

**THE GEOLOGY, LEASING, AND PRODUCTION HISTORY
OF THE RED WASH POINT URANIUM-VANADIUM MINE,
SAN JUAN COUNTY, NEW MEXICO**

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INTRODUCTION

The Red Wash Point mine was developed on a lease that was issued for carnotite mining in 1942. The mine, in the Salt Wash Member of the Morrison Formation, produced vanadium ore in the 1940s and uranium-vanadium ore in the late 1940s and early 1950s.

This report is part of an ongoing study of the uranium deposits in New Mexico, especially the deposits on King Tutt Mesa, in the eastern Carrizo Mountains, San Juan County.

Location

The Red Wash Point mine is located on Plot 1 of Lease No. I-149-IND-5905 in the eastern Carrizo Mountains, San Juan County, New Mexico (Figure 1). This plot (claim) is located on a point on the south rim of a small mesa, known locally as King Tutt Mesa. This name is derived from the fact that the mesa was the homestead and grazing area of King and Despah G. Tutt. In some reports, etc. the name is spelled Tut, which is incorrect according to Navajo census records. The mine is not shown on the Horse Mesa topographic quadrangle (U.S. Geological Survey, 1982) but is located at latitude 109° 01'00"W., longitude 36° 42' 34"N.

The mesa is a triangular shaped area bordered on the northeast by the canyon of Oak Springs Wash on the southeast by Blackrock Wash and on the west by the Red Rock

monocline. The mesa is accessible by several dirt roads from the paved road (Navajo Route 87) that heads north from Red Rock to Oak Springs (Figure 1).

The mine workings consist of a stripped area 160 ft. by 130 ft. In the southwest portion of the stripped area is a pit 25 ft. by 45 ft. with a maximum depth of 12 ft. There are twin adits off of the southwest wall of the pit (Figure 2). Waste rock from the underground workings has been neatly hand stacked in the pit area near the adits.

Land Status

King Tutt Mesa is located within the Navajo Indian Reservation. On the Reservation, all prospecting, leasing and mining is controlled by the Navajo Tribal Council and the Bureau of Indian Affairs, U.S. Department of the Interior. For Lease I-149-IND-5905, the Tribe received a royalty of 10% of the mine-mouth value of the ore.

Previous Studies

Leasing and mining of the carnotite deposits in the Carrizo Mountains for radium extraction has been described by Chenoweth (1989). Details of the vanadium production in the Carrizo's are also given by Chenoweth (1991). An earlier report by Chenoweth (1984) summarizes the uranium-vanadium production in the eastern Carrizo Mountains.

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. Ore production royalty records, prepared by the U.S. Geological Survey, Conservation Division for the Bureau of Indian Affairs, were reviewed to obtain the names of the contract miners, the mines and the months they were operating. Information on the early vanadium ore production is contained in a detailed report prepared by the General Services Administration (GSA). Indian Trust Accounting Division for the Navajo Tribe. This document (GSA, 1981) was admitted as evidence in U.S. Claims Court, Navajo Tribe vs. United States, Docket Nos. 69 and 299 (copper, vanadium, uranium, sand, rock and gravel claims) held in Albuquerque, New Mexico, February 24-March 4, 1983. A copy of the vanadium and uranium section was obtained by the Grand Junction Area Office of the U.S. Department of Energy. Details of the mineral leasing regulations, applicable to the Navajo Indian Reservation, were taken from a report prepared by DeVoto and Huber (1982) for the U.S. Department of Justice, which was also admitted as evidence in the above case. Copies of both the GSA report and the DeVoto and Huber report have been donated to the Geosciences Information Center at the New Mexico Bureau of Mines and Mineral Resources. The map of the mine workings (Figure 2) was traced by the author in 1985 from the files of the Foote Mineral Company, successor to VCA, and the mine was last examined in June 1995.

GEOLOGIC SETTING

The uranium-vanadium orebodies at Red Wash Point occur in the Salt Wash Member of the Upper Jurassic Morrison Formation. In the King Tutt Mesa area, the Salt Wash Member is approximately 220 feet thick. It is composed of light gray, fine - to very

fine-grained, well rounded, quartz sandstone with interbedded lenses in beds of reddish-brown and greenish-gray mudstone and siltstone. The mudstone and siltstone beds comprise between 5 to 45 percent of the total thickness of the member. Huffman and others (1980) have subdivided the Salt Wash Member in the King Tutt Mesa area into three stratigraphic units based on depositional environments. The lowermost unit is an average of 30 feet thick and was considered by those authors to be predominantly overbank deposits of alternating thin mudstone and sandstone. It reportedly contains a few channel sandstones, however, the present author notes that this unit is lithologically distinct from the overlying ore-bearing unit. It, also, does not host any uranium-vandadium ore deposits.

The middle stratigraphic unit is an average of 70 feet thick and is composed of channel-sandstone deposits, partially and completely abandoned channel-fill deposits, and overbank deposits. It rests with sharp erosional contact on the lower unit. Approximately 80 percent of the sandstone in this unit is active channel fill in a generally eastward flowing fluvial system (Craig and others, 1955).

The upper unit is 120 feet thick. Most of the unit is composed of braided-stream deposits, and thin overbank deposits. Active channel-fill sandstone and conglomerates are also present. The sequence of stratigraphic units probably represent a prograding wet alluvial fan (Huffman and others, 1980).

The channel sandstone that contains the orebodies at Red Wash Point is approximately 30 feet above the base of the Salt Wash, within the middle unit of the member. The outcrop of this channel sandstone was mapped as the "ore rim" by VCA

(Figure 2). Paleo channel directions measured at the mine by Stokes (1954) indicated a N 60° E direction to the streams depositing its sandstone. Detrital organic plant material, such as leaves, branches, limbs and trunks are common in the ore-bearing channel. Most all of this material is carbonized.

The uranium-vanadium orebodies were formed by the selective impregnation of the sandstone and adsorption by the mudstone and fossil plant material. Orebodies were commonly associated with detrital plant fragments in the sandstone. The orebodies were roughly tabular in cross-section and irregular in plan. They ranged from several feet in width to a few hundred feet in length. Thicknesses at the Red Wash Point mine ranged from a feather edge to up to five feet. There were apparently two ore zones on Plot 1 which would explain the shallow stripped area and the pit with the two adits. Small high-grade (+0.60% U_3O_8) pods of ore were associated with replaced fossil wood.

The ore deposits on King Tutt Mesa were originally called carnotite, because of their yellow color. Carnotite, a bright yellow mineral is a potassium uranium vanadate. Later work by Corey (1958) and S.R. Austin (written communication, 1967) found tyuyamunite, a calcium uranium vanadate, and meta-tyuyamunite as the only uranium minerals in the Carrizo deposits. The mineralogy of the nearby Nelson Point mine was studied by Corey (1958). In this mine, vanadium clay and montrosite were present. These minerals have been oxidized to form a number of secondary vanadium minerals that include sherwoodite, duttonite (?), hewettite, methahewettite, rossite, metarossite, and hendersonite (Corey, 1958). Calcite is a common cement in ore. Pyrite, iron oxides, and gypsum may also be present.

The beds of the Salt Wash on King Tutt Mesa dip two degrees to the east due to the Red Rock monocline which is directly west of the mesa where the older Jurassic rocks eastward dip as great as 10 degrees.

LEASING AND PRODUCTION HISTORY

Early Prospecting

Outcrops containing uranium and vanadium minerals in the Carrizo Mountains were discovered by John F. Wade about 1918 (personal communication, 1955). Wade of Farmington, New Mexico, operated Sweetwater Trading Post in the western Carrizo Mountains (Figure 1). Through business contacts and field trips, he determined that the same rocks that contained the carnotite deposits of southwestern Colorado were also present in the Carrizo Mountains. The newly discovered deposits could not be mined because the Navajo Indian Reservation was then closed to prospecting and mining. A Congressional Act of June 30, 1919, opened the Navajo Reservation to prospecting and locating mining claims in the same manner as prescribed by the United States Mining Law of 1872. This Act allowed prospectors to enter the Reservation and stake a mining claim if their prospecting located promising mineral deposits. The locator of the claim then obtained a lease on this land under terms that included escalating advance royalties and rentals, and annual work commitments.

During the 1920s the Office of Indian Affairs (later changed to Bureau of Indian Affairs), U.S. Department of the interior, issued four leases for metal mining in the Carrizo Mountains (GSA, 1981). Three of these leases were for carnotite mining. A fourth lease,

located in the northeastern Carrizo Mountains is believed to have been for copper. One of the leases, in the northwestern Carrizo Mountains, produced some carnotite ore for radium extraction in November 1920 (Chenoweth, 1989).

By 1992 the radium industry in southwestern Colorado was beginning to decline as the carnotite ores were no longer competitive with the newly developed high-grade pitchblende ore in the Belgian Congo (now Zaire). A vanadium market never developed, as there was little demand for domestic vanadium because of imports from Peru.

In spite of the lack of demand carnotite ores, George O. Williams and Nephi Johnson leased 20.661 acres on June 8, 1923, effective January 22, 1924. This lease covered the Upper Bell Lode Claim of U.S. Mineral Survey Number 1887. The only description of the location is T. 11 N., R. 5 W., Navajo Baseline and Meridian, San Juan County, New Mexico. Since King Tutt Mesa is located in the north-central part of this township, it is very possible that the lease was located here. No production was located by the GSA (1981), but an Office of Indian Affairs memorandum of December 4, 1936 noted "a 20-foot-deep shaft, or hole, had been dug on the claim, and about one ton of ore had been hauled to Durango, Colorado". Williams and Johnson paid rental on their lease for five years, totaling \$4727, through February, 1927 (Chenoweth, 1989).

On March 25, 1936, the Secretary of the Interior closed the Navajo Indian Reservation to claim location and prospecting for minerals until further authorization. In July 1936, an application to prospect was made to the Executive Committee of the Navajo Tribal Council. The application asked the council to pass a resolution requesting the Secretary of the Interior to open the Navajo Indian Reservation for mining to the applicant.

The resolution was rejected by the Executive Committee, which evidently did not want prospecting or mining on the Reservation at that time.

Leasing Regulations

By the mid-1930s, the mines in the carnotite region of southwestern Colorado and southeastern Utah were being reopened for their vanadium content. At the same time, the Secretary of Interior was asked to open the Navajo Indian Reservation for prospecting and mining.

The Navajo Indian Reservation was opened by a Congressional Act of May 11, 1938, but with new procedures. This Act gave the Tribal Council the authority to enter into leases for the Reservations land with approval of the Secretary of Interior. Prospectors no longer could enter the Reservation and stake a mining claim under regulation similar to those of the United States Mining Law. The new mining regulations contained escalating annual rentals, a base royalty of 10 percent (mine mouth value), bond requirements, acreage limitations, and a term of 10 years which could be extended by production.

On April 9, 1941, the Navajo Tribal Council requested the Secretary of the Interior to lease lands for mining purposed to the highest bidder. In order to take care of this situation, the mining 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.

The East Reservation Lease

When the United States entered World War II, the demand for vanadium by the steel industry greatly increased. Due to the uncertainty of foreign supplies and the need for strategic materials, the Federal government formed Metals Reserve Company in December 1941. This agency was part of the Reconstruction Finance Corporation. The Metals Reserve vanadium program with increased ore prices, buying stations, etc., was the stimulus to renew interest in the carnotite deposits in the Carrizo Mountains. Metals Reserve's vanadium program was to acquire five million pounds V_2O_5 for the nation's strategic stockpile.

On May 29, 1942, in response to requests by several mining companies, the Office of Indian Affairs advertised an exploration lease sale for carnotite and related minerals in the eastern Carrizo Mountains. The area offered was described as follows: "beginning at a point on the New Mexico-Arizona State Line which is approximately $8\frac{1}{3}$ miles south of the corner common to the states of Colorado, Utah, New Mexico, and Arizona; thence east 6 miles, thence south 12 miles; thence west 6 miles to the Arizona-New Mexico state line; thence west $3\frac{1}{2}$ miles; thence north 2 miles; thence east one mile; thence north 10 miles; thence east $2\frac{1}{2}$ miles to the Arizona-New Mexico state line and in the point of beginning." The area contained approximately 104 square miles. This was the second carnotite lease sale for Navajo lands held under the bidding procedures.

Bids were opened on June 15, 1942, at which time VCA bid \$7,600, and John F. Wade and Thomas F.V. Curran, partner, bid \$7,550 (GSA, 1981, exhibit 31). As the bids were nearly equal, and since Wade and Curran offered to pay \$2,000 over and above the highest bid received, the General Superintendent of the Navajo Service requested that the Commissioner of Indian Affairs make the decision to award the lease. VCA was awarded the lease I-149-IND- 5705, which was executed on July 14, 1942, effective July 23, 1942, for a period of 10 years.

On September 2, 1943, the lease was reduced to a permanent operating lease and 12 plots totaling 436.79 acres were selected to be retained. Six of the plots (1-6) were on King Tutt Mesa, two on the plots (7, 10) were along the north side of the canyon of Oak Springs Wash and the remaining four plots (8,9,11, and 12) were in the vicinity of Milepost 16 on the New Mexico-Arizona State line. Each of the plots were named by VCA (Table 1). Lease I-149-IND-5705 was renamed as the "East Reservation Lease" by VCA. The mines on this lease were originally known as the Eastside mines, a name still used today in U.S. Geological Survey (USGS) reports. Plot 1, 3.53 acres, covered a small point on the south rim of King Tutt Mesa where uranium-vanadium minerals were exposed.

Vanadium Mining

Mining on the East Reservation Lease commenced in August 1942 on King Tutt Mesa. When the operations were examined by the USGS in November 1972, approximately 1,800 tons of ore with an average grade of 2.30 percent V_2O_5 had been produced (Duncan and Stokes, 1942, p. 26). The USGS map of King Tutt Mesa showed only mineralized ground at Red Wash Point (Duncan and Stokes, 1942, Plate 3).

Mining continued through August 1944. Single shipments were recorded in February 1945 and in July 1947. Total vanadium production from Lease I-149-IND-5705 was 10,294.74 tons of ore containing 504,822.27 pounds V_2O_5 and averaging 2.47 percent V_2O_5 (Table 2). With the exception of the 1947 shipment, which was made to its mill at Naturita, Colorado, VCA shipped ore from this lease to the Monticello, Utah mill operated by VCA for the Metals Reserve Co. The Metals Reserve vanadium program ended in February 1944 when the stockpile had been filled. At that time, mining all but ceased in the Four Corners area including the Carrizo Mountains. The actual amount of vanadium ore produced from Plot 1 is not recorded, but it is estimated to be less than 800 tons (Chenoweth, 1991).

The AEC Program

During 1947, the U.S. Atomic Energy Commission (AEC) began a procurement program on the Colorado Plateau to obtain uranium. The first domestic contract was signed with VCA on August 29, 1947, retroactive to May 20, 1947, to purchase uranium concentrates from the company's mill in Naturita, Colorado. The AEC also contracted with VCA, effective October 8, 1948, to buy concentrates from the AEC-owned mill at Durango, Colorado, which VCA had leased with an option to buy (Albrethsen and McGinley, 1982).

Since a market had developed, VCA began prospecting and mining on their East Reservation Lease. In March 1948, shipments began from the lease, mainly from Plot 3 (Page Edwards, 1955, personal communication). Production in 1948 amounted to 1,302.62 tons averaging 0.29% U_3O_8 and 2/59% V_2O_5 (Table 3).

The reopening of the Durango mill in March 1949 resulted in a shorter haulage for the mines in the Carrizo Mountains and production from the East Reservation Lease increased to 4,331.62 tons (Table 3). It was not until early 1950 that VCA began to separate the shipments from the East Reservation Lease by the individual plots on mill receipts to the AEC. It is estimated that of the 6,757.90 tons mined in the 1948-1950 period (Table 3) only a few hundred came from Plot 1. During 1948-1950, the ore that was shipped from Plot 1 mainly came from the hand sorting of dump material that was left over from the earlier vanadium mining.

When King (1951) examined King Tutt Mesa in the spring of 1951, he noted a small stripped area on Red Wash Point that was inactive. In July 1951, a Navajo miner, Harry Russell, took a contract with VCA to mine on Plot 1. Small shipments began in August 1951 and continued through April 1952. Monthly shipments ranged from 7 to 42 tons. The April 1952 shipment is the last recorded production from Plot 1. All the ore from Plot 1 was shipped to VCA's mill at Durango, Colorado. Annual production is given in Table 4. The East Reservation Lease was canceled in 1969 by the Foote Mineral Company which had acquired VCA in 1967.

Data in the AEC files indicated that 51.43 tons shipped by Sam Harvey in 1951-1952, labeled Sams Point, possibly had come from Plot 1. This production was reported with Plot 1 in a earlier report (Chenoweth, 1984). However, a later review of Navajo royalty records indicated the Sams Point mine was actually on Plot 7, near Oak Springs.

Summary

During the vanadium era of the early 1940s it has been estimated that the Red Wash mine produced not more than 800 tons of vanadium ore (Chenoweth, 1991). Under the AEC program, at least 248.39 tons with an average grade of 0.39% U_3O_8 and 2.92% V_2O_5 can definitely be attributed to this mine (Table 4). In all probability this mine produced at least 400 tons of ore for the AEC program.

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REFERENCES

- Albrethsen, Holger, Jr., and McGinley, F.E., 1982, Summary history of domestic uranium procurement under U.S. Atomic Energy Commission contracts, final report: U.S. Department of Energy Report GJBX-220(82), 162. P.
- Chenoweth, W.L., 1984, Historical review of uranium-vanadium production in the eastern Carrizo Mountains, San Juan County, New Mexico, and Apache County, Arizona, with production statistics compiled by E.A. Learned: New Mexico Bureau of Mines and Mineral Resources Open-File Report 193, 22p.
- Chenoweth, W.L., 1989, Leasing and mining of carnotite deposits in the 1920s, Carrizo Mountains, Apache County, Arizona, and San Juan County, New Mexico: Arizona Geological Survey Contributed Report CR-89-F, 48 p.
- Chenoweth, W.L., 1991, Vanadium mining in the Carrizo Mountains, 1942-1947, San Juan County, New Mexico and Apache County, Arizona: New Mexico Bureau of Mines and Mineral Resources Open-File Report 378, 33p.
- Corey, A.S., 1958, Petrology of the uranium-vanadium ores of the Nelson Point No. 1 Mine, San Juan County, New Mexico: U.S. Atomic Energy Commission Raw Materials Exploration Report RME-122, 30 p. (Open-filed 1970)
- Craig, L.C., and others, 1955, Stratigraphy of the Morrison and related formations, Colorado Plateau region, a preliminary report: U.S. Geological Survey Bulletin 1009-E, p. 125-168.
- DeVoto, R.H., and Huber, G.C., 1982, Geology and mineral leasing and mining of the Navajo Indian Reservation 1920-1946: Canyon Resources Corporation, 188 p., (prepared for U.S. Department of Justice).
- Duncan, D.C., and Stokes, W.L., 1942, Vanadium deposits in the Carrizo Mountains district, Navajo Indian Reservation, northeastern Arizona and northwestern New Mexico: U.S. Geological Survey Raw Materials Operations Report RMO-28, 32 p. (open-filed by DOE 1982).
- General Services Administration (GSA), 1981, Navajo vanadium narrative, in Accounting report on Navajo property, copper, missions, National Monuments, rights of way, sand, rock, gravel, and vanadium, Dockets 69,299,353, volume 1: General Services Administration, Indian Trust Accounting Division Report, p. 45-65, appendix 67 p., exhibits 19-54.

- Huffman, A.C., Jr., Kirk, A.R., and Corken, R.J., 1980, Depositional environments as ore controls in Salt Wash Member, Morrison Formation (Upper Jurassic), Carrizo Mountains area, Arizona and New Mexico, in Rautman, C.A., compiler, Geology and mineral technology of the Grants uranium region 1979: New Mexico Bureau of Mines and Mineral Resources Memoir 38, p. 121-130.
- King, J.W., 1951, Geological reconnaissance of King Tutt Mesa, east Carrizo district Arizona-New Mexico: U.S. Atomic Energy Commission Raw Materials Operations Report RMO-702, 16 p. (Open-filed 1981).
- Stokes, W.L., 1954, Some stratigraphic, sedimentary, and structural relations of uranium deposits in the Salt Wash sandstone: U.S. Atomic Energy Commission Raw Materials Exploration Report RME-3102, Technical Information Service, Oak Ridge, Tennessee, 50 p.
- U.S. Geological Survey, 1982, Horse Mesa quadrangle, Arizona-New Mexico: 7.5 minute series (topographic), provisional, scale 1:24,000.

Table 1.

Location, Name and Size of Plots, East Reservation Lease

Number	Plot Name	Acres	Location
1	Red Wash Point	3.53	S.E. King Tutt Mesa
2	King Tutt Point	9.14	S.W. King Tutt Mesa
3	Shadyside	145.13	Central King Tutt Mesa
4	Williams Pint	8.62	N. Central King Tutt Mesa
5	Fissure	1.57	N. Central King Tutt Mesa
6	Franks Point	6.23	N.W. King Tutt Mesa
7	Lower Oak Creek	205.39	Oak Creek Canyon
8	Cottonwood Butte	20.66	Cottonwood Butte
9	Lone Star	6.20	E. of MP-16
10	Oak Springs	5.53	S.E. of Oak Springs
11	White Cap	20.66	S.W. of MP-16
12	Syracuse	4.13	W. of MP-16
Total		436.79	

All were located in San Juan County, New Mexico except numbers 10, 11, and 12 in Apache County, Arizona.

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

Table 2**Vanadium ore production, East Reservation Lease, 1942-1947**

YEAR	TONS OF ORE	POUNDS U_3O_8	PERCENT V_2O_5
1942	2,063.19	100,069.00	2.42
1943	7,081.60	346,729.61	2.45
1944	1,055.56	56,818.26	2.69
1945	14.56	582.40	2.00
1946	0.00	0.00	0.00
1947	14.83	623.00	2.10
Totals	10,229.74	504,822.27	2.47

Source: 1942-1945; GSA (1981)
1947; USGS memo dated June 2, 1948 (in DOE files)

Table 3. Uranium - vanadium ore production only identified as being shipped from the East Reservation Lease, New Mexico - Arizona

YEAR	SHIPPER	TONS OF ORE	POUND U_3O_8	% U_3O_8	POUNDS V_2O_5	% V_2O_5
1948	VCA	1,302.62	7,613.87	0.29	67,396.00	2.59
1949	VCA	4,331.62	15,090.72	0.17	174,222.00	2.01
1950	VCA	1,123.44	7,081.30	0.31	69,895.00	3.11
TOTALS		6,757.68	29,785.89	0.22	311,503.00	2.30

Source: Unpublished AEC ore production records.

Majority of ore shipped from Plot 3, also includes minor production from Plots 1,2,4,6,7,9,11, and 12.

Table 4. Uranium-vanadium ore identified as being produced from Plot 1. Red Wash Point, San Juan County, New Mexico

YEAR	SHIPPER	TONS OF ORE	POUND U_3O_8	% U_3O_8	POUNDS V_2O_5	% V_2O_5
1951	Harry Russell	112.16	845.85	0.38	5,685.00	2.53
1952	Harry Russell	136.23	1,100.13	0.40	8,832.00	3.24
TOTALS		248.39	1,945.98	0.39	14,517.00	2.92

Source: Unpublished AEC ore production records.

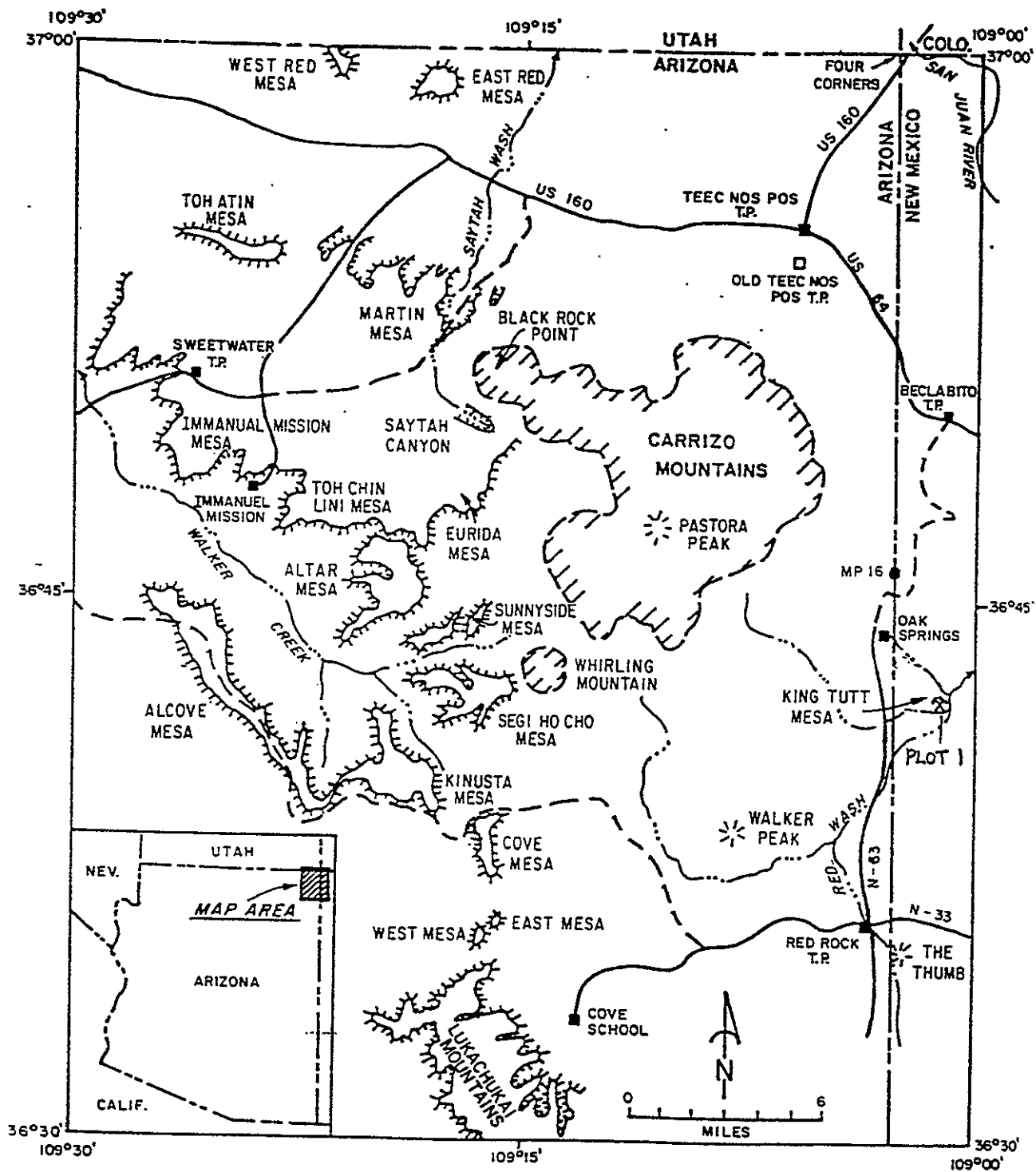


Figure 1. Index map of the Carrizo Mountains, Arizona-New Mexico showing the location of Plot 1.

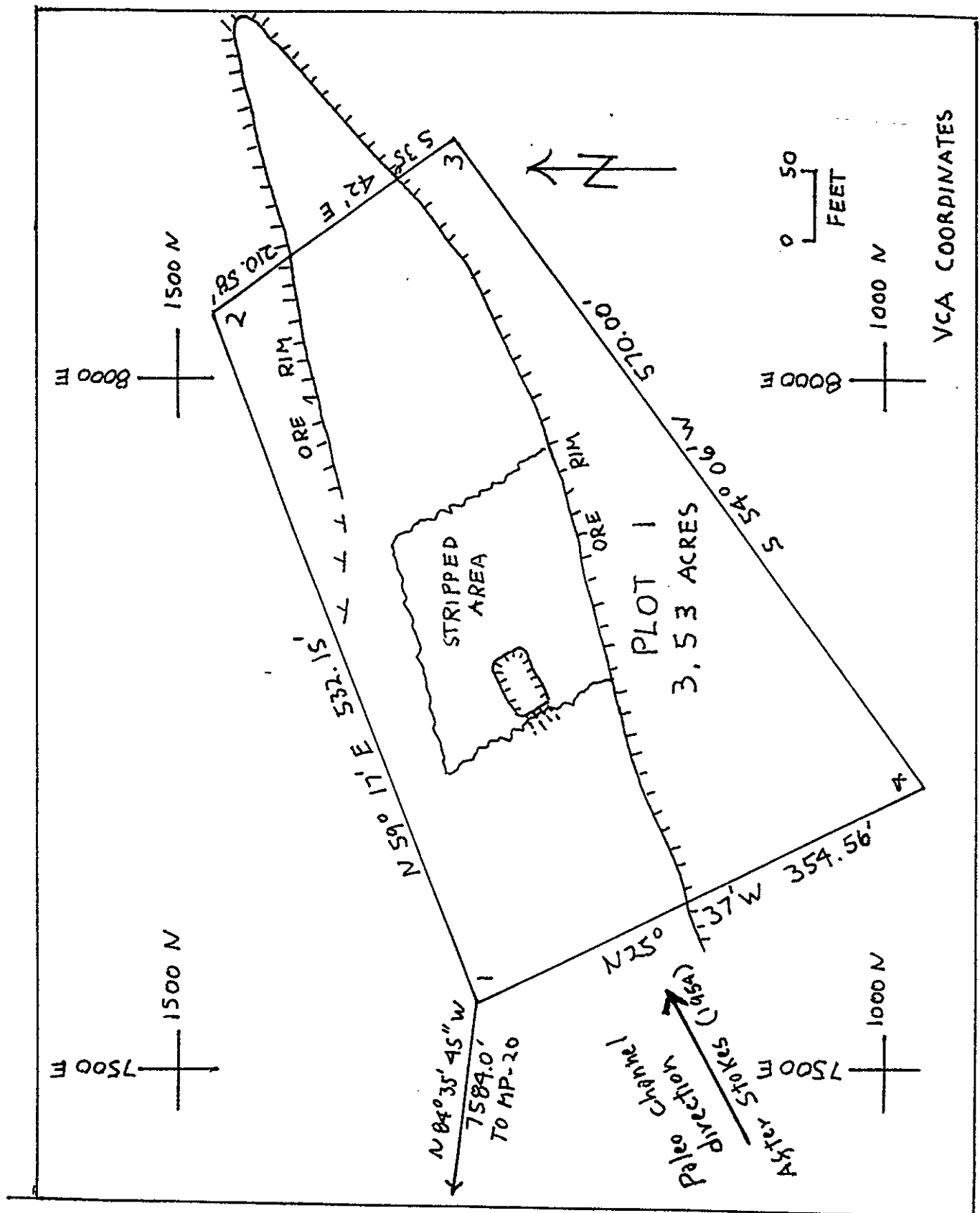


Figure 2. Plan map of the Red Wash Point uranium - vanadium mine, Plot 1, East Reservation Lease, San Juan County, New Mexico