THE GEOLOGY, LEASING AND PRODUCTION HISTORY OF THE KING TUTT POINT URANIUM-VANADIUM MINES, SAN JUAN COUNTY, NEW MEXICO

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INTRODUCTION

The King Tutt Point mines were developed on a lease that was issued for carnotite mining in 1942. The mines, 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 King Tutt Point mines are located on Plot 2 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 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 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 graded road that heads north from Red Rock to Oak Springs and Beclabito (Figure 1).

The mine workings consist of a rim stripped area approximately 400 by 100 ft (Figure 2). This was the site of the initial mining which commenced on mineralized outcrops on the mesa rim. Five adits have been driven into the northeast wall of this cut. Two of the adits provided access to the main mine which covers an area of approximately 225 by 100 ft (Figure 2). Waste rock from the underground workings has been neatly hand stacked in the stripped 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. Anderson (1981) has described the condition (in 1980) of the King Tutt Point mines in his summary of abandoned uranium mines in New Mexico.

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. Monthly mill receipts from the Vanadium Corporation of America (VCA)to the AEC, in the AEC files, were reviewed to obtain the names of the early Navajo contract miners, whose names do not appear in the annual AEC production records. 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. The map of the underground workings (Figure 2) was traced by the author in 1985 from the files of the Foote Mineral Company, successor to VCA.

GEOLOGIC SETTING

The uranium-vanadium orebodies at King Tutt 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 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 is predominantly overbank deposits of alternating thin mudstone and sandstone. It contains few channel sandstones.

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. Approximately 80 percent of the sandstone in this unit is active channel fill.

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 King Tutt Point is approximately 50 feet above the base of the Salt Wash, within the middle unit of the member. Paleo channel directions measured at the mine by Stokes (1954) indicated a N 59° 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.

Drilling by the AEC in the area north and east of the mines determined that the ore-bearing sandstone was approximately 50 feet thick (Masters and others, 1955). This drilling located a series of east-west trending orebodies in an area called the south channel of the King Tutt sandstone (Masters and others, 1955). These orebodies were accessed by the Begay No. 1 Mine (Chenoweth, 1984).

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 King Tutt mines ranged from a feather edge to up to five feet. Small high-grade (+0.50% U_3O_3) pods of ore were associated with replaced fossil wood.

The bright yellow mineral carnotite, a potassium uranium vanadate, has given these deposits their name. Later work by Corey (1958) and S. R. Austin (written communication, 1967) have identified 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, metahewettite, 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 have 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 had determined that the same rocks that contained the carnotite deposits of southwestern Colorado were 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 State 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 1920's 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 1922 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 for 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, totalling $47.27, 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 Reservation 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 purposes 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 need for vanadium by the steel industry greatly increased. Due to the uncertainty of foreign supplies and the need for vanadium in war armaments, the Federal government formed Metals Reserve Company in December 1941. This agency was part of the Reconstruction Finance Corporation. The Metals Reserve program with increased ore prices, buying stations, etc., was the stimulus to renew interest in the carnotite deposits in the Carrizo Mountains.

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 8⅓ 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 3½ miles; thence north 2 miles; thence east one mile; thence north 10 miles; thence east 2½ 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, partners, 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 totalling 436.79 acres were selected to be retained. Six of the plots (1-6) were on King Tutt Mesa, two of 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.

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 1942, 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 a small rim cut at King Tutt 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. 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 2 is not recorded, but it is estimated to be in the excess of 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 6,757.80 tons mined in the 1948-1950 period (Table 3) only a few hundred came from Plot 2.

In February 1950, a Navajo contract miner, John Joe, began mining on Plot 2. Through June he had shipped 190.40 tons with an average grade of 0.31% U_3O_8 and 2.66% V_2O_5 (Table 4). The mines were idle until August when another contract miner, Raymond Marshall, began mining on Plot 2. During August and September 1950, Marshall produced 71.95 tons averaging 0.39% U_3O_8 and 2.80% V_2O_5 (Table 4). During December 1950 and January 1951, contractor Leroy Pettigrew shipped a total of 39.92 tons averaging 0.23% U_3O_8 and 2.25% V_2O_5 (Table 4).

During April 1951, Carl Thomas shipped 29.94 tons averaging 0.42% U_3O_8 and 4.25% V_2O_5 from Plot 2. When King (1951) examined the area in spring of 1951, he noted that the mines at King Tutt Point had a total of 1,000 feet of drifts. Thomas resumed mining in July and August 1952, shipping 32.54 tons averaging 0.39% U_3O_8 and 2.74% V_2O_5 (Table 4).

The next mining on Plot 2 took place in February through April 1953 when VCA company miners operated the mines. During this three month period they produced a total of 25.76 tons averaging 0.17% U_3O_8 and 1.62% V_2O_5 (Table 4). A small amount of core drilling behind the mine workings failed to locate any additional ore.

The final mining on Plot 2 occurred during the spring of 1956 when a VCA mining crew shipped 38.20 tons averaging 0.21% U_3O_8 and 1.69% V_2O_5 (Table 4). The

mines were abandoned during 1956 and the lease was canceled in 1969 by the Foote Mineral Company which had acquired VCA in August 1967.

Summary

During the vanadium era of the early 1940's it has been estimated that the mines on Plot 2 produced at least 800 tons of vanadium ore (Chenoweth, 1991). Under the AEC program, at least 428.72 tons with an average grade of 0.31% U_3O_8 and 2.62% V_2O_5 can definitely be attributed to these mines (Table 4). In all probability they produced more than 600 tons of ore for the AEC program.

Acknowledgements

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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 Point	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 V_2O_5	% 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	POUNDS U_3O_8	% U_3O_8	POUNDS V_2O_5	% V_2O_5
1948	VCA	1,302.62	7,613.87	0.29	67,386.00	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 production identified as being shipped from the King Tutt Point Mines, San Juan County, New Mexico.

YEAR	SHIPPER	TONS OF ORE	POUNDS U_3O_8	% U_3O_8	POUNDS V_2O_5	% V_2O_5
1950	John Joe	190.40	1,134.54	0.30	10,143.00	2.66
1950	Raymond Marshall	71.95	555.82	0.39	4,034.00	2.80
1950	Leroy Pettigrew	27.62	135.48	0.24	1,276.00	2.31
1951	Leroy Pettigrew	12.31	50.15	0.20	520.00	2.11
1951	Carl Thomas	29.94	248.88	0.42	2,543.00	4.25
1952	Carl Thomas	32.54	256.14	0.39	1,783.00	2.74
1953	VCA	25.76	88.99	0.17	835.00	1.62
1956	VCA	38.20	160.07	0.21	1,295.00	1.69
	Totals	428.72	2,630.07	0.31	22,429.00	2.62

Source: Unpublished AEC ore production records, VCA mill receipts to the AEC

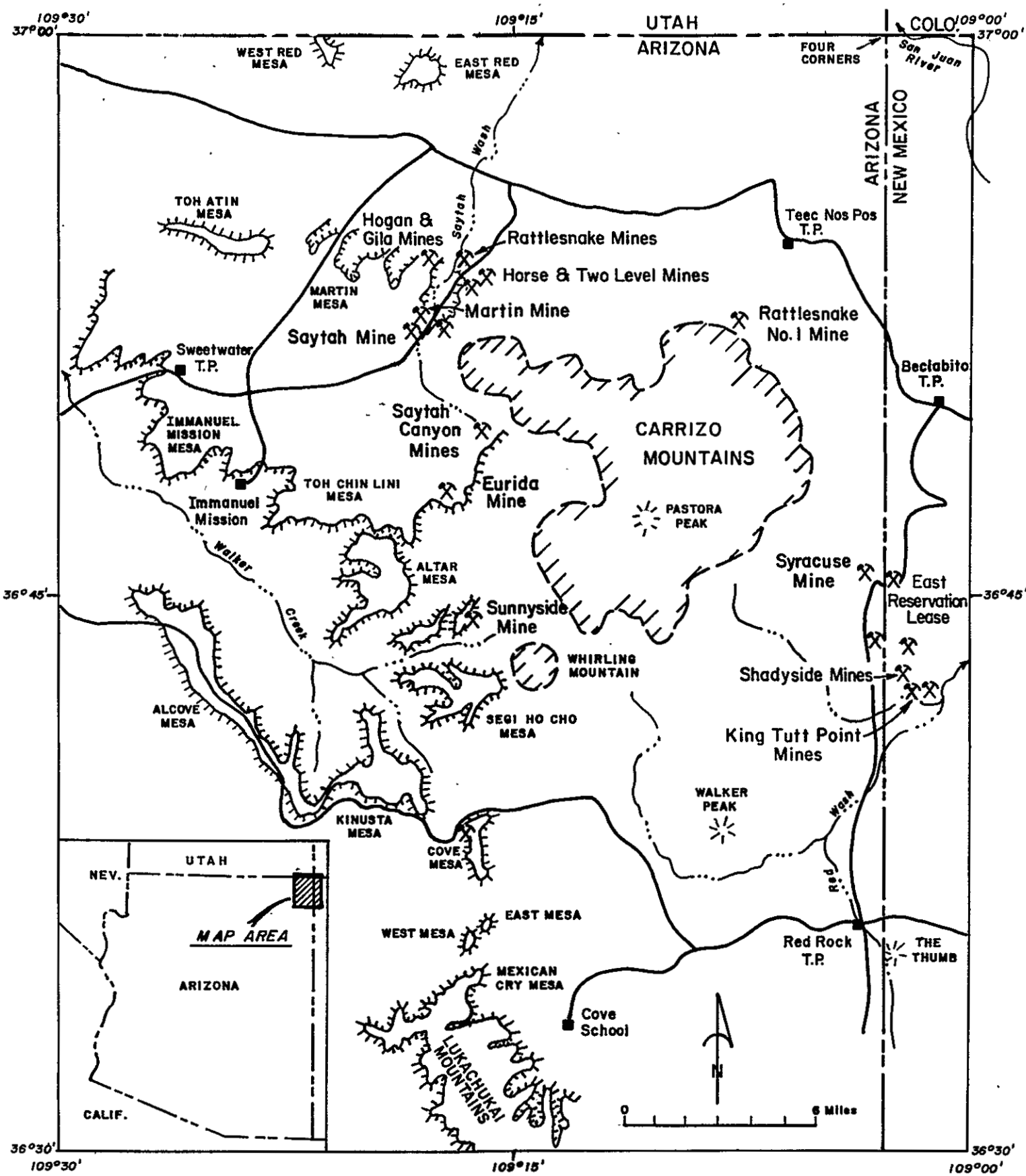

Figure 1. Index map of the Carrizo Mountains showing the location of the vanadium mines that operated in the 1940's

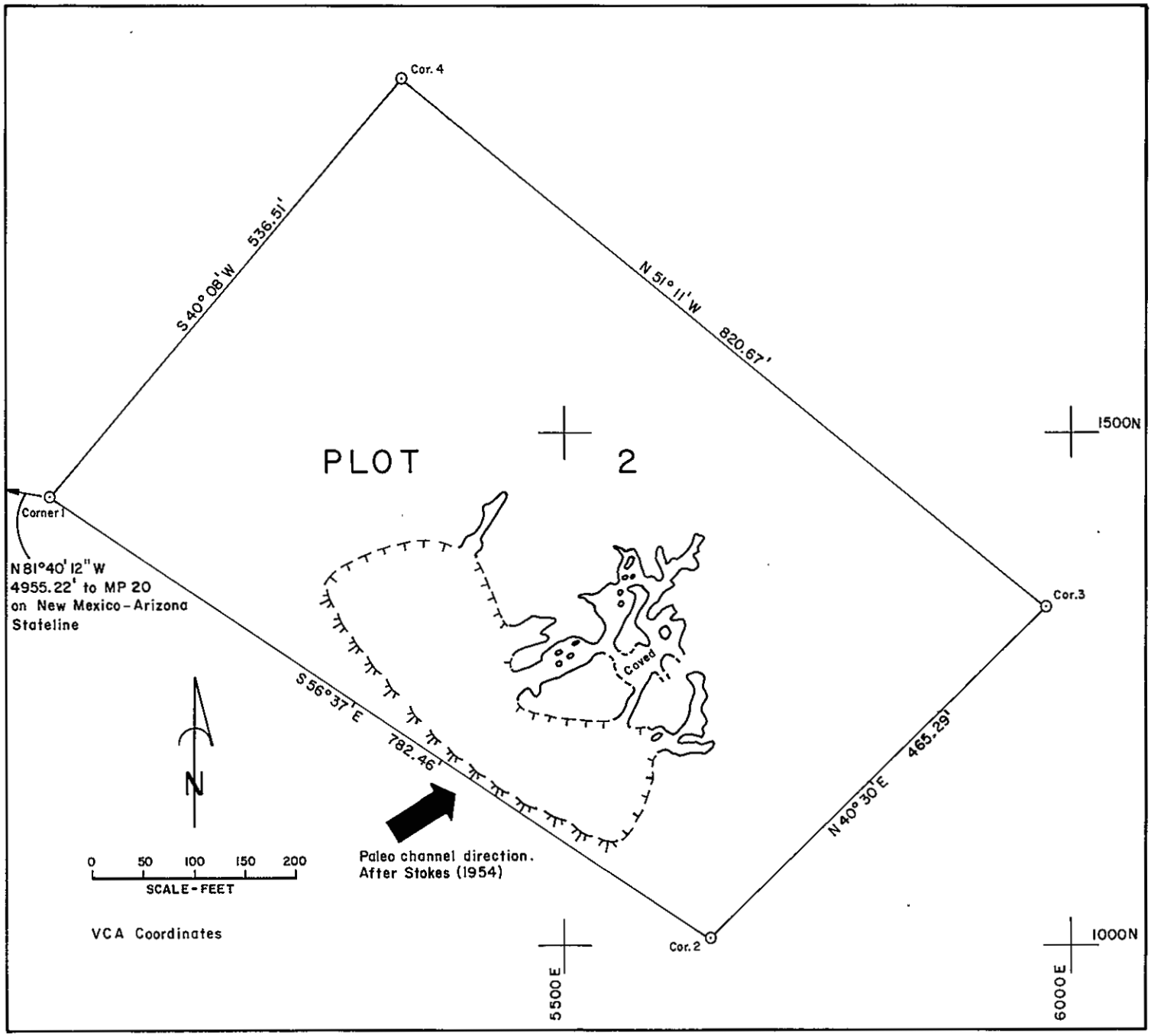

Figure 2. Plan map of the King Tutt Point uranium-vanadium mines, Plot 2, East Reservation Lease, San Juan County, New Mexico