THE GEOLOGY AND PRODUCNON HISTORY OF URANIUM DEPOSITS IN THE SALT WASH MEMBER OF THE MORRISON FORMATION, NEAR ROUGH ROCK, APACHE COUNTY, ARIZONA

by

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INTRODUCTION

The Salt Wash Member of the Morrison Formation of Jurassic age contains significant deposits of uranium-vanadium minerals in the Lukachukai Mountains in northeastern Apache County, Arizona. Similar, but smaller, deposits have been mined around the perimeter of the Carrizo Mountains north of the Lukachukai Mountains (Chenoweth and Malan, 1973).

During the uranium boom of the 1950's a small amount of uranium was mined from the Salt Wash near Rough Rock Trading Post in northwestern Apache County (Figure 1). Although some information concerning this area has been published (Chenoweth and Malan, 1973), this report gives the details of the production history.

Much of the information presented here was recently located in the old records of the U.S. Atomic Energy Commission (AEC) in the archives of the U.S. Department of Energy's Grand Junction Projects Office, Grand Junction, Colorado. A review of the 1950-53 records of the AEC's ore-buying stations provided accurate information on the dates early ore shipments were received. Information previously published by Chenoweth and Malan (1973) and Chenoweth (1973) was found to be incorrect.

GEOLOGIC SETTING

The Salt Wash Member of the Morrison Formation caps benches at the northeastern foot of Black Mesa (Figure 1). On the east side of Black Mesa the member is absent by non-deposition. The Salt Wash Member in the Rough Rock area consists of approximately 130 feet of interbedded fine- to very fine-grained grayish-brown sandstone and gray,green, and reddish-brown siltstone and mudstone. Secondary uranium minerals are associated with carbonaceous fossil logs and other plant debris in sandstone lenses 10 to 40 feet above the base of the Salt Wash Member. Fossil logs, observed during mining operations, have been at least 14 inches in diameter and over 10 feet in length. Calcite crystals associated with the logs were responsible for the ore shipments to average 31% $CaCO_3$. Non-vanadiferous primary uranium minerals, such as uraninite and(or) coffinite, within the fossil logs could account for the low vanadium content of the ore shipments.

The Salt Wash ores in the Lukachukai Mountains generally contain vanadium that is four times greater than the uranium. In the Carrizo Mountains ores the vanadium is eight times greater than the uranium (Chenoweth and Malan, 1973).

PRODUCTION HISTORY

Late in 1951, Navajo prospectors Tom Wilson, Tom Klee, and Jim Hatattly located uraniferous fossil logs in the Salt Wash Member of the Morrison Formation in the area northwest of Rough Rock Trading Post (Figure 1). This discovery was brought to the attention of the AEC, which rim stripped and drilled the area in May, 1952 (Chester, 1952a).

Another drilling project by the AEC in December, 1953, explored an area of the Salt Wash northwest of the original discoveries. This project drilled 2,202 feet in 57 holes and found no continuity to the mineralization (Anthony, 1955).

The area is part of the Navajo Indian Reservation and is under the jurisdiction of the Bureau of Indian Affairs, U.S. Department of the Interior and the Navajo Tribal Council. Mining permits are issued to individual Navajos. The permit holder can assign his mining rights to a company or individual, under Tribal regulations. The maximum amount of ground an individual Navajo can hold is 960 acres.

At ore-buying stations, the AEC assayed for, and paid for vanadium in "carnotite type ore," in accordance with Domestic Uranium Program Circular 5, Revised. Since Salt Wash ores were considered to be a "carnotite type," the ore from the Rough Rock area was assayed for vanadium (V_2O_5). Due to the fact that shipments from Rough Rock averaged less than 0.10% V_2O_5, no payment was received for any of the contained vanadium.

Details of the annual production are given in Table 1. Production by property is summarized in Table 2. The land is unsurveyed and the properties are located in Sections 1 and 2 T. 35 N., R. 22 E., and Section 6, T. 35 N., R. 23 E., Gila and Salt River Baseline and Meridian, projected. The properties can be reached by a series of unimproved dirt roads that leave Navajo Route 59 northwest of Rough Rock. All mining has been by rim stripping and shallow bulldozer cuts.

Tom Klee Mine

On April 2, 1952, Tom Klee applied for a Navajo Tribal Mining Permit to cover 114.532 acres located 4 miles northwest of Rough Rock Trading Post (Figure 1). Mining Permit No. 27 was approved to Tom Klee on April 26, 1952. Klee assigned the mining rights to his permit to C.A. Wheeler and A.H. Green, Jr., of Rough Rock Trading Post. The assignment was approved by the Bureau of Indian Affairs on June 23, 1952.

Wheeler and Green did some rim stripping, and on November 6, 1952, delivered 4.83 tons of ore averaging 0.18% U_3O_8 and 0.04% V_2O_5 to the AEC ore-buying station at Bluewater, New Mexico. After shipping an additional 2.92 tons that averaged 0.57% U_3O_8 and 0.06% V_2O_5 to Bluewater on April 2, 1953, Wheeler and Green cancelled their assignment, effective May 19, 1954.

The assignment of Mining Permit No. 27 to George W. Smith, Sr., of Cortez, Colorado was approved on May 19, 1954, the same day that Wheeler and Green's

assignment was cancelled. Sometime after receiving the assignment, Mr. Smith died. Mrs. Smith contracted with Harold F. Rodgers of Flagstaff, Arizona to explore and mine the property. Rodgers did considerable rim stripping and located numerous mineralized fossil logs. In the fall of 1956, Rodgers shipped 25.54 tons of ore averaging 0.71% U_3O_8 and 0.05% V_2O_5 to the AEC ore-buying station at Shiprock, New Mexico. Early in 1957, Rodgers shipped an additional 24.89 tons which averaged 1.57% U_3O_8 and 0.07% V_2O_5. On March 5, 1958, Mrs. George W. Smith, Sr., cancelled the assignment of Tom Klee's mining permit.

The assignment of the permit to Harold F. Rodgers was approved on March 31, 1958. During the summer of 1958, Rodgers did some 1,800 feet of wagon drilling on the property, but located little ore. In the fall of 1958, he shipped 5.90 tons of ore that averaged 0.84% U_3O_8 to the Rare Metals Corporation of America's mill near Tuba City, Arizona. Rodgers cancelled his assignment on March 31, 1959, and the property has been inactive since.

During the period 1952 through 1958, the Tom Klee produced 64.08 tons of ore that averaged 1.01% U_3O_8 and 0.06% V_2O_5 (Table 2).

Tom Wilson Mine

On April 2, 1952, Tom Wilson applied for a Navajo Tribal Mining Permit to cover 130.847 acres located 5 miles northwest of Rough Rock Trading Post (Figure 1). Mining Permit No. 29 was approved to Wilson on April 26, 1952. Wilson assigned the mining rights to his permit to C.A. Wheeler and A.H. Green, Jr., of Rough Rock Trading Post. The assignment was approved by the Bureau of Indian Affairs on June 23, 1952.

The initial ore shipment from the Tom Wilson permit was delivered to the AEC's ore-buying station at Bluewater, New Mexico on July 10, 1952. This shipment consisted of 7.07 tons which averaged 0.32% U_3O_8 and 0.04% V_2O_5. The shipper was reported as the Vanadium Corporation of America (VCA). Wheeler and Green had apparently contracted with VCA, well known mining operators in Monument Valley and in the Carrizo Mountains, to mine the property.

On October 29, 1952, Wheeler and Green delivered 4.09 tons of ore averaging 1.34% U_3O_8 and 0.07% V_2O_5 to Bluewater. Shipments by Wheeler and Green continued in January and April, 1953. These shipments totaled 12.22 tons of ore that averaged 0.27% U_3O_8 and 0.03% V_2O_5. Wheeler and Green cancelled the assignment of Tom Wilson's mining permit on May 19, 1954.

Tom Wilson assigned his mining permit to Dean Nicholson, this assignment was approved on August 10, 1953. Nicholson did some additional rim stripping to locate mineralized logs, and in the fall of 1954 shipped 8.54 tons of ore averaging 0.42% U_3O_8 and 0.03% V_2O_5 to the AEC ore-buying station at Shiprock, New Mexico. Nicholson cancelled the assignment of the mining permit on January 19,1956.

In the summer of 1956, Tom Wilson assigned his mining permit to Howard L. Stanley. The assignment was approved on June 27, 1956. Stanley did some more bulldozing and in the fall of 1956 he shipped 26.88 tons averaging 0.44%

U_3O_8 and 0.01% V_2O_5 to Shiprock. Not finding any more additional ore, Stanley cancelled the assignment on December 1, 1956. Mining Permit No. 29 expired on April 4, 1958, and the property has been inactive since then.

In summary, during the period 1952 through 1956, the Tom Wilson property produced 58.80 tons of ore which averaged 0.45% U_3O_8 and 0.03% V_2O_5 (Table 2).

Jim Hatattly Property

Jim Hatattly was issued Mining Permit No. 26 on April 26, 1952 for 63.754 acres between Tom Wilson's and Tom Klee's permits (Figure 1). C.A. Wheeler and A.H. Green, Jr., held the assignment of this permit between June 22, 1952 and May 19, 1954. They did some exploration bulldozing, but shipped no ore.
On June 27, 1956, the assignment of Mining Permit No. 26 to Howard L. Stanley was approved. Stanley did some prospecting with a bulldozer, but did not locate any ore. Stanley cancelled his assignment on December 1, 1956. The mining permit expired on April 26, 1958.

Blue Lake Property

The only known uranium occurrence in the Salt Wash Member of the Morrison Formation, in northeastern Arizona, outside of the Lukachukai Mountains, Carrizo Mountains, and the Rough Rock area, is the Blue Lake property. It is located in the northeastern corner of Navajo County on the west rim of Baby Rocks Mesa, 11 miles east of Kayenta, Arizona, and some 17 miles northwest of Rough Rock Trading Post.

This occurrence consists of carnotite type minerals, associated with fossil wood, and disseminated in a sandstone bed in the basal part of the Salt Wash Member. At the time the property was investigated by the AEC (Chester, 1952b) the ground was held by Joe Shortman and Lawrence Issac. There is no record of any production from this property.

SUMMARY

During the years 1952 through 1958, two properties in the Salt Wash Member of the Morrison Formation, located northwest of Rough Rock Trading Post were mined for uranium. Total production was 122.88 tons of ore that averaged 0.74% U_3O_8 and 0.04% V_2O_5 and contained 1,822.56 pounds of U_3O_8 and 84.56 pounds V_2O_5 (Table 1). The uranium and vanadium minerals occurred in carbonaceous fossil logs and other plant debris near the base of the Salt Wash Member.

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TABLE 1

Annual Uranium-Vanadium Production, Rough Rock Area, Apache County, Arizona

	Tons of Ore	Pounds U_3O_8	$\%U_3O_8$	Pounds V_2O_5	$\%V_2O_5$	Producing Mines
1952	15.99	172.17	0.54	15.24	0.05	Klee, Wilson
1953	15.14	99.86	0.33	11.94	0.04	Klee, Wilson
1954	8.54	71.75	0.42	5.12	0.03	Wilson
1955	0.00	0.00	0.00	0.00	0.00	None
1956	52.42	597.17	0.56	32.26	0.03	Klee, Wilson
1957	24.89	782.43	1.57	20.00	0.07	Klee
1958	5.90	99.18	0.84	NA	NA	Klee
Totals	122.88	1,822.56	0.74	84.56	0.04[1]	

NA - not assayed for vanadium
[1]Grade calculated on actual tons assayed for vanadium

Source: Unpublished data, U.S. Atomic Energy Commission, Grand Junction, Colorado office.

TABLE 2

Uranium-Vanadium Production by Mine, Rough Rock Area, Apache County, Arizona

	Operator		Tons of Ore	Pounds U_3O_8	$\%U_3O_8$	Pounds V_2O_5	$\%V_2O_5$
Tom Wilson	1952	VCA	58.80	529.64	0.45	29.93	0.03
	1952-53	Wheeler & Green					
	1954	D. Nicholson					
	1956	H. Stanley					
Tom Klee	1952-53	Wheeler & Green	64.08	1,292.92	1.01	54.63	0.06[1]
	1956-57	G. Smith (H. Rodgers)					
	1958	H. Rodgers					
TOTALS			122.88	1,822.56	0.74	84.56	0.04[1]

[1]Grade calculated on actual tons assayed for vanadium.

Source: Unpublished data, U.S. Atomic Energy Commission, Grand Junction, Colorado office.

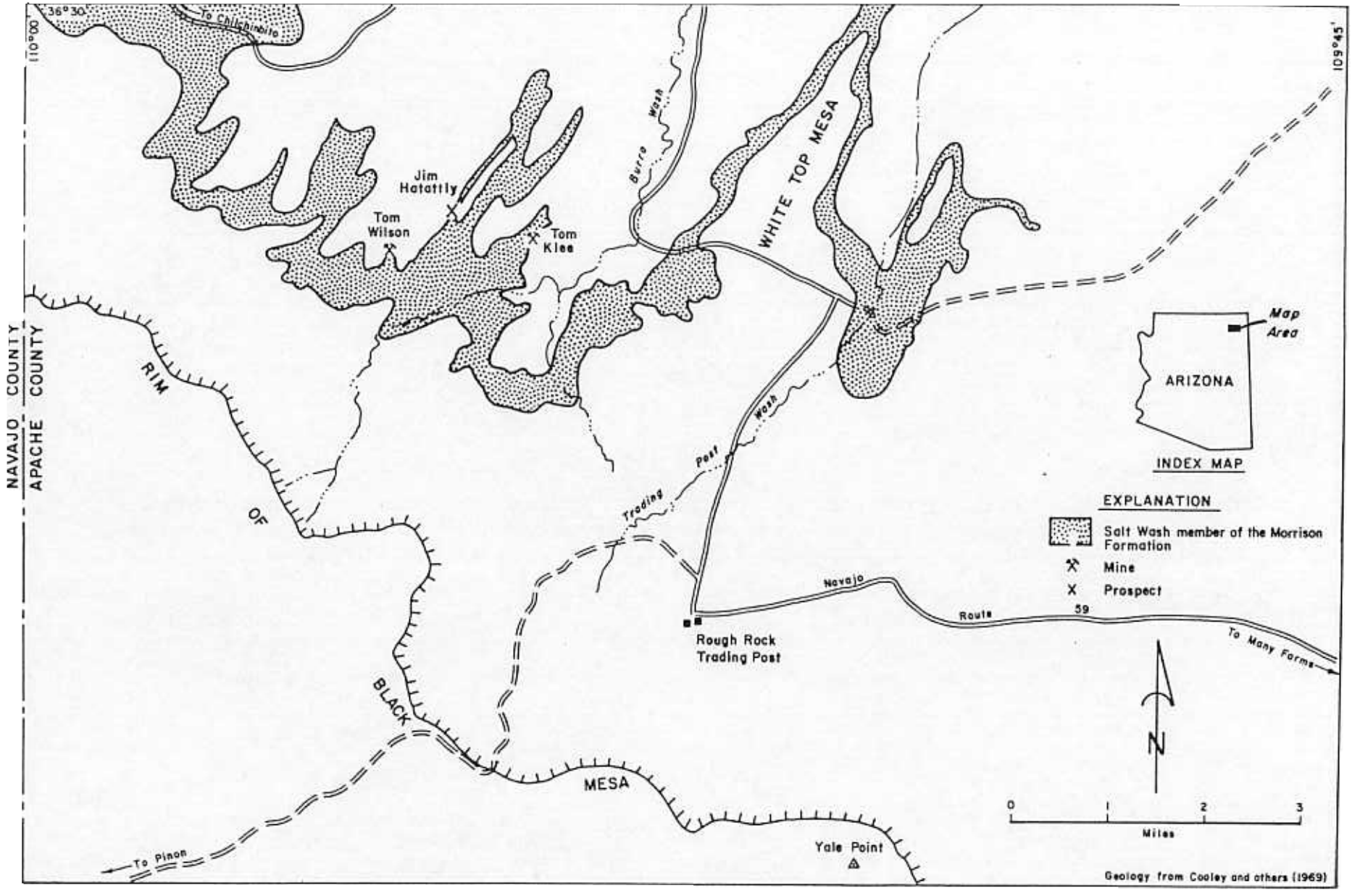

Figure Mine location map Rough Rock area, Apache County, Arizona