

**THE GEOLOGY, LEASING AND
PRODUCTION HISTORY OF THE OAK
SPRINGS URANIUM-VANADIUM MINES,
APACHE COUNTY ARIZONA**

by

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Arizona Geological Survey
Contributed Report 95-G
September 1995

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*Interpretations and conclusions in this report are those of the consultant
and do not necessarily coincide with those of the staff of the Arizona
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INTRODUCTION

The original Oak Springs Mine, known as Plot 10, was developed on a lease that was issued for carnotite mining in 1942. Drilling by the U.S. Atomic Energy Commission (AEC) in 1952 and 1953 located additional ore bodies behind the existing mine, and on a contiguous claim, where a second mine was developed. This mine was known as Cato Sells Oak Springs Mine for the Navajo Indian that held the claim. These interconnected mines are in the Salt Wash Member of the Morrison Formation of Upper Jurassic age. The contiguous ore bodies represent the largest uranium deposit in the Arizona portion of the eastern Carrizo Mountains mining area.

Although Scarborough (1980, p.26) included a map of the Oak Springs mines in his report, no history of the operations was included. This report, from the author field notes etc., briefly summarizes the activities at the two properties.

LOCATION AND LAND STATUS

The Oak Springs mines are located on a small mesa, immediately south of the settlement of Oak Springs in the eastern Carrizo Mountains, Apache County, Arizona (Figure 1). The location of the mines are shown on the Horse Mesa quadrangle at latitude 36° 44' 50" N and longitude 109° 03' 00" W (U.S. Geological Survey, 1982). This mesa is locally known as Gravel Top due to a thick bed of unconsolidated pediment gravel that caps the mesa. These gravels, mainly diorite porphyry, were derived from the Carrizo Mountains and made drilling on the mesa extremely difficult.

The Oak Springs mines are located within the Navajo Indian Reservation. On the Reservation, all prospecting, exploration and mining is controlled by the Navajo Tribal Council and the Bureau of Indian Affairs, U.S. Department of the Interior.

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, 1993. 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 Arizona Geological Survey library.

GEOLOGIC SETTING

The uranium-vanadium ore bodies at Oak Springs occur in the Salt Wash Member of the Upper Jurassic Morrison Formation. In the Oak Springs - 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. Between 5% and 45% of the total thickness of the member consists of mudstone and siltstone beds. Huffman and others (1980) have subdivided the Salt Wash Member in the Oak Springs - King Tutt Mesa area into three stratigraphic units based on depositional environments. The lowermost unit consists of an average of 30 feet of predominately 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% 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 ore bodies at Oak Springs is approximately 50 feet above the base of the Salt Wash, within the middle unit of the member. Its exposure on Plot 10 was mapped as the "ore rim" by VCA (Figure 2). Paleo-channel directions measured at the mine by Stokes (1954) indicated that the streams depositing its sandstone flowed in a S 75° E direction (Figure 2). 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 ore bodies were formed by the selective impregnation of the sandstone and adsorption by the mudstone and fossil plant material. Ore bodies were commonly associated with detrital plant fragments in the sandstone. The ore bodies 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 Oak Springs mines ranged from a feather edge to up to five feet. Small high-grade (>0.50% U₃O₈) pods of ore were associated with replaced fossil wood.

The deposits were originally called carnotite after the bright yellow mineral carnotite, a potassium uranium vanadate. 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 Gravel Top 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 VANADIUM PRODUCTION HISTORY

Early Prospecting

Outcrops containing uranium and vanadium minerals in the Carrizo Mountains were discovered by John F. Wade in about 1918 (personal communication, 1955). Wade came from Farmington, New Mexico and operated the 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 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 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 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.

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% (mine mouth value), bond requirements, acreage limitations, and a term of 10 years which could be extended by production.

On April 9, 1942, 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 8 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 1/2 miles; thence north 2 miles; thence east on mile; thence north 10 miles; thence east 2 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. The first was held in December, 1941 for a lease in the western Carrizo Mountains (Chenoweth, 1991).

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. The Navajo Tribe received a straight royalty of 10% of the mine-mouth value of the ore produced from this lease.

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). Plot 10, containing 5.53 acres, covered the southwestern rim of Gravel Top Mesa where several exposures of vanadium minerals had been located (Duncan and Stokes, 1942, p.27). 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 and continued through August 1944. Single shipments were recorded in February 1945 and in July 1947. Ore was mined off all the plots of the lease, but the majority came from Plot 3 on King Tutt Mesa (Chenoweth, 1991). 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% V_2O_5 (Chenoweth 1991). 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 10 is not recorded, but it is estimated to be less than 100 tons (Chenoweth, 1991). The ore was produced from a small rim cuts (Figure 2).

URANIUM PRODUCTION HISTORY

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 on King Tutt Mesa (Page Edwards, 1955, personal communication). 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 began to increase.

Plot 10 (Oak Springs) Mine

In the fall of 1949, Cato Sells obtained a contract from VCA to mine on Plot 10. The initial mining was on several mineralized exposures in the northwestern part of the plot (Figure 2). One of the exposures was followed into the mesa and a small underground mine was developed (Figure 2). By March 1950, Sells had depleted all of the visible ore. Since commencing mining in November 1949, he shipped a total of 501.84 tons of ore averaging 0.17% U_3O_8 and 2.75% V_2O_5 (Table 2). Included in this figure are 46 tons averaging 0.27% U_3O_8 and 2.94% V_2O_5 which Sells had mined from his adjacent claim, but which a later survey showed had actually come from VCA's ground (Figure 2).

In order to increase the ore production in the eastern Carrizo area, the AEC did diamond core drilling behind the existing mines searching for additional ore bodies. Between February 11, 1952 and August 17, 1952, a total of 948 holes with a footage of 100,038 feet were drilled in the King Tutt Mesa - Oak Springs area (Masters and

others, 1955). The drilling project was known as the East Carrizo No. 1 project - Contract No. AT (30-1)-1260. All drill holes had the prefix EC. The middle and lower units of the Salt Wash were cored. On Gravel Top Mesa, 14 holes were drilled. Seven holes were drilled on a 100-foot grid and seven holes were 50-foot offsets to ore and mineralized holes. This drilling located 270 tons of ore averaging 0.40% U_3O_8 and 4.43% V_2O_5 (Masters and others, 1955). During the spring of 1953, about a dozen more holes were drilled on Gravel Top Mesa as 50-foot offsets to ore and mineralized holes drilled the previous year. This drilling was part of the East Carrizo No. 2 project - Contract No. AT(30-1)-1364 (Blagbrough and Brown, 1955).

After the AEC located ore on Plot 10, northeast of the old workings, VCA did some drilling to delineate an orebody near AEC hole EC-551A. They then resumed mining early in 1955. The mining was done with Navajo miners employed by VCA. Mine inspection reports record that an average of three men were employed underground and one man on the surface during 1955. Mining by VCA employees ceased in the fall of 1957. At that time they had produced 1,259.06 tons of ore averaging 0.26% U_3O_8 and 2.94% V_2O_5 (Table 2). Not knowing where the property line was underground, some of the VCA mining was later found to be on Cato Sells adjacent claim (Figure 2).

In October 1957, two Navajo contract miners, William Tanner and Carl Thomas took over the final cleanup mining on Plot 10. Mining continued into April 1958. When the author visited the mine on May 14, 1958, there was no equipment present and the mine appeared abandoned. During the time they operated the mine, Tanner and Thomas produced 217.50 tons of ore averaging 0.25% U_3O_8 and 2.93% V_2O_5 (Table 2). All of the ore was shipped to VCA's mill at Durango, Colorado. Lease I-149-IND-5705 was canceled in 1969 by Foote Mineral Company which had acquired VCA in August 1967. Total ore production from Plot 10 during the period 1949-1958 was 1,978.49 tons averaging 0.24% U_3O_8 and 2.82% V_2O_5 (Table 2).

Navajo Mining Permits

In 1949 the Navajo Tribal Council approved regulations that would allow individual Navajos to stake claims. Mining permits were issued so that mining could take place and the tribe receive a royalty. A few individuals, such as Cato Sells, took advantage of these new regulations.

Due to the uranium boom on the Colorado Plateau, the Tribal Council adopted Resolution CM-3-51 on March 22, 1951 authorizing the Advisory Committee to draft new mining regulations. New regulations pertaining to prospecting and mining were adopted on April 27, 1951 and were approved on September 19, 1951. The new regulation stated that all prospectors must have a permit. Mining permits and leases were to be issued by the Navajo Tribal Council and approved by the Bureau of Indian Affairs (BIA), U.S. Department of 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 would be issued directly by the BIA, and approved by the Secretary of the Interior. 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 the

permittee and the tribe would receive royalties from ore production. Based on the mine value of the ore, the tribe would receive between 10% and 20% royalties and the permittee between 2% and 5% royalties.

In addition to mining permits, the tribe could issued drilling and exploration permits. These permits were good for 120 days and were not renewable. So many Navajos applied for mining permits it became necessary for the Navajo Tribal Mining Department began numbering them in April 1952. Prior to that time the permits were not identified with a number.

Cato Sells Oak Springs Mine

In August 1949, Cato Sells of Farmington, New Mexico obtained an unnumbered mining permit for a rectangular claim on Gravel Top Mesa. The southwest boundary of the claim was contiguous with the northeast boundary of Plot 10 (Figure 2). During November, 1949 he mined 69.05 tons of ore averaging 0.27% U_3O_8 and 2.94% V_2O_5 from surface exposures near the southwest corner of the claim (Figure 2). Since Sells was also mining on Plot 10 for VCA, he agreed to ship this ore to the VCA mill at Durango, Colorado. A later survey determined the correct position of the northwest corner of Plot 10 and that 46 tons had mistakenly been mined off of Plot 10.

On August 6, 1952 Navajo Tribal Mining Permit No. 56 was approved to Cato Sells. This permit included ground on Cove Mesa, Gravel Cap Mesa and near milepost 17 on the Arizona-New Mexico line, and totaled 135.27 acres.

After the AEC drilling located ore on his permit, Sells did some additional drilling to delimit the ore bodies. Early in 1954, Sells sank a 100-foot deep, timbered shaft to the ore zone near AEC drill hole EC-555 (Figure 2). In April 1954 the initial ore was shipped to the AEC ore-buying station at Shiprock, New Mexico. Ore production in 1954 was 988.87 tons with an average grade of 0.23% U_3O_8 and 2.41% V_2O_5 (Table 3).

Ore production reached a peak in 1955 when 1,294.60 tons averaging 0.26% U_3O_8 and 2.51% V_2O_5 were shipped (Table 3). During that year, an average of five men underground and one man on the surface were employed at the mine.

Production declined in 1956 to 427.09 tons averaging 0.21% U_3O_8 and 1.95% V_2O_5 as most of the ore near the shaft was depleted. Sells did additional drilling in December 1956 and in February and March 1957. As the result of the drilling, Sells reported to the AEC that 3,000 tons of reserves had been located. Production in 1957 increased to 821.37 tons averaging 0.24% U_3O_8 and 2.41% V_2O_5 (Table 3).

During 1957, federal mine inspectors declared the shaft was unsafe due to shifting of the pediment gravel at the collar. On November 19, 1957, a new 300-foot long, minus 12 degrees, 5 by 7-foot decline was started from the north side of the mesa (Figure 2). Trenton Davis of Cortez, Colorado contracted to sink the decline. When the mine was visited by the author on March 11, 1958 the decline had another 30 feet to be sunk before reaching the existing mine workings near the shaft. At the time of a May 14, 1958 visit, the new decline was in use. In the mine and in the decline, rail haulage was used with a small hoist used to pull the mine cars up to the surface. Five

men were employed underground with one man on the surface to operate the hoist. During 1958 the Sells' mine workings connected with the Plot 10 workings.

On November 15, 1958, the mine was producing about 100 tons per month with ore being hoisted up the decline and also being taken out via the Plot 10 workings. Ore production During 1958 increased to 1,161.25 tons averaging 0.21% U_3O_8 and 2.00% V_2O_5 (Table 3).

Mining in 1959 continued until May. When the mine was visited in June 1958, all equipment had been removed as it appeared abandoned. Records of the Navajo Tribal Mining Department show that Sells canceled his mining permit on August 24, 1959. During the period of underground mining (1954-1959), Sells had produced 4,988.53 tons of ore averaging 0.23% U_3O_8 and 2.29% V_2O_5 (Table 3).

On September 26, 1960, a new mining permit MP-547, was approved to Cato Sells. This permit covered the same 135.27 acres as his earlier MP-56. In February 1962, Sells assigned the mining rights of 62.47 acres to W. D. Tripp of Cortez, Colorado. This acreage included the Upper and Lower Canyon claims near milepost 17 and the Oak Springs claim. This assignment was not approved until April 3, 1962.

In March 1962, W. D. Tripp sank a 35-foot long decline located 300 feet southeast of the shaft near AEC drill hole EC-556B. He had drilled five additional holes near the AEC hole and had located a small ore body. When visited on March 28, 1962, the decline was completed and two miners were mining low-grade ore. When visited on May 4, 1962, the decline appeared abandoned. During April 1962, Tripp shipped 99.88 tons of ore averaging 0.10% U_3O_8 and 1.82% V_2O_5 (Table 30).

The final shipment from Cato Sells Oak Springs claim was in early 1966, when as the result of a final cleanup, W. D. Tripp shipped 660 pounds of ore averaging 0.24% U_3O_8 and 2.12% V_2O_5 (Table 3). The mining permit and assignment were canceled in September 1966. During the period 1949 through 1966 a total of 5,111.79 tons of ore averaging 0.23% U_3O_8 and 2.28% V_2O_5 were mined on Cato Sells Oak Springs claim (Table 3).

SUMMARY

The ore bodies on Gravel Top Mesa produced a total of 7,090.28 tons of ore averaging 0.23% U_3O_8 and 2.43% V_2O_5 . This represents the largest uranium ore deposit in the Arizona portion of the eastern Carrizo Mountains (Chenoweth, 1984). All of the uranium concentrate produced from processing of the ores from the two properties was purchased by the AEC. At VCA's Durango mill, only 20% of the vanadium concentrate was purchased by the AEC, the remainder was sold to the steel industry (Albrethsen and McGinley, 1982). At Shiprock, the vanadium content of the ores was paid for by the AEC, but not all of it was recovered at the Kerr-McGee Oil Industries, Inc. mill (Albrethsen and McGinley, 1982).

Acknowledgments. This report would not have been prepared without the encouragement of Larry D. Fellows, State Geologist and Director of the Arizona Geological Survey. Stephen M. Richard reviewed the manuscript.

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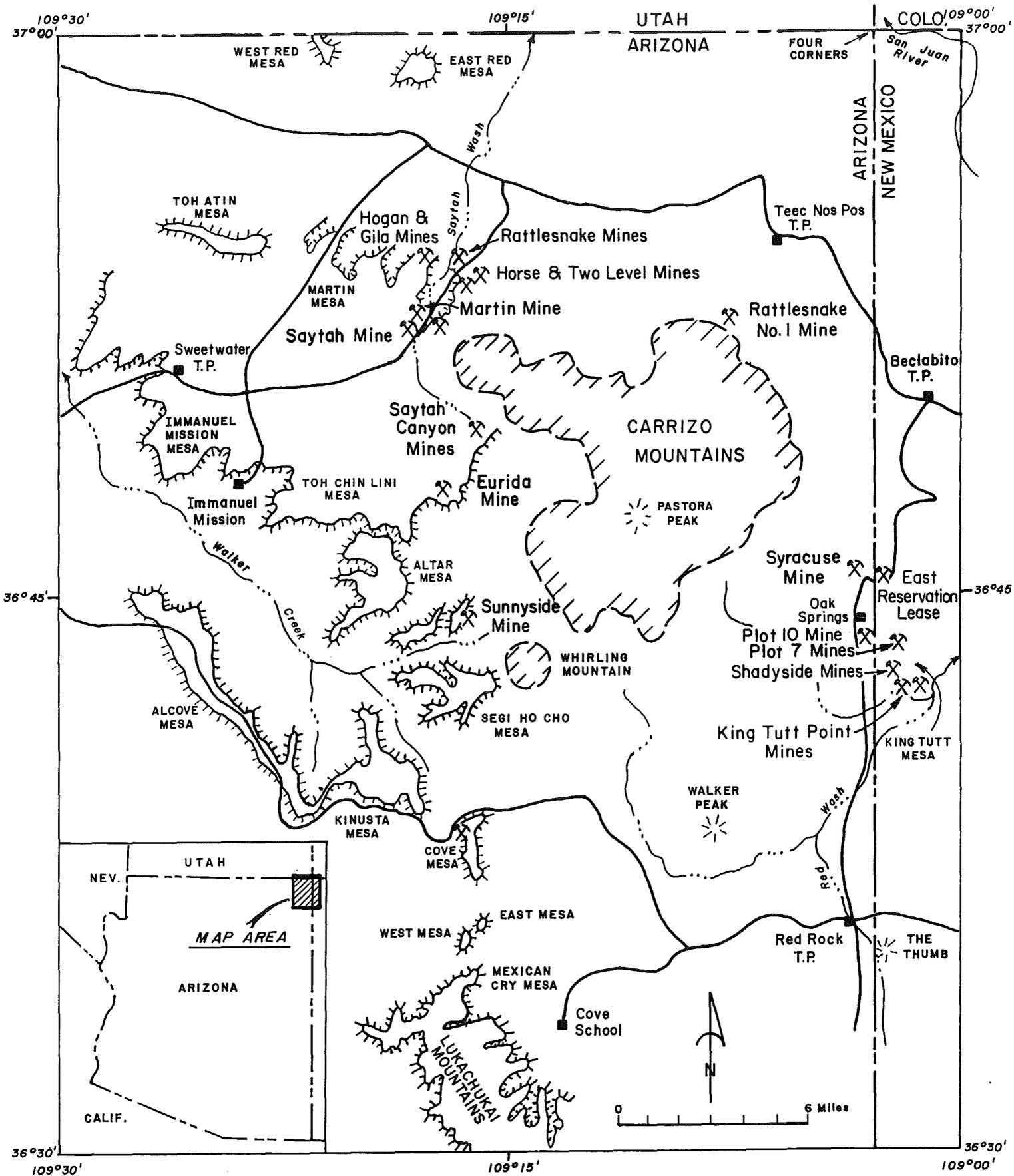


Figure 1. Index map of the Carrizo Mountains showing the location of the vanadium mines that operated in the 1940's

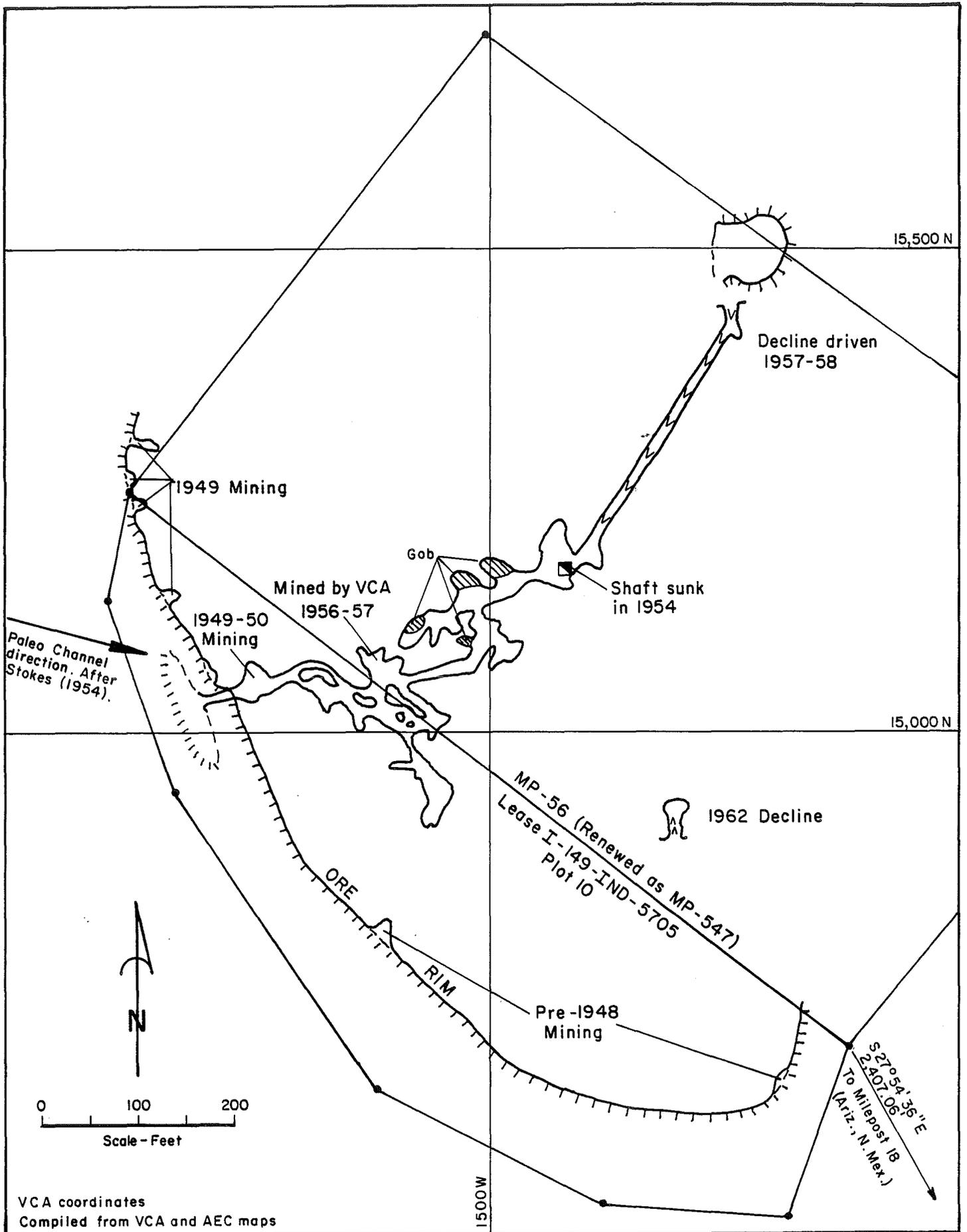


Figure 2. Plan map of the Oak Springs uranium-vanadium mines, Apache County, Arizona

Table 1. Name, size and location of Plots, East Reservation Lease

<i>NO.</i>	<i>PLOT NAME</i>	<i>ACRES</i>	<i>LOCATION</i>
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 ACRES		436.79	

All plots 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. Ore production from the Plot 10 Mine, Apache County, Arizona

<i>YEAR</i>	<i>QTR</i>	<i>OPERATOR</i>	<i>ORE (Tons)</i>	<i>U₃O₈ (lbs.)</i>	<i>% U₃O₈</i>	<i>V₂O₅ (lbs.)</i>	<i>% V₂O₅</i>
1949	4	CatoSells	290.66	1,232.86	0.21	18,592.00	3.20
1950	1	CatoSells	211.18	517.35	0.12	8,971.00	2.12
1955	1	VCA	83.66	439.58	0.26	5,840.00	3.49
1955	2	VCA	342.78	2,038.25	0.30	18,565.00	2.71
1955	3	VCA	70.97	347.73	0.24	3,290.00	2.32
1955	4	VCA	57.66	213.21	0.18	2,517.00	2.18
1956	1	VCA	158.25	629.72	0.20	8,572.00	2.71
1956	2	VCA	55.52	215.34	0.19	2,956.00	2.66
1956	4	VCA	67.12	459.39	0.34	4,565.00	3.40
1957	1	VCA	145.55	971.88	0.33	9,158.00	3.15
1957	2	VCA	158.48	826.77	0.26	9,417.00	2.97
1957	3	VCA	119.07	408.68	0.17	6,262.00	2.63
1957	4	Tanner&Thomas	96.10	444.65	0.23	5,829.00	3.03
1958	1	Tanner&Thomas	76.33	453.51	0.30	4,864.00	3.19
1958	2	Tanner&Thomas	45.16	190.30	0.21	2,060.00	2.28
MINE TOTAL			1,978.49	9,389.22	0.24	111,458.00	2.82

SOURCE: Unpublished ore production records, U.S. Atomic Energy Commission, Grand Junction, Colorado office.

**Table 3. Ore production from the Cato Sells Oak Springs Mine,
Apache County, Arizona**

<i>YEAR</i>	<i>QTR</i>	<i>OPERATOR</i>	<i>ORE (Tons)</i>	<i>U₃O₈ (lbs.)</i>	<i>% U₃O₈</i>	<i>V₂O₅ (lbs.)</i>	<i>% V₂O₅</i>
1949	4	Cato Sells	23.05	124.76	0.27	1,352.39	2.93
1954	2	Cato Sells	164.54	873.15	0.27	6,949.33	2.11
1954	3	Cato Sells	448.30	1,889.33	0.21	20,153.76	2.25
1954	4	Cato Sells	376.03	1,776.10	0.24	20,536.03	2.73
1955	1	Cato Sells	711.73	3,800.37	0.27	39,300.62	2.76
1955	2	Cato Sells	408.96	2,033.06	0.25	17,335.27	2.12
1955	3	Cato Sells	173.91	825.03	0.24	8,238.23	2.37
1956	2	Cato Sells	31.23	122.04	0.20	1,554.01	2.49
1956	3	Cato Sells	38.55	161.89	0.21	1,911.88	2.48
1956	4	Cato Sells	357.31	1,503.48	0.21	13,167.26	1.84
1957	1	Cato Sells	191.63	733.17	0.19	9,024.16	2.35
1957	2	Cato Sells	154.81	839.60	0.27	7,895.00	2.55
1957	3	Cato Sells	179.79	914.24	0.25	9,725.28	2.70
1957	4	Cato Sells	295.14	1,442.79	0.24	12,981.34	2.20
1958	1	Cato Sells	83.66	415.60	0.25	3,385.12	2.02
1958	2	Cato Sells	308.19	1,181.36	0.19	11,015.87	1.79
1958	3	Cato Sells	376.70	1,304.72	0.17	14,604.99	1.94
1958	4	Cato Sells	392.70	2,006.16	0.26	17,542.13	2.23
1959	1	Cato Sells	226.20	933.23	0.21	10,463.32	2.31
1959	2	Cato Sells	69.15	198.08	0.14	2,571.04	1.86
1962	2	W. D. Tripp	99.88	208.88	0.10	3,641.00	1.82
1966	1	W. D. Tripp	0.33	1.58	0.24	13.97	2.12
MINETOTAL			5,111.79	23,288.62	0.23	233,362.00	2.28

SOURCE: Unpublished ore production records, U.S. Atomic Energy Commission, Grand Junction, Colorado office.