Summary of the uranium-vanadium ore production 1947-1969 Monument Valley district, Apache and Navajo Counties, Arizona

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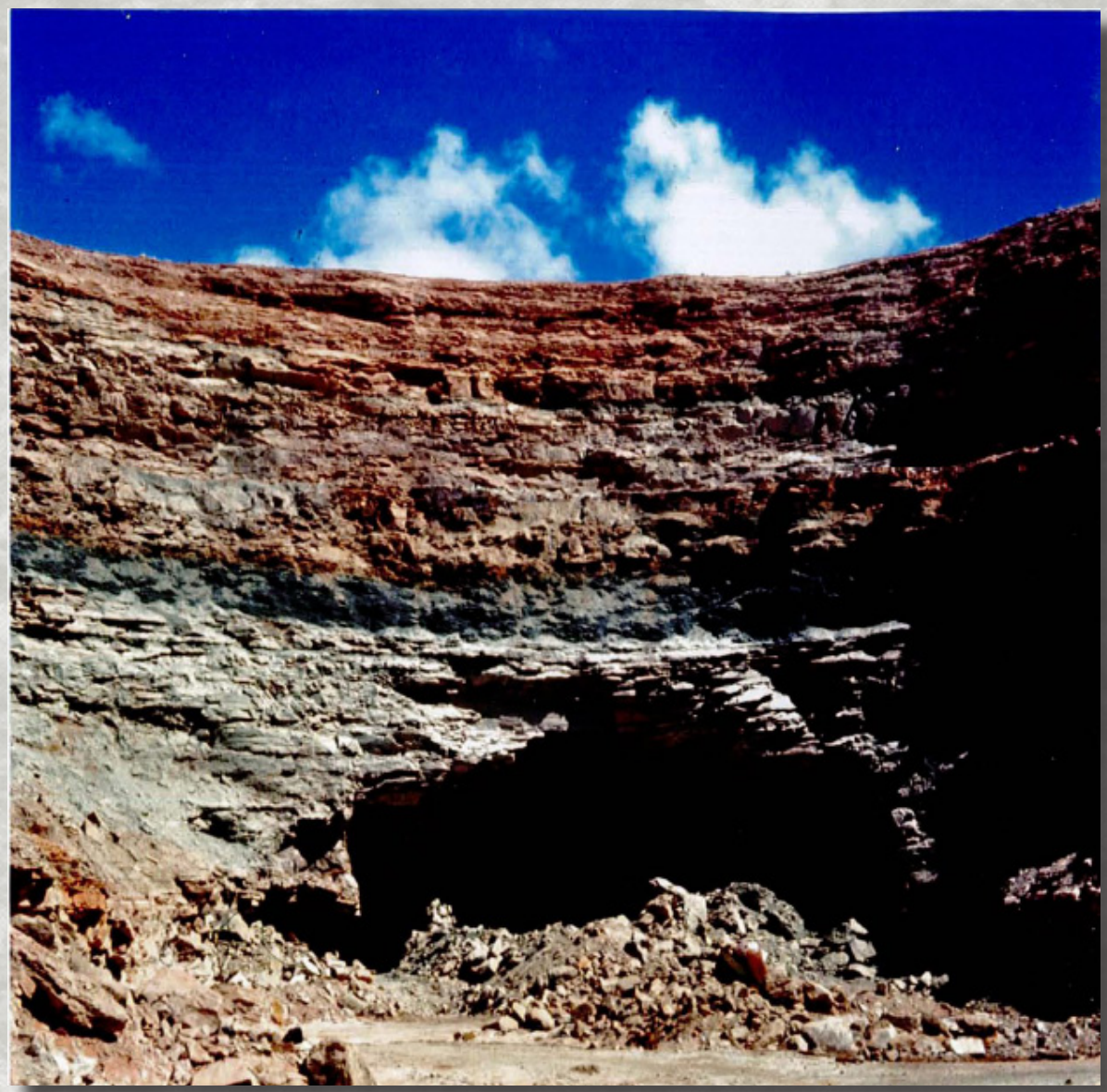

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Summary of the Uranium-Vanadium Ore Production 1947-1969 Monument Valley District, Apache and Navajo Counties, Arizona

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Introduction

The Monument Valley uranium district is located in northeastern Arizona and in southeastern Utah (Figure 1). It is within the Navajo Indian Reservation where exploration and mining was under the control of the Navajo Tribal Council and the Bureau of Indian Affairs, U.S. Department of the Interior. A report on the Utah portion of the district was published in 1991 (Chenoweth, 1991). The purpose of this report is to summarize the production in the Arizona portion of the district.

Land Status

The following is a summary of how land for mining was acquired on the Navajo Indian Reservation after 1940.

On April 9, 1941, the Navajo Tribal Council requested the Secretary of the Interior approve regulations wherein mining leases would be granted to the highest bidder. These leases were written for large areas and subsequently reduced in acreage at the end of the specified time period. The net effect of this type of lease was that a prospecting permit was issued to the highest bidder, who then had the right to lease land within the permit area up to a maximum acreage. The maximum acreage a company could lease on the Reservation was 960 acres. Under these new regulations, two leases were issued in Monument Valley for vanadium mining.

The U.S. Atomic Energy Commission was created in 1947. Mining uranium under this new agency increased the interest to prospect on the Reservation. In 1939, the Interior Department and the Navajo Tribal Council developed new regulations that allowed individual Navajos to prospect. If a discovery was made, the ground would be held by a tribal mining permit. On March 22, 1951, the Tribal Council adopted Resolution CM-3-51 authorizing the Advisory Committee to draft new mining regulations. New regulations pertaining to prospecting and mining were adopted on April 27, 1951 and were approved on September 19, 1951. The new regulations stated that all prospectors must have a permit. Mining permits and leases were to be issued by the Navajo Tribal Council and approved by the Bureau of Indian Affairs (BIA), U.S. Department of Interior. Only individual Navajos could obtain mining permits. Permit holders could assign the mining rights to another individual or a company, but the Tribal Council and the BIA had to approve these assignments. Leases would be issued directly by the BIA, and approved by the Secretary of the Interior. Permits were issued for a 2-year period and could be renewed for an additional 2 years. Leases were issued for a period up to 10 years. Anyone company or individual could hold no more than 960 acres of tribal land. Both the permittee and the tribe would receive 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.

Early Vanadium Production

Prior to the U.S. Atomic Energy Commission's (AEC) ore procurement program, 1947-1970, vanadium ore was produced at the Monument Nos. 1 and 2 mines operated by the Vanadium Corporation of America (VCA). Details of their production in 1942-1946 is given in a report by Chenoweth (1985).

Previous Reports

During the period 1989 - 2003, the author prepared 19 separate reports on the geology and production history of the uranium mines in the Monument Valley district in Apache and Navajo Counties. These reports were made available to the public by the Arizona Geological Survey as part of their Contributed Report (CR) series. In 2011, the Survey released an additional four reports dealing with uranium-vanadium mines in Apache County. A listing of all 23 reports is given in the appendix.

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. The annual ore production numbers in the Monument Valley reports came from three documents: Allport (1951, 1952, 1953), U.S. Atomic Energy Commission (1953) and the U.S. Department of Energy (1997).

Figure 2 showing annual ore production was prepared by the author for use by Scarborough (1981). After this report was released, the author located some 1947 production from Monument No.2. Office of Indian Affairs royalty records, in the AEC files, show that in October through December 1947, this property produced 83.52 tons of ore containing

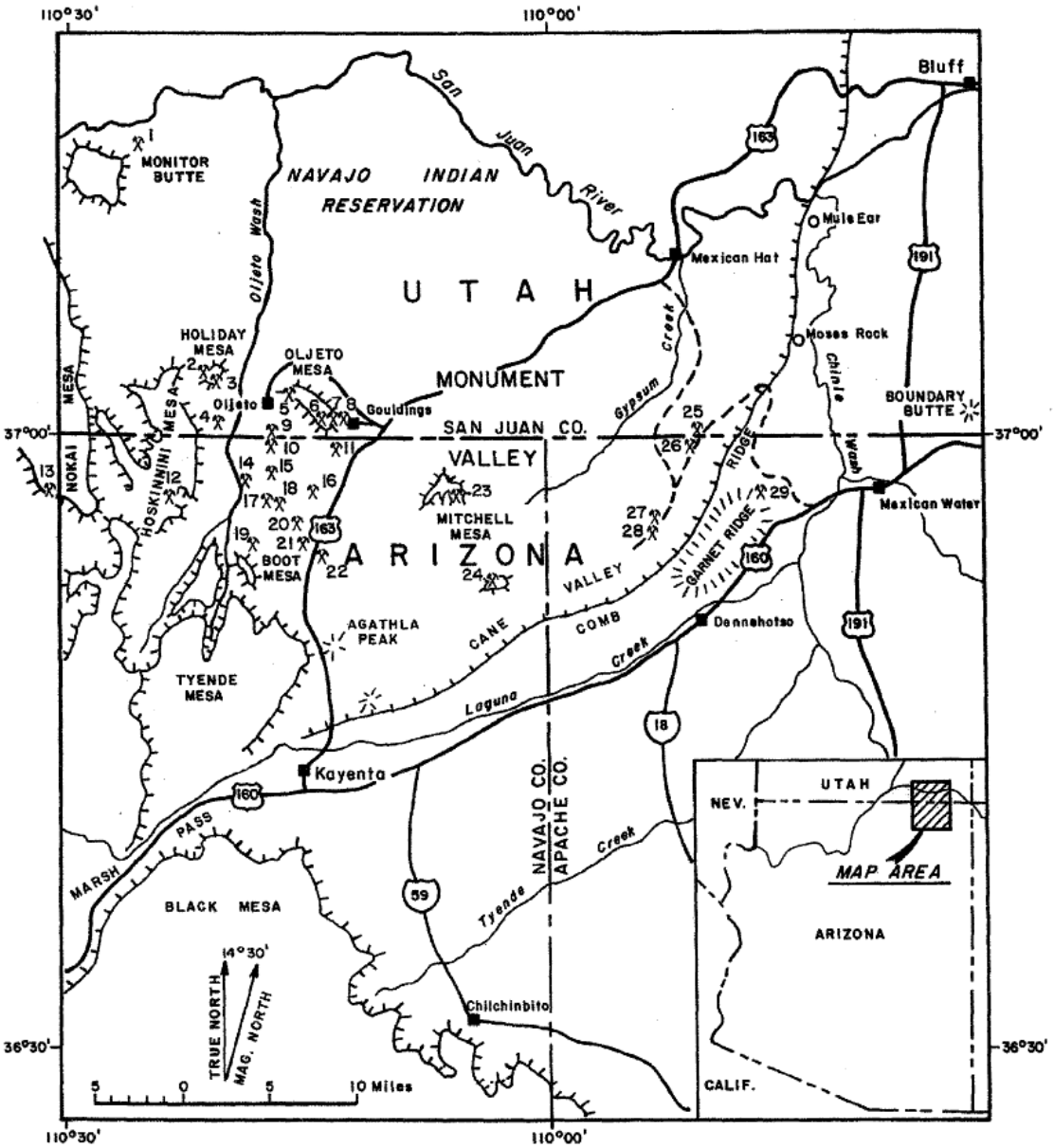

Figure 1. Index map of Monument Valley, Arizona-Utah, showing the location of the uranium mines.

List of mines on Figure 1.

1. Whirlwind
2. Taylor Reid 18. Big Chief
3. C-3 19. Bootjack
   Mitten 3
4. Monument 3
5. Charles Keith
6. Tom Holliday (Rock Hat) Sally
7. Mitten 1
   Skyline
8. RockDoor
9. Utah 1
   Radium Hill
10. Fern 1
11. Harve Black 2
12. Tract 11
13. Tract 17
14. Starlight
   Starlight East
15. Moonlight
16. Monument 1
   Mitten 2
   Golden Crown
17. Sunlight
   South Sunlight
   Big Four 2
20. Firelight 6 (Naschoy 1)
21. Alma-Seegan
22. Black Rock
23. Mitchell Butte
24. Sam Charlie 1
25. Harvey Blackwater 3
26. Harvey Blackwater 1
   Harvey Blackwater 4
27. Chee Nez 1
   John Yazzie 1
28. Monument 2 Complex
   Main Ridge, Plot 1
   South Ridge, Plot 2
   Tract 1 North
   Tract 1 South
   Tract 2
   Black and Blackwater
   Willie Waters
29. Bluestone

1,636.00 pounds of U_3O_8 (Allport, 1951). The ore was hauled to the company's mill at Naturita, Colorado. In Figure 2, this production is included with 1948.

Geologic Setting

With the exception of the Bluestone mine (Figure 1, No. 29) all of the uranium-vanadium mines in the Monument Valley district occurred in the Shinarump Member of the Chinle Formation of the Triassic Age. The Bluestone deposit occurs as a vein deposit associated with an igneous dike in the Navajo Sandstone on Garnet Ridge. Copper minerals occur with the uranium-vanadium minerals, giving the mine its name.

The deposits in the Shinarump Member occur in scoured paleochannels scoured into the underlying Moenkopi Formation. In the largest mines, the Monument No.2 and the Moonlight, the scouring reached into the Permian De Chelly Sandstone underlying the Moenkopi. A map by Young and Malan (1969) shows the distribution of the Shinarump channels in Monument Valley. Besides vanadium being a coproduct, some copper was recovered at the mill at Mexican Hat, Utah in the unoxidized ores from mines south of Oljeto, Utah.

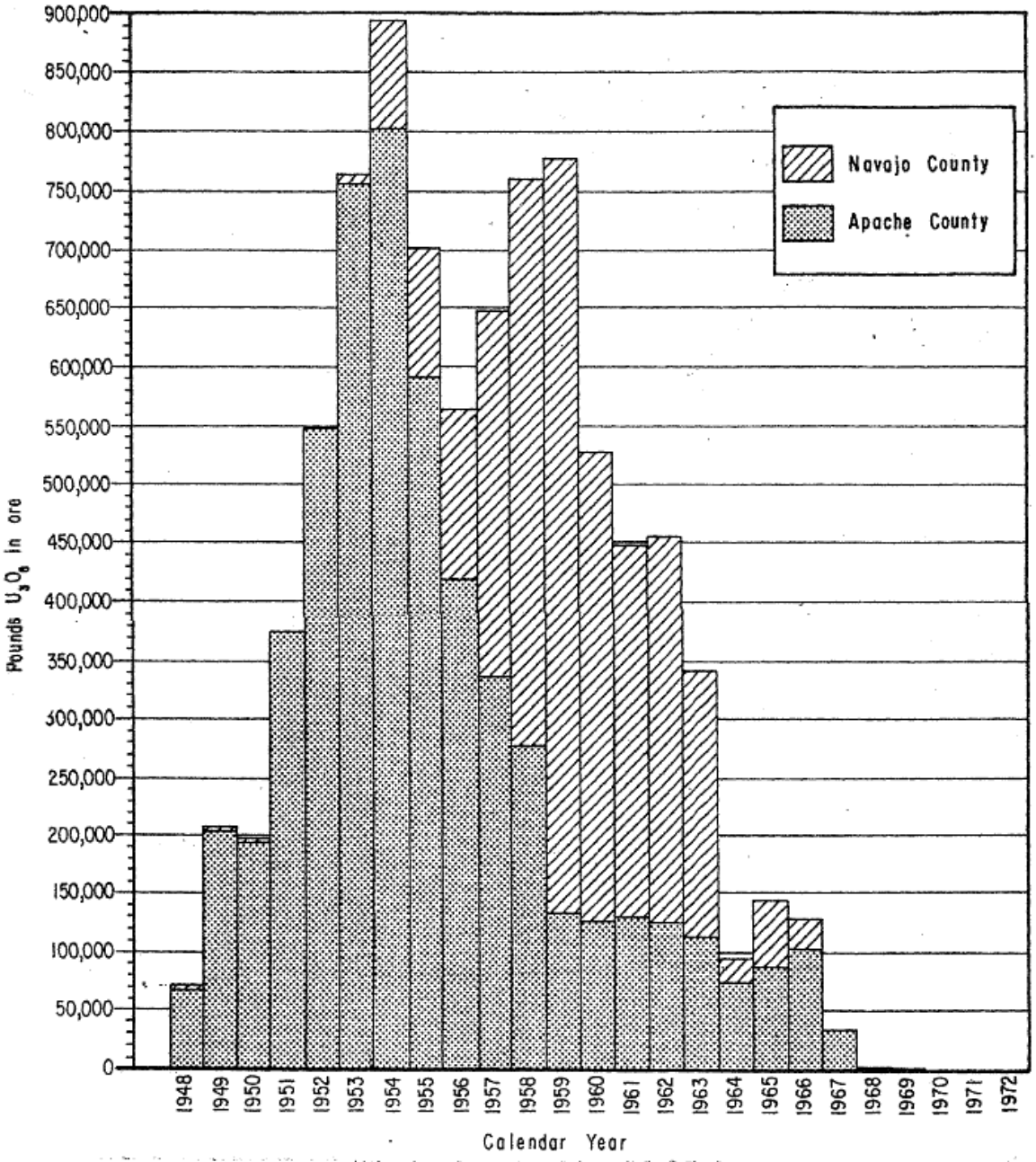

Figure 2. Annual uranium production, Monument Valley, Arizona. From Scarborough (1981).

Brief History of Exploration and Mining

The uranium-vanadium mineral carnotite was first noted in the valley by the U.S. Geological Survey (USGS) geologist Herbert E. Gregory in 1917. In 1921, an occurrence of uranium-vanadium minerals was discovered north of Kayenta by John Wetherill, a Kayenta trader. This occurrence was investigated by Frank Hess, USGS and by several prospectors.

On October 1, 1942, the Office of Indian Affairs, U.S. Department of the Interior, offered for sale a lease on 20.06 acres north of Kayenta. This was probably the site of the Wetherill discovery. When the bids were opened on October 22, 1942, Vanadium Corporation of America (VCA) was the highest bidder with a bonus bid of $739.83. This lease was named the Monument No.1 by VCA. Mining began in December 1942 and continued through February 1944. Shipments resumed in October 1945 and ceased in January 1946. This vanadium ore was shipped to a mill at Monticello, Utah. Total production was 3,525 tons of ore that averaged 1.94% V_20_5.

In 1942, Luke Yazzie discovered carnotite mineralization in the Cane Valley area in eastern Monument Valley. He told Harry Goulding, a local trader, of this discovery, who contacted VCA. As news of this discovery spread the area was investigated by several firms and individuals. Due to the interest in the area, the Office of Indian Affairs offered for lease 1,845 acres in the Cane Valley area on July 31, 1943. When the bids were opened on September 3, 1943, VCA was the only bidder with a bonus bid of $3,000. The lease was reduced to two plots totaling 42.09 acres in March 1944. VCA named this lease Monument No.2. Shipments to the Monticello, Utah mill began in October 1943 and continued until April 1944. Later shipments were made in February and December 1945 and January 1946. Total production was 487 tons of ore that averaged 1.40% V_20_5. At the Monticello mill, the Manhattan Engineer District (MED) secretly recovered uranium from the carnotite ores.

In 1949, individual Navajos were allowed to acquire ground on mining permits. In the vicinity of the Monument No.2 lease, Cato Sells, Jessie Black, Harvey Blackwater, Chee Nez, John Yazzie and Thomas CIani obtained mining permits surrounding VCA's two plots. The permits were assigned to mining companies who located and mined ore on all the permits. VCA let their Monument No. 1 lease expire on December 12, 1952, and the ground was claimed by Cecil Parrish Jr. on Mining Permit (MP) No. 77.

Late in 1953, VCA began stripping a large open pit on the Main Ridge where mining had occurred in 11 underground mines. By 1956, the mining area was converted to an open pit 3,500 feet long and 500 feet wide. To upgrade low grade material, VCA operated a mechanical sand-slime upgrader plant at the mine site from mid-1955 until June 1964. This plant separated the uranium-vanadium minerals from the sand grains. Material which averaged 0.04%-0.09% U_30_8 became ore that averaged 0.40%- 0.80% U_3O_8. On July 20, 1959, VCA modified their original 1943 lease to include the adjacent mining permits of the individual Navajos. The amended lease consisted of three parcels of land totaling 220.69 acres on Yazzie Mesa, Main Ridge and South Ridge.

In 1953, Seth Bigman acquired MP-73 for 600 acres 3 miles north, northwest of the Monument No. 1 mine. Drilling by the Industrial Uranium Co. in 1954 located the Moonlight ore body on the permit. By 1955, several other Navajos were obtaining MPs in the area of the Oljeto syncline between Highway 163 and Oljeto Wash. They were anticipating future drilling downdip from the Monument No. 1 mine, where an ore body was being mined on the adjacent Mitten No.2 permit. By 1956, some 25 square miles had been covered by MPs. It was in this area that blind drilling discovered the Bootjack, Starlight, Sunlight, Firelight and Big Chief ore bodies. All of these deposits were below the water table and contained unoxidized uranium, vanadium and copper minerals.

Due to confusion and conflict regarding MPs in the western portion of Monument Valley, the Navajo Tribal Council withdrew a large area from prospecting and mining on July 19, 1955. The area extended from the San Juan River on the north to Tyende Mesa on the south and from

Oljeto Wash west to Nokai Wash. Twenty-nine tracts in the area were offered for mining leases at a sealed bid sale in late 1955. The highest bidder on each tract was given 18 months, beginning on January 24, 1956, to explore its tracts. After exploration drilling, Phillips Petroleum Co. obtained leases on Tracts 10 and lIon Hoskinnini Mesa and Tract 17 on Nokai Mesa. Mines were developed on Tracts 11 and 17.

Production reached an all-time annual high in 1954 when 896,860 pounds of uranium oxide was produced from ores from 8 mines. Eighty-eight percent of this uranium came from mines on VCA's Monument No. 2 lease. After a small decline, the second highest year was 1959 when 774,670 pounds of uranium oxide were produced from 9 mines. Seventy-three percent of the uranium came from the Moonlight, Bootjack, Sunlight, and Big Chief mines in the Oljeto syncline. After that year, production began to decline. The last shipment from Monument Valley was in 1969, a clean-up of the Monument No.2 site (Figure 2).

Summary

A summary of the uranium ore production from the Monument Valley district is as follows:

County & State	Tons of Ore	Pounds U_30_8	% U_30_8
Apache Co., AZ	787,213.13	5,373,395.25	0.34
Nava.io Co., AZ	559,783.47	3,221,136.64	0.29
San Juan Co., UT	54,033.19	322,802.07	0.3
TOTALS	1,401,029.79	8,917,333.96	0.32

Summary of the uranium-vanadium ore production 1947-1969 Monument Valley district

This ranks Monument Valley as the third largest uranium district in the Chinle Formation on the Colorado Plateau. Lisbon Valley, Utah is first with 77.9 million pounds U_30_8 and White Canyon, Utah is second with 11.3 million pounds U_30_8.

VCA's Monument No.2 mine produced 95 percent of the uranium in Apache County and the Moonlight, Starlight and Sunlight mines of Industrial Uranium Company account for 62 percent of the Navajo County production.

The Monument Valley ores were processed at various mills in the Four Corner States. All of the uranium that was recovered was sold to the U.S. Atomic Energy Commission. Vanadium that was recovered at mills, such as at Naturita and Durango, Colorado and at Shiprock, New Mexico, was sold to the steel industry. Copper recovered at the Mexican Hat, Utah mill was sold to a smelter in Arizona.

Comment on Two Properties

Before the road from the Monument No.2 area was improved over Comb Ridge, ore from that area was hauled northward, crossing the San Juan River at Mexican Hat, Utah. Due to the small bridge at Mexican Hat, only 6-ton trucks were able to use the bridge. Operators stockpiled their ore in an area north of the bridge. When the stockpiles were large, 20-ton trucks were used to haul the ores to ore buying stations or mills. The author believes the property labeled Black Mustache was actually ore stolen from VCA's Monument No.2 stockpile and other mines stockpiles over a period of two years.

In 1949, VCA shipped 676.35 tons of low-grade ore to the AEC ore buying station at Monticello, Utah. These shipments were labeled "Mexican Hat Stockpile." The author believes that this stockpile was from the site of a mechanical up grader that VCA had on the banks of the San Juan River at Mexican Hat, Utah in 1948.

Mystery Shipment

In 1949, Henry Phillips delivered a total of 90.22 tons of ore averaging 0.54 percent U_30_8 and 0.89 percent V_20_5 to the AEC ore buying station at Monticello, Utah. These shipments were identified as Gothe and originating in Navajo County, Arizona. Records at the Navajo Tribal Mining Department, at Window Rock, Arizona, showed that Henry Phillips was issued Navajo Tribal Mining Permit No. 28 on April 26, 1952. The permit consisted of three parcels: Copper Canyon No.1, 20 acres in the West Fork of Copper Canyon, one mile south of the Arizona state line in Apache County, Arizona; Oljetoh No.1, 20 acres located 3/4 mile south of the junction of Begie Creek and Oljetoh Creek in San Juan County, Utah; Cove, 65 acres on the north end of Mesa $1^{1/2}$ in the Lukachukai Mountains, Apache County, Arizona. This last parcel was where Cuna Uranium County illegally mined 16 tons averaging 0.25 percent U_30_8 and 1.04 percent V_20_5 in 1955.

The Copper Canyon No.1 parcel is actually in Navajo County, not Apache County, Arizona. The name Gothe is an unusual name for a mine. It is interesting that the Navajo word got means" to mine" (Young and Morgan 1943, p. 90).

Geologic mapping by the USGS in the Arizona portion of Monument Valley in 1951-1952, noted several channels in the basal Shinarump Member of the Chinle Formation in the area of the Copper Canyon No. 1 parcel. None of these outcrops contained any uranium-vanadium minerals (Witkind and Thaden 1963, p. 72). Also, Mr. Phillips did not notify the ore buying station that this ore came from the Navajo Reservation as these shipments are not listed in Allport (1951). It is the author's opinion that these shipments called Gothe did not come from Navajo County, Arizona, and its source is still a mystery.

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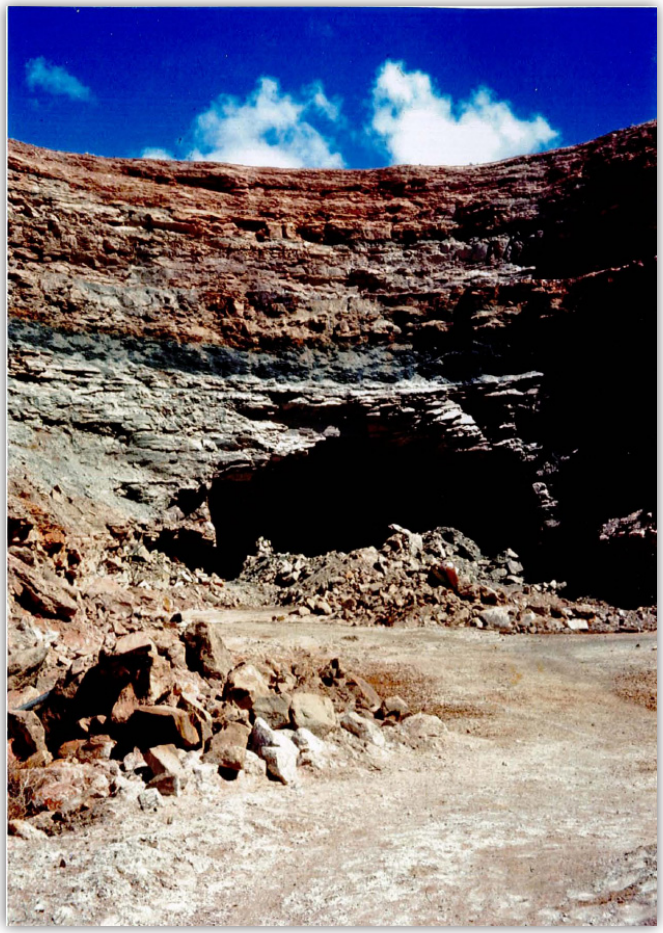

Figure 3. The abandoned Moonlight pit in 1967. Note the caving at the underground workings. Photo by Chenoweth.

Appendix

Report No. of previously published mine reports
CR-89-E Harve Black No.2
CR-91-A Black Rock, Sally
CR-91-B Bluestone
CR-92-A Monument No.1, Mitten No.2
CR-92-B Harvey Blackwater Nos. 1,3,4
CR-92-C Firelight No.6
CR-92-D Big Chief
CR-93-A Bootjack
CR-94-A Black Mustache
CR-94-C Alma-Seegan
CR-94-G Big Four No.2
CR-94-H FemNo.l
CR-95-B Mitchell Butte
CR-95-C Sam Charlie
CR-95-F Golden Crown
CR-96-A Tract 11, Tract 17
CR-97-A Sunlight, South Sunlight
CR-97-B Starlight, Starlight East
CR-03-E Moonlight
CR-II-F Tract 1 North, Tract 1 South, Tract 2, Willie Waters
CR-II-G Black and Blackwater
CR-II-H Chee Nez No.1, John M. Yazzie No.1
CR-II-P Monument No.2

Copies of these reports are available from the Arizona Geological Survey, 416 W. Congress, Suite 100, Tucson, AZ 8570 l and online at the Arizona Geological Survey Document Repository (https://repository.azgs.az.gov).

Table 1. Ore production Monument Valley, Apache County, Arizona

No. on Figure 1	Mine	Tons of Ore	Pounds U_3O_8	% U_3O_8	Pounds V_2O_5	%V_2O_5	Years	Report No.
28	Black and Blackwater	5,449.97	27,496.39	0.25	109,711.32	1.01	1950-57	CR-11-G
-	Black Mustache	94.79	432.36	0.23	3,777.00	1.99	1950-51	CR-94-A
29	Bluestone	52.69	228.74	0.22	867.74	0.82	1955-56	CR-91-B
27	Chee Nez No. 1	638.22	4,001.19	0.31	15,634.25	1.22	1955-57	CR-I1-H
26	Harvey Blackwater No. 1	291.02	1,192.49	0.2	3,144.75	0.54	1954-57	CR-92-B
26	Harvey Blackwater No. 4	373.76	1,531.27	0.2	2,595.37	0.35	1955-56	CR-92-B
27	JohnM. Yazzie No.1	2,558.71	17,663.85	0.35	40,701.43	0.8	1951-57	CR-I1-H
-	Mexican Hat Stockpile	676.35	1,421.07	0.11	9,542.71	0.71	1949	CR-II-P
28	Monument No. 2	748,785.68	5,139,947.39	0.34	21,383,117.66	1.43	1947-69	CR-I1-P
28	Tract 1 North	17,958.00	104,156.00	0.29	423,809.00	1.18	1951-59	CR-II-F
28	Tract 1 South	8,049.00	64,392.00	0.4	244,690.00	1.52	1952-54	CR-II-F
28	Tract 2	295	1,770.00	0.3	2,891.00	0.49	1955, 1957-58	CR-II-F
28	Willie Waters	1,989.94	9,162.50	0.23	48,995.34	1.23	1954-55	CR-I1-F
	TOTAL	787,213.13	5,373,395.25	0.34	22,299,477.57	1.42	-	

Source: Allport (1951, 1952, 1953), U.S. Atomic Energy Commission (1953), U.S. Department of Energy (1997).

Table 2. Operating mines and the controllers, Monument Valley, Apache County, Arizona

Year	Mine	Controller(s)
1947	Monument No.2	VCA
1948	Monument No.2	VCA
1949	Monument No.2	VCA
	Mexican Hat Stockpile	VCA
1950	Black and Blackwater	Blackwater Mining
	Black Mustache	Capitan Benally
	Monument No.2	VCA
1951	Black and Blackwater	Blackwater Minin1l;
	Black Mustache	Thomas Benally
	John M. Yazzie No. 1	Clani and Yazzie
	Monument No.2	VCA
	Tract 1 North	Climax Uranium
1952	Black and Blackwater	Blackwater Mining
	John M. Yazzie No. 1	Clani and Yazzie
	Monument No.2	VCA
	Tract 1 North	Climax Uranium
	Tract 1 South	Climax Uranium
1953	Black and Blackwater	Blackwater Minin1];, Byler an
	John M. Yazzie No.1	Clani and Yazzie
	Monument No.2	VCA
	Tract 1 North	Climax Uranium
	Tract 1 South	Climax Uranium, Cato Sells
1954	Black and Blackwater	Byler and Pollack
	H. Blackwater No. 1	Mex Air Uranium
	John M. Yazzie No. 1	Clani and Yazzie, Spencer Uranium
	Monument No.2	VCA
	Tract 1 North	Climax Uranium
	Tract 1 South	Cato Sells
	Willie Waters	Bee-Sho-Shee Uranium
1955	Black and Blackwater	Blackwater Minin~, Mex Air U
	Bluestone	MagorMines
	Chee Nez No. 1	Bee-Sho-Shee Uranium
	H. Blackwater No. 1	Mex Air Uranium
	H. Blackwater No. 4	Mex Air Uranium
	John M. Yazzie No.1	Spencer Uranium
	Monument No.2	VCA
	Tract 1 North	Climax Uranium, Uranium Reserves
	Tract 2	Cato Sells
	Willie Waters	Bee-Sho-Shee Uranium

Table 3. Mining Contractors, Monument Valley, Apache County, Arizona

Year	Mine	Contractor
1958	Tract 2	Gilbert Shumway
1959	Monument No.2	A.K. Skalla

Source: AEC records

Table 4. Ore production Monument Valley, Navajo County, Arizona

No. on Fig. 1	Mine	Tons of Ore	Pounds U308	% U308	Pounds V205	% V205	Years	Report No.
21	Alma	5,750.37	22,019.97	0.19	NA		1965-66	CR-94-C
18	Big Chief	33,833.75	151,221.03	0.23	11,490.45	0.96	1959-61	CR-92-D
17	Big Four No. 2	3,929.66	20,444.32	0.26	NA		1963	CR-94-G
22	Black Rock	36.78	58.64	0.08	95.41	0.13	1955	CR-91-A
19	Bootjack	36,236.40	331,010.15	0.46	48,218.56	0.27	1957-60 1965-66	CR-93-A
10	Fern No. 1	9,582.43	126,702.74	0.66	55,544.60	0.37	1956-57 1961	CR-94-H
20	Firelight No.6	2,140.66	7,610.96	0.18	25,327.44	0.59	1959-60	CR-92-C
16	Golden Crown	70.38	178.26	0.13	180.78	0.13	1955-56	CR-95-F
11	HarveBlack No.2	374.98	1,689.34	0.22	5,961.96	0.79	1954-55 1962	CR-92-B
23	Mitchell Butte	1,764.19	5,025.31	0.14	60,378.42	1.71	1962, 1965-66	CR-95-B
16	Mitten No. 2	9,433.05	53,178.07	0.28	204,008.60	1.19	1950-52 1954-56 1960-61	CR-89-D
16	Monument No.1 (South)	4,163.86	32,300.58	0.39	152,127.50	1.83	1948-50 1953	CR-92-A
16	Monument No. 1 (North)	29,057.77	176,415.42	0.3	817,623.10	1.41	1954-56 1964-66	CR-92-A
15	Moonlight	223,236.77	1,177,501.29	0.26	940,725.29	0.6	1956-66	CR-03-E
22	Sally	66.81	139.99	0.1	46.93	0.04	1955	CR-91-A
24	Sam Charlie No.1	5.07	24.34	0.24	131.86	1.3	1953	CR-95-C
21	Seegan	1,018.90	3,520.93	0.17	NA		1966	CR-94-C
14	Starlight East	45,990.38	289,377.67	0.31	NA		1961-64	CR-97-B
14	Starlight	40,378.25	231,730.52	0.29	96,977.37	0.5	1958-61	CR-97-B
17	Sunlight	55,023.51	291,461.88	0.26	25,498.79	0.53	1958-64	CR-97-A
17	South Sunlight	28,644.74	171,459.83	0.3	NA		1962-65	CR-97-A
12	Tract 11	14,913.09	95,103.31	0.32	4,968.66	0.17	1958-63	CR-96-A
13	Tract 17	4,131.67	32,962.09	0.4	NA		1959	CR-96-A
Total		559,783.47	3,221,136.64	0.29	2,449,305.72	0.76		

Source: Allport (1951, 1952, 1953), U.S. Atomic Energy Commission (1953), U.S. Department of Energy (1997). NA -No Analyses