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A SUMMARY OF URANIUM-VANADIUM MINING IN THE CARRIZO MOUNTAINS, ARIZONA AND NEW MEXICO, 1920-1968

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Outcrops containing uranium-vanadium minerals in the Carrizo Mountains, Apache County, Arizona and San Juan County, New Mexico, were discovered about 1918 by John F. Wade of Sweetwater Trading Post. Although similar occurrences in Colorado were being mined for their radium content, the ones in the Carrizo Mountains could not be, since the Navajo Indian Reservation was closed to prospecting and mining. The ore deposits occur in fluvial sandstone beds of the Salt Wash Member of the Upper Jurassic Morrison Formation. The orebodies were formed by the selective impregnation of the sandstone and absorption by mudstone and fossil plant material, and are commonly associated with derital carbonaceous plant material in the sandstone. The orebodies are roughly tubular in cross-section and irregular in plan. They range from a feather edge to 10 ft in thickness, with an average thickness of 3 ft. The deposits were called carnotite type after the bright yellow mineral carnotite, a potassium uranium vanadate. Later work has identified tyuyamunite, a calcium uranium vanadate, and meta-tyuyamunite as the only uranium minerals in the Carrizo deposits. Vanadium clay and montrosite are also present. All of the known deposits are well oxidized.

The Reservation was opened to mining and prospecting on June 30, 1919. Prospectors could stake claims under the Mining Law of 1872 and if a discovery was made, then lease the land from the Office of Indian Affairs, U. S. Department of the Interior. During 1920 to 1923, three leases for carnotite mining were issued in the Carrizo Mountains. Radium Ores Company leased 570.02 acres in the western Carrizos. This acreage included 21 claims along Saytah Wash on the east side of Martin Mesa, five claims on Eurida Mesa and one claim on Sunnyside Mesa (Fig. 1). Carriso Uranium Company leased 177.48 acres, which included 40 claims north of Oak Springs near milepost 16 on the Arizona-New Mexico state line (Fig. 1). Johnson and Williams leased 20.66 acres on King Tutt Mesa (Fig. 1). John F. Wade was associated with both Radium Ores and the Carriso Uranium companies. In November, 1920, Radium Ores shipped 40,000 lbs of ore to Colorado for the radium content. The ore came from outcrops along Saytah Wash in Apache County. No production was recorded from the other two leases. Due to the lack of any further activity, the Reservation was closed to prospecting and mining on March 25, 1936.

Due to the demand for vanadium to harden steel for war armaments, the Reservation was reopened on May 11, 1938, but with new procedures. The Tribal Council could now enter into leases with mining companies, with the approval of the Secretary of the Interior. On December 4, 1939,

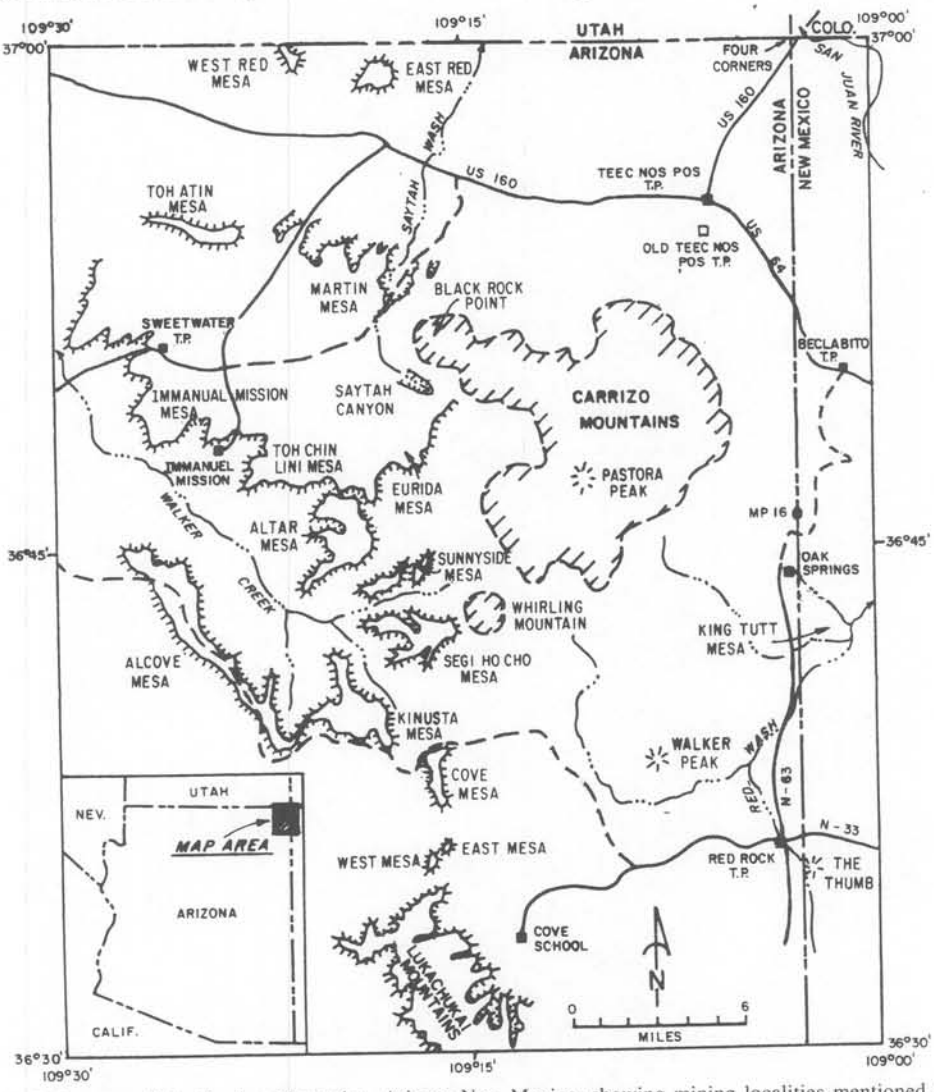

FIGURE 1. Index map of the Carrizo Mountains, Arizona-New Mexico, showing mining localities mentioned in the text.

Wade, Curran and Company leased 65.02 acres, which included two claims along Saytah Wash and one claim on Eurida Mesa (Fig. 1). On April 5, 1940, the company leased an additional 42.32 acres, which included one claim on Sunnyside Mesa and one claim near milepost 16. These leases covered much of the same ground held by Wade's previous two companies. During the years 1942-1943, five mines on these leases produced 3164 tons of ore containing 212,327 lbs V_2O_5 and averaging 3.36% V_2O_5. The ore was shipped to the Metal Reserve Company's plant at Durango, Colorado, operated by U.S. Vanadium Corporation. Metals Reserve was a government agency which had to acquire 5 million lbs of V_2O_5 for a strategic stockpile.

On April 9, 1941, the Navajo Tribal Council requested the Secretary of the Interior to lease lands for mining purposes to the highest bidder. In order to take care of this order, the mining leases were written for large areas and subsequently reduced in acreage at the end of a specific time period. On December 19, 1941, Vanadium Corporation of America (VCA) was the successful bidder on the first of these new lease sales for 144 mi^2 in the western Carrizo Mountains. This lease, known as the West Reservation Lease, was reduced to 16 plots (claims) totaling 229.14 acres on September 2, 1943. Thirteen of the plots were in the vicinity of Saytah Wash below Black Rock Point and three were on Eurida Mesa (Fig. 1). VCA also was the highest bidder on 104 mi^2 in the eastern Carrizo Mountains on June 15, 1942. The East Reservation Lease was reduced to 12 plots, totaling 436.76 acres, on September 2, 1943. Six of the plots were on King Tutt Mesa, four were near milepost 16, and two were at Oak Springs (Fig. 1).

Curran Brothers and Wade were the only bidders on 168 mi^2 in the western and southern Carrizos on August 3, 1943. On October 29, 1943, two thirds of the lease was assigned to the U. S. Vanadium Corporation (USV). On March 22, 1944, the lease was reduced to 12 plots totaling 959.7 acres. Three of the plots were along Saytah Wash, three were in Saytah Canyon, three were in Segi Ho Cho Mesa and one each were on Eurida, Cove and Kinusta Mesas (Fig. 1). These plots covered much of the same ground covered by Wade's two earlier leases, which had been canceled. Union Mines Development Corporation, the geologic contractor for the U.S. Army's Manhattan Engineer District (MED), had assisted Curran Brothers and Wade and USV in selecting the 12 plots considered to have the best possibilities for developing uranium reserves. On April 24, 1944, Union Mines acquired full control of the lease for $16,000. Union Mines did no mining but recommended acreage to be drilled to the MED. On February 1, 1944, VCA was the only bidder on a 13.50 acre plot 3 mi south of the old Teec Nos Pos Trading Post (Fig. 1). Here, Navajo prospectors had found exposures of uranium-vanadium minerals. All of the vanadium leases were issued for 10 years and could be renewed. The Tribe received a 10% royalty on the value of the ore at the mine.

During the years 1942-1947, 38 properties on the four leases produced 18,269 tons of ore containing 812,923 lbs of V_2O_5 and averaging 2.22% V_2O_5. The East Reservation Lease produced 10,231 tons averaging 2.47% V_2O_5 during 1942-1945, 1947, and the West Reservation Lease shipped 7504 tons with an average grade of 1.83% V_2O_5 in 1942-1944. The Curran Brothers and Wade-VCA lease produced 388 tons averaging 1.94% V_2O_5 in 1943 and 1944, and VCA's Teec Nos Pos lease shipped 146 tons at a grade of 0.12% V_2O_5 in 1945. VCA shipped its ore to the Metals Reserve mill at Monticello, Utah operated by VCA. The 1947 shipment of 15 tons went to VCA's mill at Naturita, Colorado. Curran Brothers and Wade-USV's ore went to the plant at Durango operated by USV. During 1943-1945, an estimated 76,000 lbs U_3O_8 were secretly recovered from the ores for the Manhattan Project at these mills. Details of the vanadium mining in the Carrizo Mountains were given by Chenoweth (1991).

Mining for uranium under the newly created U.S. Atomic Energy Commission (AEC) began in 1948 at VCA's inactive vanadium mines. Shipments to the mill at Naturita, Colorado began in March from the East Reservation Lease and in November from the West Reservation Lease. The Union Mines lease was assigned to the AEC on February 28, 1949 and the AEC contracted with VCA to mine these plots.

In 1949, 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. In 1951, additional regulations allowed non-Navajos to prospect on the Reservation, but only Navajos could obtain a mining permit. Permits could be assigned to an individual or company to explore and mine. Permits were issued for 2 years and could be renewed. Both the Tribe and the permittee received royalties. Prospecting, after the new regulations were adopted, led to over 50 new discoveries in the Carrizo Mountains. Since VCA held 960 acres of Reservation land, including their Monument Valley leases, the company could not expand their holdings past this acreage limit. Navajo prospectors, Cato Sells, Eugene Tapahonso, Thomas Clani and George Simpson acquired mining permits contiguous with many VCA and AEC plots in the Carrizo Mountains where sizable ore bodies were later located. Drilling projects by the AEC located additional ore bodies behind old vanadium mines and on adjacent land. The areas where Union Mines had recommended drilling were subsequently drilled by AEC.

On January 7, 1952, the AEC opened an ore buying station at Shiprock, New Mexico. This station provided a market for the non-VCA mines in the Four Corners area. VCA-controlled mines shipped their ore to the mill at Durango, which reopened in 1949. Due to the large reserves they developed in the Lukachukai Mountains, south of the Carrizo Mountains, Kerr-McGee Oil Industries, Inc., built a mill at Shiprock, at the site of the ore buying station. This mill began operating on November 1, 1954.

Ore production reached an all-time annual high in 1955 when 14,267 tons averaging 0.22 % U_3O_8 and 1.93% V_2O_5 were produced. After that year, ore production began to gradually decline or the larger orebodies had been depleted. As the AEC began to phase out their procurement program, the agency canceled their Navajo lease on June 30, 1961. Some of the plots were immediately acquired by Navajos with mining permits and some small scale mining continued.

In March 1963, VCA acquired the Shiprock mill from Kerr-McGee. With a shorter hauling distance, VCA began to mine lower grade ore at their Carrizo mines, especially on the East Reservation Lease. In June 1966 the final shipments were made from the West Reservation Lease and in August 1967 the last ore was shipped from the East Reservation Lease mines. Cleanup mining on the two leases had depleted the mines of the available economic ore. During the period 1948-1967, 119,706 tons of ore averaging 0.22% U_3O_8 and 1.93% V_2O_5 was produced from 105 properties around the perimeter of the Carrizo Mountains. Of this total, 69% of the uranium came from the mines on the old vanadium leases. VCA was merged into Foote Mineral Company on August 31, 1967 and Foote canceled their mining leases in 1969. Details of the 1948-1967 mining activities are given by Chenoweth (1984, 1985). The potential for new discoveries in the Carrizo Mountains is only fair. Moreover, due to past reclamation/environmental problems it is unlikely that the Navajo Nation will ever gain permit uranium mining in the Carrizos.

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