

**THE GEOLOGY AND PRODUCTION
HISTORY OF THE SUNLIGHT AND
SOUTH SUNLIGHT URANIUM
MINES, NAVAJO COUNTY, ARIZONA**

by

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and do not necessarily coincide with those of the staff of the Arizona
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INTRODUCTION

The Sunlight and South Sunlight Mines were two of fifteen uranium deposits located by exploration drilling in the Oljeto syncline area of Monument Valley, Navajo County, Arizona. Of all the deposits that were mined, the Sunlight was the third largest and the South Sunlight was the sixth largest. In his compilation of data of uranium in Arizona, Scarborough (1981, p.218) confused these two mines on the Big Four No. 1 claim with the small Big Four No. 2 Mine on that claim.

Most of the information in the this report is from U. S. Atomic Energy Commission (AEC) documents. Unfortunately, no maps of the mine workings could be located. This report is another one in the series on uranium mines in the Monument Valley area of Navajo County, Arizona (See Appendix 1).

LOCATION AND LAND STATUS

The Sunlight and South Sunlight Mines were approximately 16 miles north of Kayenta, Arizona and 4.5 miles west of U. S. Highway 163 (Figure 1). The two mine sites have been reclaimed, but the mine waste from the South Sunlight decline is shown on the Boot Mesa topographic map (U.S. Geological Survey, 1988) at latitude 36° 56' 53" N and longitude 110° 17' 15 W.

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. 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 for 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.

GEOLOGICAL SETTING

The Sunlight and South Sunlight ore deposits on the Big Four No. 1 claim were two of fifteen uranium ore deposits that were located by "blind" drilling in the El Capitan Flat area of Monument Valley. The Flat is a large, sand-dune-covered area on the eastern side of Oljeto Wash (Figure 1). Oljeto Wash roughly follows the axis of the Oljeto syncline, which is between the Organ Rock anticline to the west and the crest of the Monument Uplift to the east. Underlying the dune sand in the Big Four area is the Upper Triassic Chinle Formation. Rocks of this formation dip approximately 2° to the west into the syncline (Witkind and Thaden, 1963).

The ore bodies on the Big Four No. 1 claim were formed in a channel deposit in the basal portion of the Shinarump Member of the Chinle Formation. The channel at the Sunlight Mine approximately 200 feet wide and 100 feet deep, was scoured into the underlying Moenkopi Formation of Lower Triassic age and filled with medium-to-coarse-grained sandstone and conglomerate. Carbonaceous plant materials, including fossil logs, are abundant in the channel sediments.

Geological studies of the Shinarump channels in Monument Valley, based largely on industry drilling, by Young and others (1964) indicate the South Sunlight ore deposit occurs at the junction of the

northwest trending channel containing the Big Chief, Firelight No. 6 and Alma-Seegan Mines and the northeast trending channel containing the Big Four No. 2 Mine. The Sunlight ore deposit is located in the north northwest trending channel formed by the merger of the other two channel. (Figure 2).

The Sunlight deposits were unoxidized due to a perched water table in the basal Shinarump. Uraninite (uranium oxide) was the principal uranium mineral. Montrosite, a vanadium oxide, was also present, as were copper sulfides such as bornite, chalcocite, and chalcopyrite. Calcium carbonate (CaCO_3) was the principal cementing agent of the sandstone.

Data compiled by Roger C. Malan, of the AEC, for his published report on Monument Valley (Malan, 1968) indicated that 61,000 tons of ore shipped from the Sunlight Mines averaged 1.05 percent copper (Cu) and 5.30 percent CaCO_3 .

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 north, near the axis of the syncline. By early 1956, more than 25 square miles on the eastern flank of the Oljeto syncline were claimed by mining permits. Because of confusion and conflicts over permits, the large area west of Oljeto Wash was withdrawn for prospecting and mining by the Navajo Tribal Council on July 19, 1955 (Navajo Tribal Council, 1955).

Navajo Tribal Mining Permit (MP) No. 349 was approved to Roy and Betty Gray on October 19, 1955. This permit covered the 960 acres of the Big Four Nos. 1, 2, 4, and the Blood, Sweat and Tears claims (Figure 3). Each claim contained 160 acres. The Industrial Uranium Company, Salt Lake City, Utah, did exploration drilling in the area of the permit in 1956. Since this drilling located some uranium ore bodies, the firm requested the assignment of the mining rights to claims Nos. 1, 2 and 4. The assignment was approved by the BIA on September 4, 1956. Since the Big Four No. 1 claim contained large ore bodies, Industrial Uranium converted this 160 acres to Lease No. 14-20-5607-2291 on June 27, 1957. The assignment of claims 2 and 4 was canceled and the mining permit expired. To be compatible with their other nearby mines, the Moonlight and Starlight, Industrial named the mines on the Big Four No. 1 claim, Sunlight.

SUNLIGHT MINE

Data in the AEC files indicates the Sunlight Mine was located and developed by 175 drill holes with a total footage of 43,750 feet. This drilling delineated 54,000 tons of ore with an average grade of 0.37 percent U_3O_8 . The ore ranged in thickness from 2 to 25 feet with an average thickness of 12 feet.

Shaft sinking began in March, 1957. Navajo miners sank the first 130 feet, at a rate of 1 foot per day, until they were replaced by a contractor with shaft-sinking expertise. When visited by the State Mine Inspector in May, 18 men were employed sinking the 260 foot-deep, two compartment shaft. The shaft was equipped with a 50 horsepower, single drum, electric hoist (U. S. Atomic Energy Commission, 1959). The State Mine Inspector reports indicate that 10 to 14 men were employed underground and 2 to 4 men were on the surface between 1958 and 1963.

John J. Borkert (written communication, 1992), a former mining engineer for Industrial Uranium, reported that there were two ore zones at the Sunlight Mine, with the upper zone being of lower grade. The mine was developed by a modified room and pillar method with track haulage in the ore zones. After

the shaft and initial development were completed, Industrial Uranium did an additional 40,000 feet of drilling to further delineate the ore bodies.

A 150-ton amenability shipment was made in January, 1958, but sustained production did not begin until April with the ore shipped to the AEC ore-buying station at Monticello, Utah (Table 1). Some 2405.57 tons were analyzed for vanadium at Monticello which averaged 0.53 percent V_2O_5 (Table 2). Beginning in 1959 all production was shipped to the mill at Mexican Hat, Utah operated by the Texas-Zinc Minerals Corporation. The hauling distance from the mine to the mill was 31 miles. In March 1962, Industrial began shipping 400 tons per month from their Monument Valley mines to the mill at Tuba City, Arizona, operated by El Paso Natural Gas Company. These shipments continued through May 1962, when the mill stopped purchasing ore (Albrethsen and McGinley, 1982). After the mill closed, all shipments resumed to Mexican Hat. On July 31, 1963, the Atlas Corporation purchased Texas-Zinc Minerals. An Atlas subsidiary, A-Z Minerals, operated the Mexican Hat mill until it closed in February, 1965 (Albrethsen and McGinley, 1982). From 1960 through 1963 the monthly ore production from the Sunlight Mine averaged approximately 1,000 tons per month.

When the Sunlight Mine closed in 1964 it had produced 55,023.51 tons of ore averaging 0.26 percent U_3O_8 and containing 291,461.88 pounds U_3O_8 (Table 1). These pounds rank the Sunlight Mine as the third largest mine in the Oljeto syncline behind the Moonlight and Bootjack Mines. The copper content of the ore shipped to Mexican Hat averaged 1.05 percent Cu. John J. Borkert (written communication, 1992) remembered the Sunlight Mine had better copper grades than the Big Chief mine to the southeast and the Starlight East to the northwest.

SOUTH SUNLIGHT MINE

Very little information is available on the South Sunlight Mine. The ore deposit was developed via a long decline driven in 1961, and production began in 1962, just as production from the Sunlight Mine began to decline (Table 1). The mine was developed using modified room and pillar methods with rubber tired, diesel equipment used underground. State Mine Inspector reports indicate between 17 to 18 men worked underground and 2 to 3 men were on the surface in 1962 and 1963. During 1963, monthly ore production averaged just over 1,000 tons per month.

The mine was inactive for most of 1964 until a contractor for Industrial Uranium began to clean up mining in 1964 and in 1965. In October 1965, three men were employed at the mine by John Hargrove of the Combined Metals Mining Company, Cortez, Colorado. This clean up mining resulted in the grade dropping from 0.33-0.34% U_3O_8 to 0.19-0.20% U_3O_8 (Table 3). Total ore production from the South Sunlight Mine was 28,644.74 tons of ore with an average grade of 0.30 percent U_3O_8 and containing 171,459.83 pounds U_3O_8 (Table 3). Incomplete records indicate that the copper content of much of this ore averaged 1.05 percent Cu. The South Sunlight Mine was the sixth largest ore deposit in the Oljeto syncline, behind the Moonlight, Bootjack, Sunlight, Starlight East and Starlight Mines. All of the ore was shipped to the mill at Mexican Hat, Utah.

SUMMARY

All of the uranium concentrate produced at the mills, Monticello, Tuba City and Mexican Hat, from the Sunlight and South Sunlight ores were sold to the AEC. Copper recovered at the Mexican Hat Mill was sold to a smelter in Arizona. Vanadium was paid for at the AEC ore-buying station at Monticello but was not recovered after March 31, 1956 at the AEC's Monticello mill (Albrethsen and McGinley, 1982).

Acknowledgements. Ken A. Phillips, Arizona Department of Mines and Mineral Resources, supplied information on mine inspections. The manuscript was reviewed by Stephen M. Richard of the Arizona Geological Survey.

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- Young, R.C., Malan, R.C., and Gray, I.B., 1964, Geological map showing uranium deposits and Shinarump channels in the Monument Valley district, San Juan County, Utah, Navajo and Apache Counties, Arizona: U.S. Department of Energy Preliminary Map 34, scale 1:95,000.

Table 1. Uranium ore production, Sunlight Mine, Navajo County, Arizona

YEAR	TONS OF ORE	POUNDS U_3O_8	% U_3O_8	DELIVERY POINT
1958	4,334.26	16,118.59	0.19	Monticello
1959	6,482.08	34,011.01	0.37	Mexican Hat
1960	12,515.31	63,290.28	0.25	Mexican Hat
1961	11,374.40	63,965.08	0.28	Mexican Hat
1962	15,825.57	90,937.45	0.29	Mexican Hat/Tuba City
1963	3,472.13	20,391.92	0.29	Mexican Hat
1964	1,019.76	2,623.50	0.13	Mexican Hat
Total:	55,023.51	291,461.88	0.26	

All shipments made by the name of Industrial Uranium Company

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

Table 2. Vanadium content of uranium ore shipments, Sunlight Mine, Navajo County, Arizona

YEAR	TONS OF ORE	POUNDS V_2O_5	% V_2O_5
1958	2,405.57	25,498.79	0.53

Ore shipped to Monticello, Utah

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

Table 3, Uranium ore production South Sunlight Mine, Navajo County, Arizona

YEAR	TONS OF ORE	POUNDS U_3O_8	% U_3O_8
1962	8,322.13	56,397.10	0.34
1963	13,841.06	90,304.03	0.33
1964	282.71	1,153.07	0.20
1965	6,198.84	23,605.63	0.19
Total:	28,644.74	171,459.83	0.30

All shipments made under the name of Industrial Uranium Company to Mexican Hat, Utah

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

APPENDIX 1. List of Uranium Mine reports, Monument Valley, Arizona

Uranium Mine Reports, Monument Valley,
Navajo County, Arizona

Name of Mine	Contributed Report No.
Alma	CR-94-C
Big Chief	CR-92-D
Big Four 2	CR-94-G
Black Rock	CR-91-A
Bootjack	CR-93-A
Fern 1	CR-94-A
Firelight 6	CR-92-C
Golden Crown	CR-95-F
Harve Black 2	CR-89-E
Mitchell Butte	CR-95-B
Mitten 2	CR-92-A
Moonlight	CR-95-D
Monument 1	CR-92-A
Sally	CR-91-A
Sam Charlie 1	CR-95-C
Seegan	CR-94-C
South Sunlight	This report
Starlight	In press
Starlight East	In press
Sunlight	This report
Tract 11	CR-96-A
Tract 17	CR-96-A

APPENDIX 2. Legal Description Navajo Tribal Mining Lease No. 14-20-5607-2291

"Commencing at Corner No.1, thence S 51° 52' E, 2,640 feet to Corner No. 2, thence S 38° 08' W, 2,640 feet to Corner No. 3, thence N 51° 52' W, 2,640 feet to Corner No. 4, thence N 38° 08' E, 2,640 feet to Corner No. 1, the point of beginning, contains 160 acres more or less. Corner No. 4 is S 31° 06' E, 13,350 feet, S 55° 50' W, 9,167 feet, S 38° 08' W, 2,640 feet from the S E Corner Section 31, T.43 S., R. 15 E., Salt Lake Baseline and Meridian."

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

Note: In the AEC records, the Big Four No. 1 lease is recorded as No. 14-20-5607-2292, which appears to be in error.

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- Figure 3. Index map showing the location of the Big Four No. 1 and adjacent claims, Navajo County, Arizona, from AEC files.

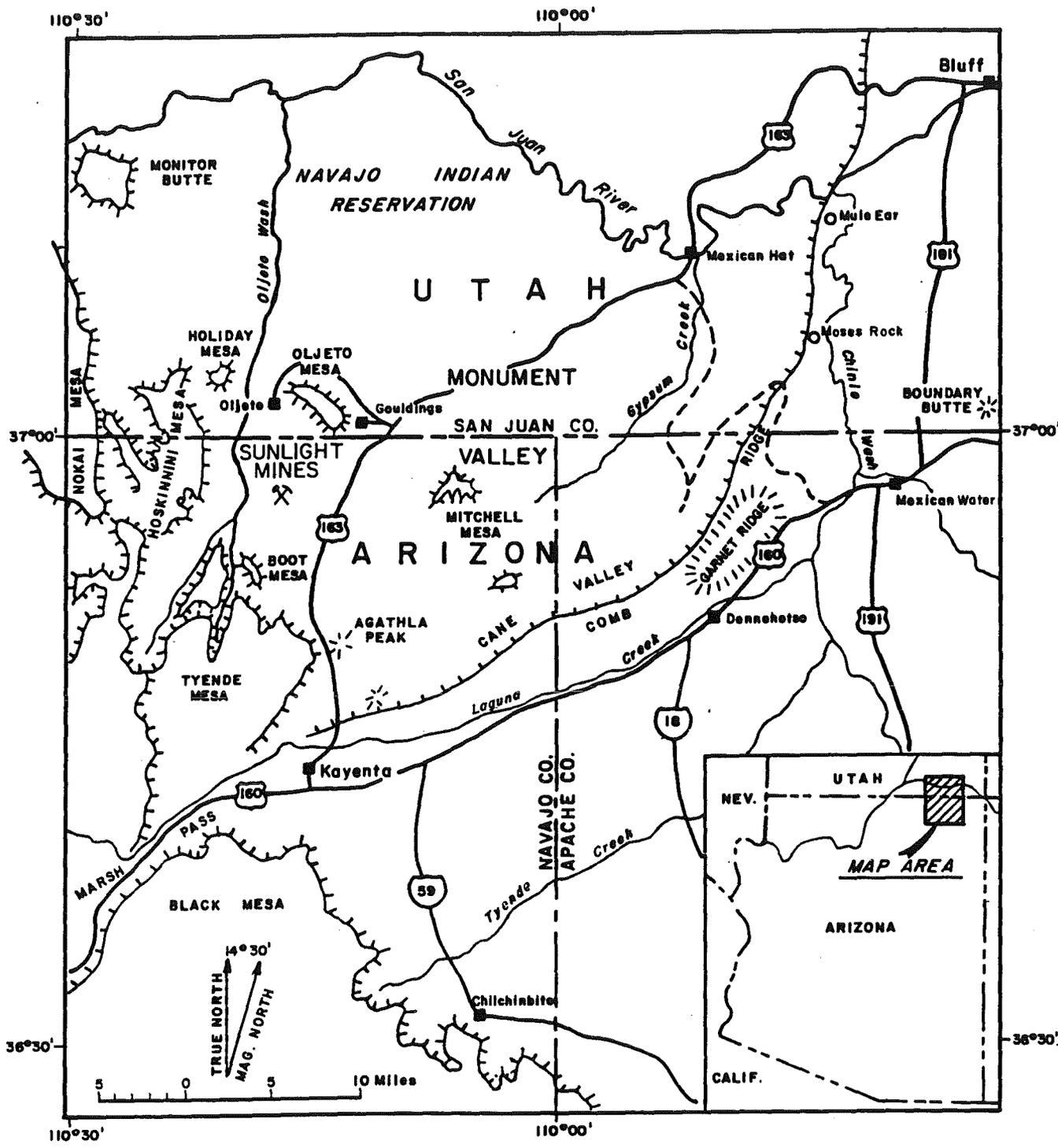


Figure 1. Index map of Monument Valley, Arizona-Utah, showing the location of the Sunlight and South Sunlight uranium mines.

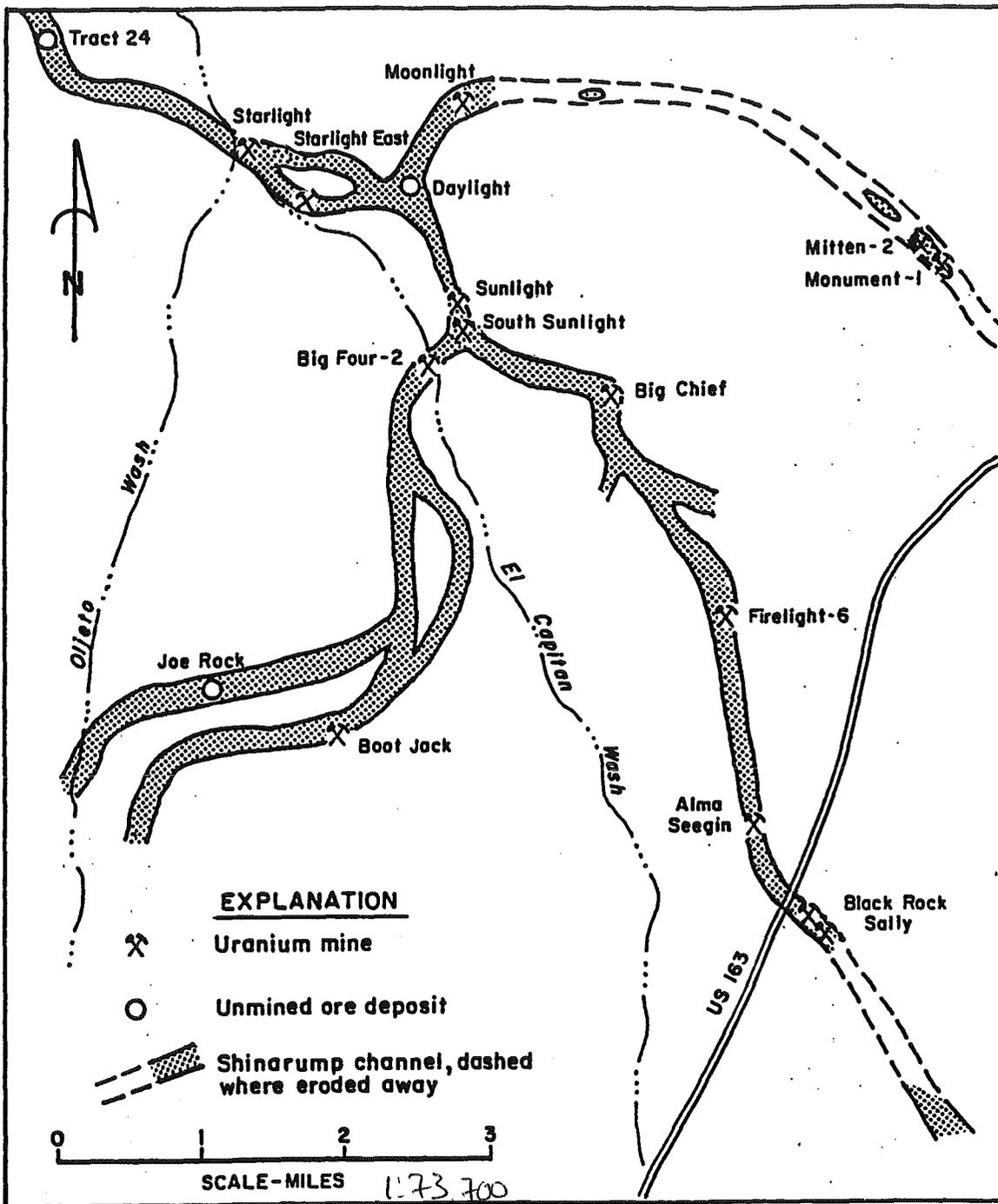


Figure 2. Map of the El Capitan Wash area, Navajo County, Arizona, showing Shinarump channels and uranium deposits. After Young and other (1964).

T41N, R19E G.&SR., B&M.

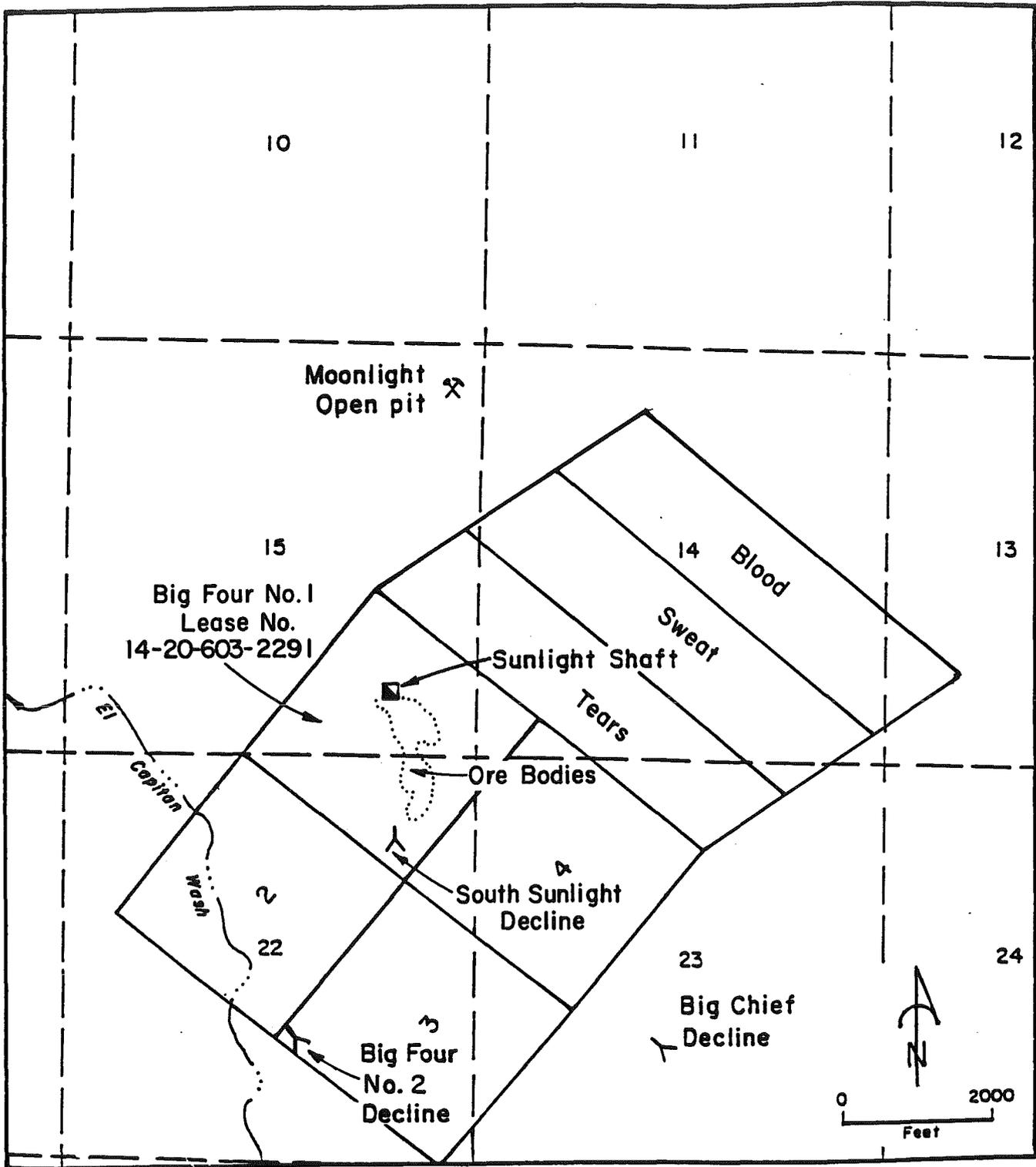


Figure 3. Index map showing the location of the Big Four No. 1 and adjacent claims Navajo County, Arizona, from AEC files.