THE LOCATION AND PRODUCTION HISTORY OF THE CHIMNEY NO. 1 URANIUM VANADIUM MINE, APACHE COUNTY, ARIZONA

by

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INTRODUCTION

While compiling information on the uranium-vanadium occurrences around the perimeter of the Carrizo Mountains, either Scarborough (1981) or Chenoweth (1985) could obtain the location of the Chimney No. 1 mine. U.S. Atomic Energy Commission (AEC) records indicated the mine was in the Carrizo Mountains, and that 71 tons of low-grade ore were shipped to the mill at Durango, Colorado for processing in 1951.

Recently, I was able to review the Navajo Indian Reservation mine files of the former U.S. Geological Survey (USGS) Conservation Division, now in the Bureau of Land Management (BLM) archives in Phoenix, Arizona. As the result of this review, the location of the Chimney No. 1 mine was established, which is the subject of this brief report.

LOCATION AND LAND STATUS

The ore shipped as the Chimney No. 1 mine is believed to have originated from outcrops of the Salt Wash Member of the Upper Jurassic Morrison Formation on the west side of Altar Mesa in the western Carrizo Mountains, Apache County, Arizona (Figure 1) (approximately 109° 19.9′ W. Long., 36° 45.5′ N. Lat.). The area is shown on the Toh Chin Lini Mesa 7.5′ topographic USGS quadrangle map.

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 period up to 10 years. No more than 960 acres of tribal land could be held by any one company or individual. Both on the mine value of the ore, the tribe received between 10% and 20% royalties and the permittee between 2% and 5% royalties.

GEOLOGY OF THE URANIAN-VANADIUM DEPOSITS

The uranium-vanadium deposits, which have been mined around the perimeter of the Carrizo Mountains, occur in the Salt Wash Member of the Upper Jurassic Morrison Formation. In the Carrizo Mountains the Salt Wash Member consists of 180-250 feet of fluvial, light tan to white, fine-grained sandstone with interbedded, thin beds and lenses of gray, grayish-green and reddish-gray mudstone. The mudstone comprises from 5 to 30 percent of the member.

The uranium-vanadium orebodies are formed by the selective impregnation of the sandstone and adsorption by the mudstone and fossil plant material. Orebodies are commonly associ-

ated with detrital plant fragments in the sandstone. The orebodies are roughly tabular in cross-section and irregular in plan. They range from several feet to a few hundred feet in length. Thicknesses range from a feather edge to up to ten feet. Small high-grade pods of ore are associated with replaced fossil wood, commonly called "trees". Throughout the Carrizo Mountains the uranium mineralization occurs at various stratigraphic horizons in the Salt Wash Member; however, the orebodies are always found in the lower one-half of the member.

The bright yellow mineral carnotite, a potassium uranium vanadate, has given the deposits their name. Later work by Corey (1956, 1958) and S.R. Austin (written communication, 1967) have identified tyuyamunite, a calcium uranium vanadate, and metatyuyamunite as the only uranium minerals in the Carrizo deposits. Vanadium clay and montroseite are present. These minerals have been oxidized to form a number of secondary vanadium minerals that include sherwoodite, duttonite(?), hewettite, metahewettite, rossite, metarossite, and hendersonite (Corey, 1958). Calcite is a common cement in ore. Pyrite, iron oxides, and gypsum may also be present.

MANHATTAN ENGINEER DISTRICT INVESTIGATIONS

The U.S. Army's Corps of Engineers Manhattan Engineer District was in charge of developing atomic weapons during the 1940's (Manhattan Project). A civilian contractor, Union Mines Development Corporation, carried out uranium resource investigations for the Army. On the Colorado Plateau all known exposures of the Salt Wash Member were prospected and mapped. Exposures of carnotite-bearing minerals, prospects, and mines were mapped and described. Ore reserves were calculated from samples collected on outcrops and in mines. Areas where reserves could be developed by additional drilling were especially noted. All of this work was done under the disguise of looking for vanadium.

Altar Mesa was one of several mesas in the western Carrizo Mountains that is capped with sandstone beds of the Salt Wash Member of the Morrison Formation. Union Mines' Party No. 3 under the leadership of Francis X. Corbett investigated Altar Mesa (Chenoweth, 1988). Two exposures of uranium-vanadium minerals were located on the western side of the mesa. Corbett (1943) described the occurrences as follows:

> "No. 33 - Mineralized tree. Low grade V_2O_5 and U_3O_8. Two feet below tree and three feet to the east are very thin high-grade stringers in sandstone. Thirty five feet above base of Morrison Formation."

> "No.34 - Size: 6 feet by 30 feet. 50 feet above the base of the Morrison Formation. Character: Massive low-grade ore and stringers. No U_3O_8, tree is present. Average - 1% V_2O_5."

A map, ARIZ-CU-23, included in Harshbarger's (1946) summary report of Union Mines' work in the Carrizo Mountains, shows the location of the two occurrences which are 5,000 feet apart. In the 1940's the base of the salt Wash Member was considered the base of Morrison Formation.

PRODUCTION HISTORY

On August 10, 1950, the Navajo Tribal Council and the BIA issued Henry Pie and Richard Harrison of Cortez, Colorado an unnumbered mining permit for "vanadium-uranium and/or other minerals." The permit was described as being "one mile by one half mile in size, contained 320 acres, and located 6 1/2 miles southeast of Immanuel Mission in Apache County, Arizona." This

description definitely locates the mine on Altar Mesa, where Union Mines geologists had described occurrences of uranium and vanadium minerals.

In March 1951, Pie and Harrison shipped 31.26 tons of ore averaging 0.11 percent U_3O_8 and 1.74 percent V_2O_5 to the Vanadium Corporation of America (VCA) processing mill at Durango, Colorado. In April, two shipments were made to Durango; 19.28 tons averaging 0.12 percent U_3O_8 and 2.35 percent V_2O_5 and 12.45 tons averaging 0.07 percent U_3O_8 and 1.07 percent V_2O_5 (Table 1). A 7.59 tons shipment averaging 0.06 percent U_3O_8 and 1.75 percent V_2O_5 was made in May (Table 1). All three shipments were identified as the Chimney No. 1 mine. Ores assaying less than 0.10 percent U_3O_8 were not purchased under the AEC's ore purchase schedule. However, VCA probably paid Pie and Harrison for the vanadium content of the last two shipments. No further shipments were made, and the mining permit expired on August 10, 1952.

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Table 1. Summary of uranium-vanadium shipments, Chimney No. 1 mines, Apache County, Arizona

MONTH 1951	TONS OF ORE	POUNDS U_3O_8	$\%U_3O_8$	POUNDS V_2O_5	$\%V_2O_5$
March	31.26	69.44	0.11	1,087.00	1.79
April	19.28	44.82	0.12	906.00	2.35
April	12.45	16.47	0.07	266.00	1.07
May	7.59	9.11	0.06	265.70	1.79
Total	70.58	138.84	0.10	2,524.70	1.79

Source: Unpublished USGS and AEC records.

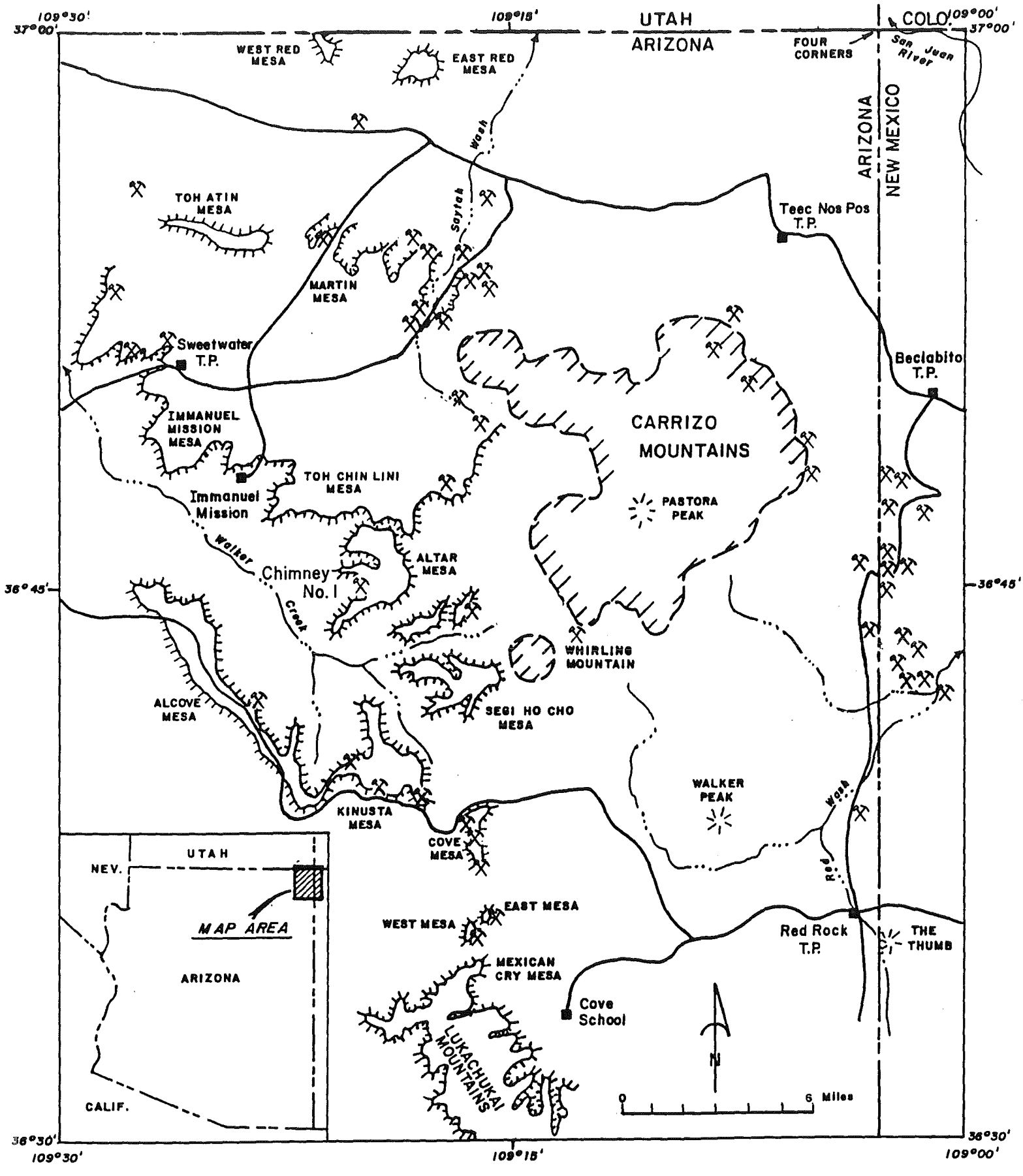

Figure 1. Index map of the Carrizo Mountains showing the location of uranium - vanadium mines, including the Chimney No. 1 mine