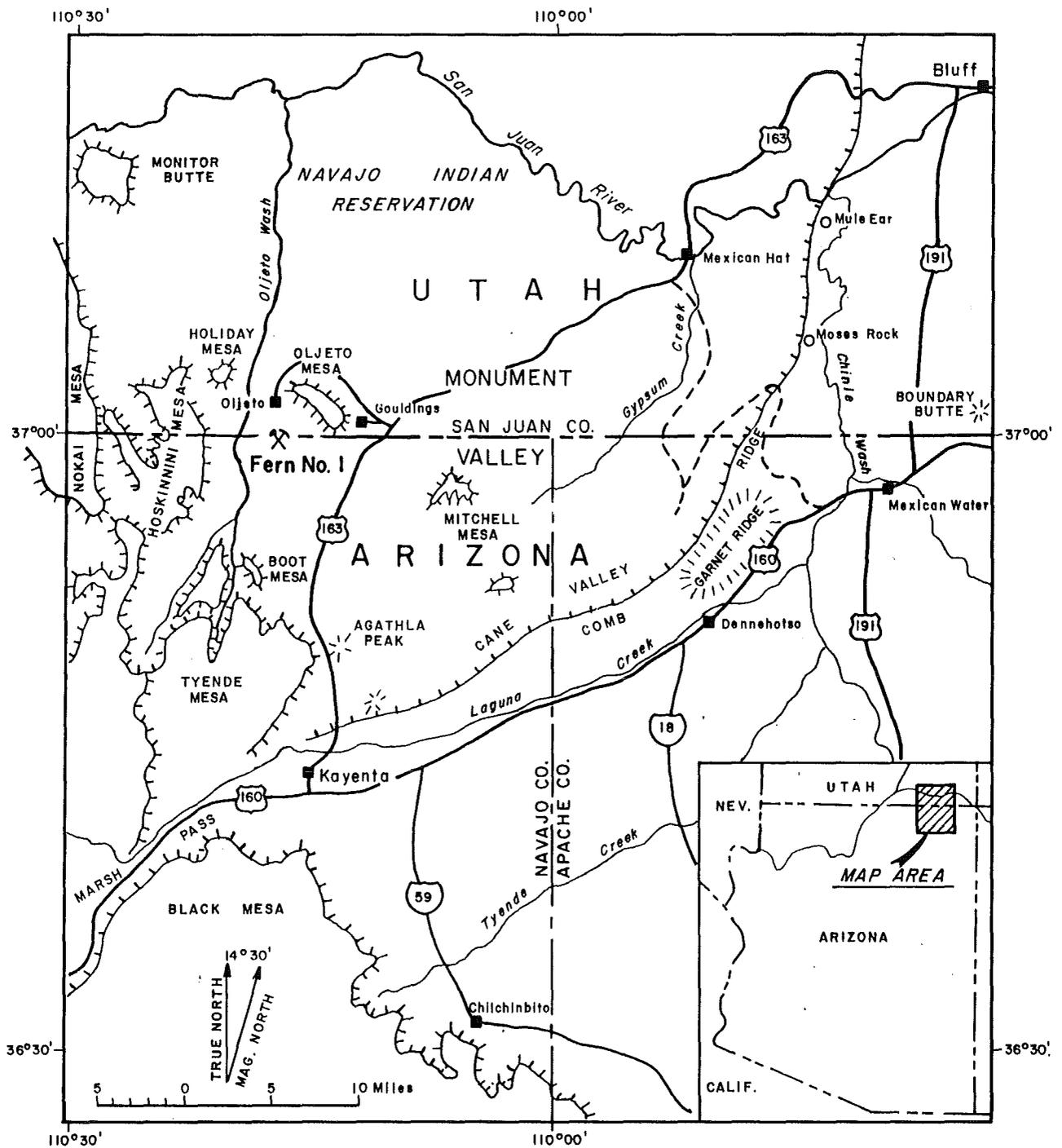


Figure 1. Index map of Monument Valley, Arizona-Utah, showing the location of the Fern No. 1 uranium mine.

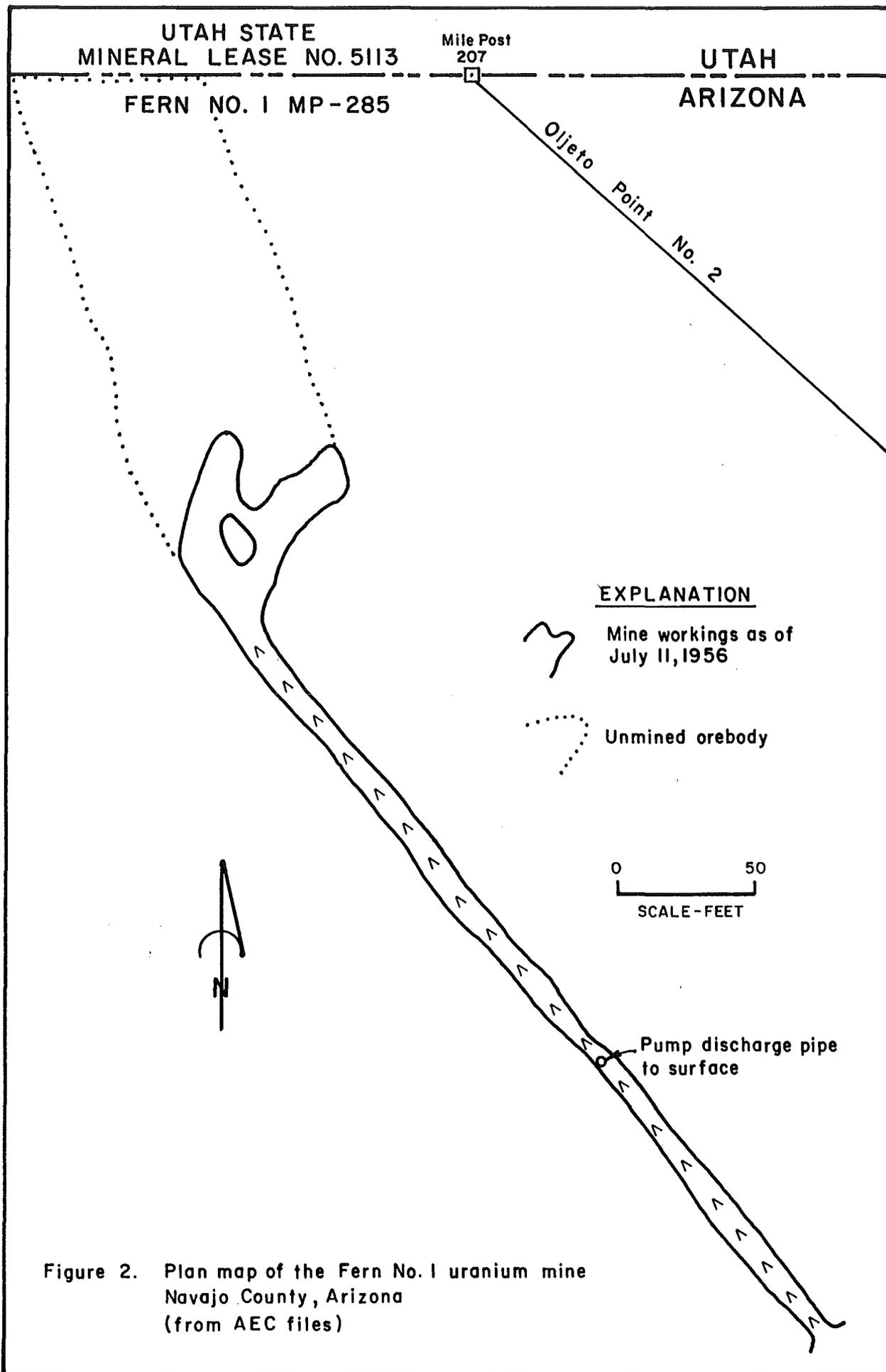


Figure 2. Plan map of the Fern No. 1 uranium mine Navajo County, Arizona (from AEC files)