

**GEOLOGY AND PRODUCTION HISTORY
OF THE FIRELIGHT NO. 6 URANIUM
MINE, NAVAJO COUNTY, ARIZONA**

by

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INTRODUCTION

One of the smaller uranium mines in the Monument Valley area of Navajo County, Arizona, the Firelight No. 6 Mine has also been referred to as the Naschoy or Noschoy Mine (Young and others, 1964; Chenoweth and Malan, 1973; Scarborough, 1981). *Naschoy* is a Navajo Indian word meaning "lizard" (Young and Morgan, 1943, p. 51). "Firelight No. 6" is the name used in this report, however, because it appears in the official ore-production records of the U.S. Atomic Energy Commission (AEC).

I examined the mine in late 1959, while employed by the AEC. Most of the information in this report is from AEC documents. The mapping and geological interpretation of the drill-hole data were done by Rudolph W. Kopf and other AEC geologists who worked in Monument Valley.

A map of the underground workings (Figure 1) and other data pertaining to the Firelight No. 6 Mine were recently located in the files of the U.S. Geological Survey (USGS) at the Denver Federal Center.¹ Warren I. Finch of the USGS permitted me to copy the map for the Arizona Geological Survey.

LOCATION AND LAND STATUS

The Firelight No. 6 Mine was located 14 miles north of Kayenta, Arizona, in Navajo County (Figure 2), approximately 7 miles south of the Arizona-Utah border and 1.4 miles west of U.S. Highway 163. On the Boot Mesa topographic map, the mine site appears close to the ponds shown near lat 36°55'N and long 110°15'W (U.S. Geological Survey, 1988).

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 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. 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.

GEOLOGIC SETTING

The Firelight No. 6 ore deposit was located by exploration drilling because the surface at the mine site was covered with dune sand. The underlying Triassic Chinle Formation rocks dip approximately 5° to the west into the Oljeto syncline (Witkind and Thaden, 1963).

The orebodies were 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 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 outline as determined by company

drilling is shown in Figure 1. The deposit was unoxidized because of a perched water table in the Shinarump. The ore was classified by the AEC as low-vanadium ($< 0.75\%$ V_2O_5), low-lime ($< 6\%$ $CaCO_3$) uraninite.

Although Monument Valley uranium ores are known to contain copper as well as vanadium, no information is available on the copper content of the Firelight No. 6 ore. A sample (MJM-034) of radioactive rock from the mine dump, collected during the National Uranium Resource Evaluation program of the DOE, contained 462 ppm U_3O_8 , 150 ppm copper, and 500 ppm vanadium (Field and Blauvelt, 1982, Appendix C).

Geologic studies of the channels in Monument Valley by Young and others (1964) indicate that the Firelight No. 6 deposit is located in a north- to northwest-trending channel that contains the Black Rock, Sally, and Alma-Seegan deposits to the south, and the Big Chief deposit to the north. This channel has been traced by drilling for approximately 6 miles before it merges with the Bootjack-Big Four channel at the Sunlight Mine (Young and others, 1964).

PRODUCTION HISTORY

During 1955, numerous Navajos acquired permits to hold land for mining on the sand-covered flats along El Capitan Wash, on the eastern flank of the Oljeto syncline. They applied for these permits in anticipation of exploration drilling that was to be done by companies looking for uranium deposits farther west, near the axis of the syncline.

On November 16, 1955, John Todea was issued Mining Permit No. 374,² which consisted of 103.37 acres. On January 14, 1957, he assigned the mining rights to William J. Carey, Robert L. Boorstin, Bess Olsan, and Bernard Olsan, and to Robert L. Boorstin acting as independent executor of the estate of the late Joseph Olsan. This assignment was approved by the BIA on April 18, 1957.

On November 1, 1957, the original assignees, William J. Carey and others, assigned the permit to the Climax Uranium Company of Grand Junction, Colorado. This document (now in the AEC files) states that "Climax shall receive 60% of the payment for the ore produced and the Carey group 40% until Climax has realized a profit of \$10,000. After this has been accomplished, both parties shall share equally in the mining profits. Profits considered are those remaining after the payment of royalties to John Todea and the Navajo Tribe." This assignment was approved by the BIA on August 13, 1958.

Climax Uranium drilled the property in the fall of 1958 and located a uranium ore deposit near the center of the area covered by the mining permit. This drilling, totalling 8,000 feet, was done in a 50-foot grid pattern. The deposit reportedly contained 6,040 tons of ore averaging 0.31% U_3O_8 and 1.02% V_2O_5 . The ore averaged about 170 feet in depth and ranged from 2 to 11.5 feet in thickness, with an average thickness of 4.5 feet.

E.E. Lewis, Inc., of Grand Junction, Colorado, was contracted to develop and mine the orebody. In the winter of 1958-1959, Lewis drove a 380-foot-long, 31° decline. On April 15, 1959, he sent the initial shipment to the Climax Uranium Company's mill in Grand Junction. This shipment consisted of 29.44 tons of ore that averaged 0.30% U_3O_8 . Total shipments for 1959 were 697.07 tons, which averaged 0.20% U_3O_8 and 0.74% V_2O_5 (Table 1). As reported in the AEC production records, 60% of the ore was credited to Climax Uranium and 40% to Carey and others.

Mining continued until March 1960, when the final shipments were made. The mine was shut down in April 1960 because of low grades and ore discontinuity. The map (Figure 1) was updated on February 5, 1960, about 2 months before the mine closed. At that time, the mine workings consisted of about 600 feet of drifts (Figure 1). The gamma-ray logs of the drill holes had indicated that the ore was thicker and of better grade than was actually found during mining (John Peeso, personal commun., 1992).

By June 1960, all equipment at the mine site had been removed and the portal filled in with dune sand. Although approximately 50 gallons of water had been pumped from the mine per minute, flooding (Scarborough, 1981, p. 223) was not the cause of the closing. The mine closed because of a lack of economic ore (John Peeso, personal commun., 1992). Total ore production for the mine during the year it was in operation was 2,140.66 tons, which averaged 0.18% U_3O_8 and 0.59% V_2O_5 (Table 1). All of the ore had been processed at the Climax Uranium Company's mill in Grand Junction, Colorado, and the uranium concentrate was sold to the AEC.

ACKNOWLEDGMENTS

Jon E. Spencer and Emily Creigh DiSante of the Arizona Geological Survey reviewed this report and greatly improved it. John Peeso, a former employee of E.E. Lewis, Inc., kindly supplied information regarding the operation of the mine.

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¹This information is part of the collection of geological data that was moved to the Denver Federal Center by the Department of Energy (DOE). In 1983 the uranium resource and liaison programs of the DOE were transferred from Grand Junction, Colorado, to Washington, D.C. During the next few years, all of the geologic data and publications that the AEC, Energy Research and Development Administration, and DOE had collected and produced from 1947 to 1983 were relocated to the USGS in Denver.

²Legal Description of Navajo Tribal Mining Permit No. 374:
 "Beginning at Corner No. 1 which bears N. 67°-03' W., 6,398.2 feet from U.S. [Indian Service] Mineral Monument No. 4; thence S. 21°-59' E., 1,962.2 feet to Corner No. 2; thence S. 21°-59' E., 2,605.1 feet to Corner No. 3; thence N. 79°-05' W., 1,996.6 feet to Corner No. 4; thence N. 9°-05' W., 1,605.1 feet to Corner No. 5; thence N. 12°-36' W., 2,325.4 feet to Corner No. 1, the point of beginning. This parcel contains 103.37 acres."

--From the files of the Navajo Tribal Mining Department, Window Rock, Arizona.

Table 1. Ore production, Firelight No. 6 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
1959	Climax Uranium	418.24	1,670.99	0.20	6,189.65	0.74
1959	W.J. Carey	278.83	1,113.98	0.20	4,126.44	0.74
1960	Climax Uranium	866.15	2,895.59	0.17	9,006.81	0.52
1960	W.J. Carey	<u>577.44</u>	<u>1,930.40</u>	<u>0.17</u>	<u>6,004.54</u>	<u>0.54</u>
Total		2,140.66	7,610.96	0.18	25,327.44	0.59

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

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Figure 1.

Plan map of the Firelight No. 6 uranium mine
Navajo County, Arizona

EXPLANATION



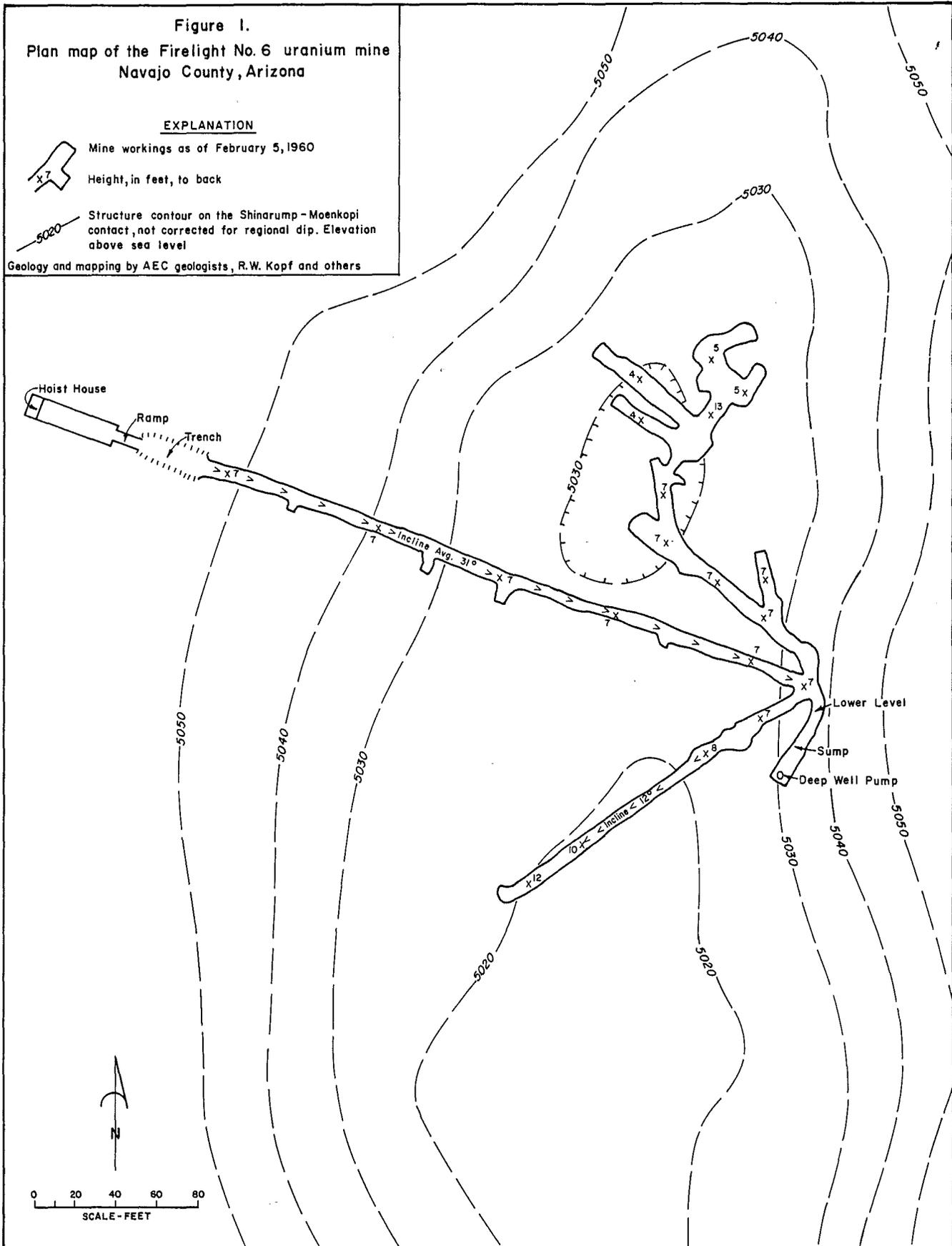
Mine workings as of February 5, 1960

Height, in feet, to back



Structure contour on the Shinarump-Moenkopi contact, not corrected for regional dip. Elevation above sea level

Geology and mapping by AEC geologists, R.W. Kopf and others



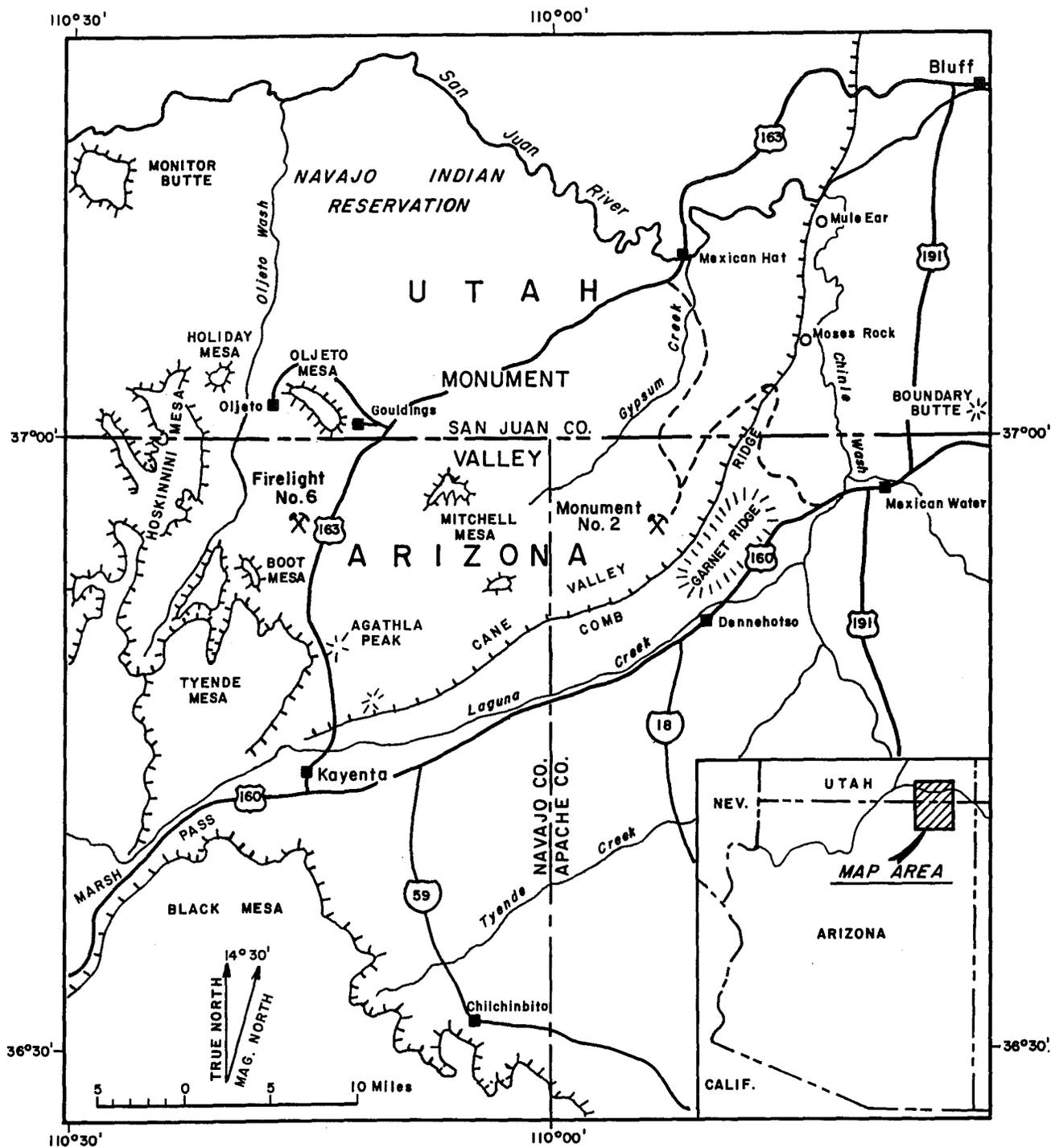


Figure 2. Index map of Monument Valley, Arizona - Utah, showing the location of the Firelight No. 6 uranium mine.