

THE GEOLOGY, EXPLORATION AND PRODUCTION HISTORY
OF THE BEGAY NO. 1 AND CARRIZO NO. 1
URANIUM-VANADIUM MINES,
SAN JUAN COUNTY, NEW MEXICO

New Mexico Bureau of Mines and Mineral Resources

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INTRODUCTION

The Begay No. 1 and Carrizo No. 1 mines were developed in orebodies that were located in 1952 by drilling done by the U.S. Atomic Energy Commission (AEC). The mines, in the Salt Wash Member of the Morrison Formation, produced uranium–vanadium ore in the mid-1950s and in the mid-1960s. 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 portal of the Begay No. 1 mine is located on the south rim of a small mesa, known locally as King Tutt Mesa (Figure 1). 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 portal of the Carrizo No. 1 mine is on the mesa, approximately 600 ft northwest of the Begay No. 1 portal (Figure 2). 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).

Land Status

King Tutt Mesa is located within the Navajo Indian Reservation. Mining

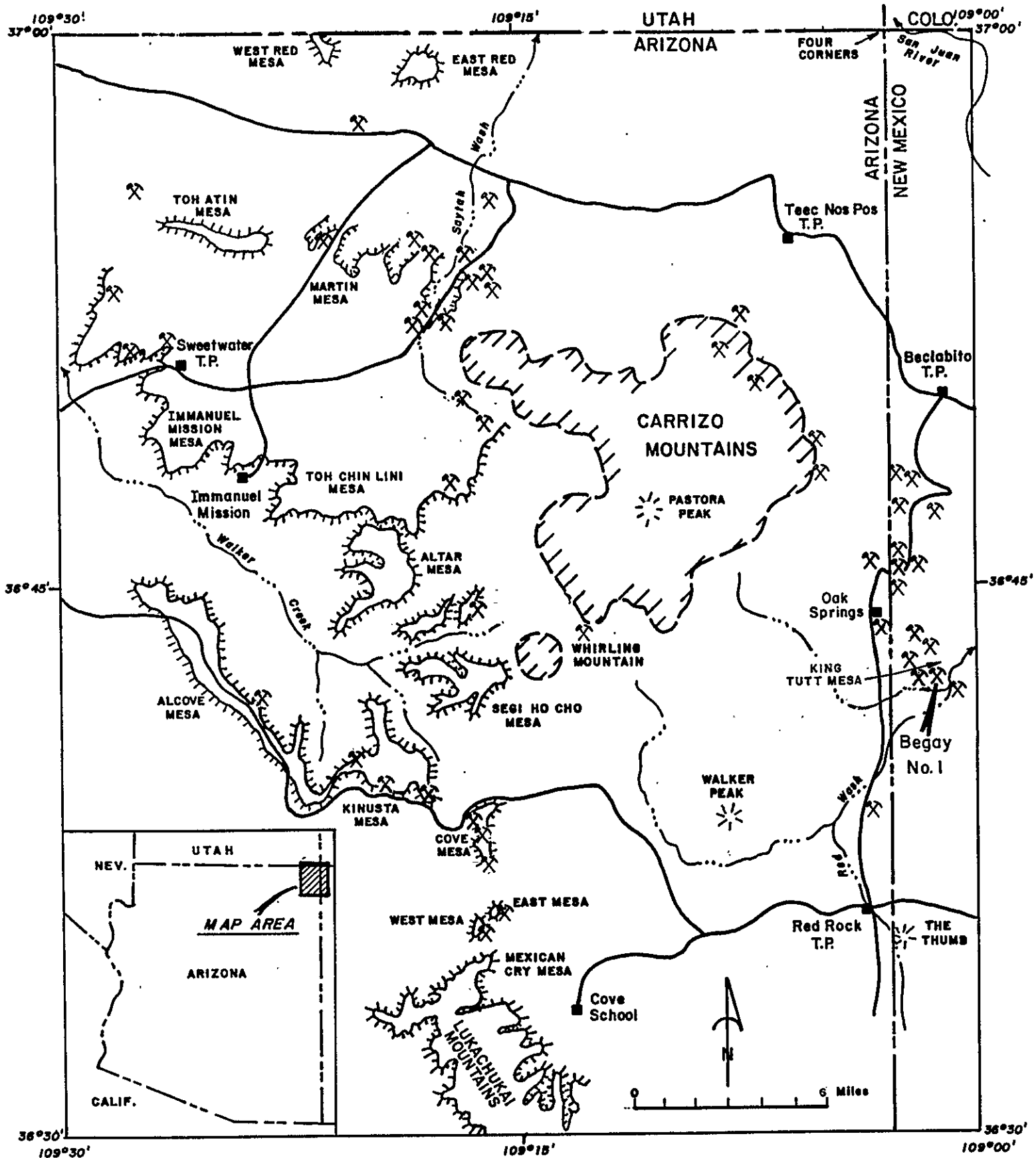


Figure 1. Index map of the Carrizo Mountains showing the location of uranium - vanadium mines, including the Begay No. 1 mine

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

In addition to mining permits, the tribe issued drilling and exploration permits. These permits were good for 120 days and were not renewable.

Previous Studies

A report by Chenoweth (1984) summarizes the uranium–vanadium production in the eastern Carrizo Mountains. Anderson (1981) has described the condition (in 1980) of the Begay No. 1 and Carrizo No. 1 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. 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 the Vanadium Corporation of America.

GEOLOGIC SETTING

The uranium–vanadium orebodies at the Begay No. 1 and Carrizo No. 1 mines 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 ft 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 ft thick and is predominantly overbank deposits of alternating thin mudstone and sandstone. It contains a few channel sandstones.

The middle stratigraphic unit is an average of 70 ft 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 ft 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 AEC's study of core and drill hole logs determined that the orebodies which would be exploited by the Begay No. 1 and Carrizo No. 1 mines were in a channel sand unit which they named the south channel of the King Tutt sandstone. This unit was about 50 ft thick and occupied an interval 20 to 70 ft above the base of the Salt Wash (Masters and others, 1955).

The King Tutt sandstone is a very fine- to fine-grained, fairly well sorted, quartzose sandstone, generally gray in color and friable. Locally, grayish-green mudstone make up a large part of the unit. The orebodies occur in the upper half of the channel, about 50 ft above the base of the Salt Wash (Masters and others, 1955). The south channel of the King Tutt sandstone trends S80°E. 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 maximum of 50 ft in length. Thicknesses at the Begay No. 1 mine ranged from a feather edge up to three ft.

The bright yellow uranium mineral in the Carrizo ore deposits was originally called 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 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.

EXPLORATION BY THE AEC

In the late 1940s, numerous old vanadium mines existed on the rim of King Tutt Mesa (Chenoweth, 1991). Studies of outcrops by AEC geologists indicated that the ore-bearing sandstone projected eastward into the mesa where there was no drilling. Hence, the AEC decided to drill the mesa in an attempt to develop additional ore. Between February 11, 1952 and August 17, 1952, a total of 948 holes with a footage of 100,038 feet were drilled on King Tutt Mesa and in the 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. The drill spacing ranged from 1,000 ft in the initial grid to 25 ft where ore grade material was found. In the area of the Begay No. 1 tract, four orebodies were found. Using a cutoff of one ft of 0.10 percent U_3O_8 , the AEC calculated the following indicated and inferred ore reserves (Masters and others, 1955):

Block No.	Tons of ore	% U_3O_8	% V_2O_5	Avg. thickness
1	1,360	0.22	0.66	1.7 ft
2	2,280	0.28	2.07	1.5 ft
3	2,800	0.23	2.07	1.8 ft
4	2,430	0.28	2.18	1.9 ft

Two ore zones, about 15 ft apart vertically, were present in Blocks 3 and 4. These blocks and the eastern part of Block 2 were mined by the Begay No. 1 workings. The western part of Block 2 and part of Block 1 were mined by the Carrizo No. 1 mine (Figure 2).

PRODUCTION HISTORY

Anticipating the AEC's drilling project on King Tutt Mesa, Eugene Tapahonso claimed this part of the mesa not already held as Plots 1–6 of Vanadium Corporation of America's Lease I-149-IND-5905 and King Tutt's Navajo Tribal Mining Permit (MP) No. 6. Tapahonso's land was in the central and southern part of the mesa. On

February 22, 1952, he applied to the Tribal Council for a mining permit covering 329.4 acres. This application contained four tracts as follows:

Navajo Tribal Mining Permit No. 24

<u>Tract Name</u>	<u>Acres</u>
Begay No. 1	136.8
Begay No. 2	110.6
Tent	19.0
Junction	<u>63.0</u>
TOTAL	329.4

Mining Permit No. 24 was approved to Eugene Tapahonso on April 26, 1952. On that same day he assigned the mining rights to the Begay No. 1 and the Junction tracts to Walter Duncan, Jr. of Oklahoma City, Oklahoma, with a field office in Cortez, Colorado. The mining assignment was approved by the Tribal Council and the BIA on June 17, 1952. Duncan dug a 180 ft-long, 12 ft-wide trench on the south side of the mesa. A portal was established at the north end of the trench, and a 230 ft-long drift was driven into the lower ore zone in AEC Block 3 (Figure 2). An initial shipment of 37.09 tons of ore averaging 0.22 percent U_3O_8 and 0.75 percent V_2O_5 was made to the AEC's ore-buying station at Shiprock, New Mexico, in May 1953.

The upper ore zone was more continuous and most of the mine workings were on this level (Figure 2). Ore from the upper level was dropped into ore chutes to the lower level where it was loaded into 16 cubic foot mine cars and trammed to the

surface loadout. An open stope with random pillar mining method was used with rail haulage.

In January 1954, Walter Duncan reported to the AEC he was discouraged with the mining to date. Orebodies in Blocks 3 and 4 were narrower and thinner than he had expected from the AEC drill hole data. Mining dilution also was reducing the expected grade (Garbrecht, 1954). Mining continued throughout 1954 using Navajo contract miners in an attempt to improve the grade. An average of six men were employed underground and two men on the surface during 1954.

A long drift was driven to the northwest to intersect the Block 2 orebody (Figure 2). Again the results were disappointing. When the final shipments were made in late 1954, Walter Duncan had mined only 3,810.00 tons of ore averaging 0.21 percent U_3O_8 and 1.63 percent V_2O_5 (Table 1). Walter Duncan cancelled the assignment of the mining permit in early 1955.

In 1956, Delmar M. Spafford of Farmington, New Mexico, doing business as Spafford and Sons, acquired the mining rights to the Begay No. 1 tract of MP-24. This firm drove an 85-ft long, minus 12 degree decline to reach the westernmost workings of the abandoned Begay No. 1 mine (Figure 2). Shipments to the AEC ore-buying station at Shiprock began in July 1956.

When the author examined the mine on February 14, 1957, two Navajo miners stated they had done 300 ft of drifting since Mr. Spafford began the new mine. They also stated that they had mined about 300 tons of ore since July 1956 and were now shipping about 14 tons per week. An examination on February 11, 1958 found that

the miners had just reached AEC drill hole EC-145BB and were planning to drift to hole EC-145JJ (Figure 2). At that time production had declined to about 10 tons per week.

Mr. Spafford informed the author on May 14, 1958 that he had closed down the Carrizo No. 1 mine on April 18, 1958. At that time it had produced only 827.57 tons of ore with an average grade of 0.21 percent U_3O_8 and 1.32 percent V_2O_5 (Table 2). Spafford encountered the same problems as had Walter Duncan; thin, narrow orebodies which were easily diluted by mining.

Eugene Tapahonso's Mining Permit No. 24 apparently expired in 1959 due to lack of mining on any of the tracts. On May 19, 1961, he was issued a new permit, MP-555, which covered the same 329.4 acres as did MP-24. No assignment was made of the Begay No. 1 tract after the new permit was issued. However, mining did commence on the Begay No. 2 tract the next year.

On April 1, 1962, the AEC's allocation program (market quotas) went into effect. Under this program, the AEC would purchase uranium concentrate (yellow cake) only from ore discovered before November 24, 1958, or equal to the amount of ore produced from July 1, 1956, through June 30, 1960 (Albrethsen and McGinley, 1982). The latter method was used to help small miners who did not block out large amounts of ore prior to mining.

In 1966, Eugene Tapahonse was issued MP-608 to replace MP-555. The mining rights to the entire 329.4 acres were assigned to the Vanadium Corporation of America (VCA) on August 10, 1966. This assignment was approved on September 12,

1966.

VCA received an allocation from the AEC to produce ore from anywhere within the mining permit. This allocation, A-810, allowed VCA to produce up to 2,220 pounds of U_3O_8 per year, and was based on past production from the Carrizo No. 1, Begay incline and the Tent mines.

In December 1966, VCA had Navajo miners hand pick ore grade material out of the old Begay No. 1 dump. This activity amounted to 1,220 pounds of ore which averaged 0.21 percent U_3O_8 and 2.62 percent V_2O_5 . It was shipped to the Shiprock mill in December 1966.

The mill was now owned by VCA. The following year, VCA produced 107.30 tons of ore averaging 0.14 percent U_3O_8 and 1.63 percent V_2O_5 , before abandoning the mining in the spring of 1967. This ore was produced as the result of cleanup mining, pulling pillars, etc., in the old Begay No. 1 workings. During the life of this mine a total of 3,920.91 tons of ore averaging 0.21 percent U_3O_8 and 1.63 percent V_2O_5 were produced (Table 1). All of the uranium concentrate produced from processing the ores from the Begay No. 1 and Carrizo No. 1 mines was purchased by the AEC. The vanadium content of the ores was paid for by the AEC, but not all of it was recovered at the Shiprock mill (Albethsen and McGinley, 1982).

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APPENDIX

Legal Description of the Begay No. 1 Claim

THE BEGAY NO. 1 CLAIM: Commencing at Corner No. 1, common to the SE Corner No. 3 of the Tent Claim, which point is S 19° 30' E, 900' and N 85° E, 740' from Corner No. 11 of Vanadium Corporation of America, Plot No. 3, Least I-149-Ind. 5705; thence N 8° 30' E, 880' to Corner No. 2, which is common to NE Corner No. 2 of the Tent Claim; thence N 85° 22' E, 714.42' to Corner No. 3, which is common to Corner No. 12 of Vanadium Corporation of America, Plot No. 3, Lease I-149-Ind.-5705 and Corner No. 1 of the Begay No. 2 Claim; thence S 73° 40' E, 3195' to Corner No. 4, which is common to Corner No. 7 of the Begay No. 2 Claim; thence S 29° W, 1320' to Corner No. 5; thence S 19° W, 945' to Corner No. 6; thence S 29° E, 467' to Corner No. 7; thence N 76° W, 450' to Corner No. 8; thence N 61° W, 1040' to Corner No. 9; thence N 50° W, 530' to Corner No. 10; thence N 14° W, 1220' to Corner No. 11; thence N 76° W, 690' to Corner No. 1, the point of beginning. This parcel contains 136.8 acres, more or less.

(From the Navajo Tribal Mining Department, Window Rock, Arizona)

Figures

(To be drafted if this report is approved for open-filing)

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

Figure 2. Map of the underground workings of the Begay No. 1 mine, San Juan County, New Mexico (at 1" to 50' map is about 1" x 24").

TABLE 1—Uranium-vanadium ore production, Begay No. 1 mine, San Juan County, New Mexico.

Year	Qtr	Shipper	Tons of ore	Pounds U ₃ O ₈	% U ₃ O ₈	Pounds V ₂ O ₅	% V ₂ O ₅
1953	2	Walter Duncan, Jr.	45.95	183.68	0.20	855.46	0.93
1953	3	Walter Duncan, Jr.	709.96	2,881.68	0.20	23,946.41	1.69
1953	4	Walter Duncan, Jr.	914.16	3,739.57	0.20	27,798.06	1.52
1954	1	Walter Duncan, Jr.	1,004.34	4,359.52	0.22	30,989.20	1.54
1954	2	Walter Duncan, Jr.	325.97	1,356.62	0.21	11,963.63	1.84
1954	3	Walter Duncan, Jr.	343.79	1,126.41	0.16	10,097.14	1.47
1954	4	Walter Duncan, Jr.	468.83	2,537.62	0.27	18,845.98	2.01
Subtotal			3,813.00	16,185.10	0.21	124,495.88	1.63
1966	4	VCA	0.61	2.53	0.21	32.00	2.62
1967	1,2	VCA	107.30	303.75	0.14	2,971.00	1.38
TOTAL			3,920.91	16,491.38	0.21	127,498.88	1.63

Source: Unpublished AEC ore production records.

TABLE 2—Uranium-vanadium ore production, Carrizo No. 1 mine, San Juan County, New Mexico.

Year	Qtr	Shipper	Tons of ore	Pounds U ₃ O ₈	% U ₃ O ₈	Pounds V ₂ O ₅	% V ₂ O ₅
1956	3	Spafford & Sons	83.35	470.43	0.28	3,013.51	1.81
1956	4	Spafford & Sons	167.54	603.59	0.18	4,643.80	1.39
1957	1	Spafford & Sons	171.03	552.76	0.16	4,708.00	1.38
1957	2	Spafford & Sons	153.23	726.98	0.24	4,737.00	1.55
1957	3	Spafford & Sons	49.42	186.21	0.19	1,322.00	1.34
1957	4	Spafford & Sons	43.88	172.27	0.20	1,029.00	1.17
1958	1	Spafford & Sons	114.08	540.40	0.24	1,556.32	0.68
1958	2	Spafford & Sons	45.03	173.70	0.19	907.00	1.01
TOTAL			827.57	3,426.34	0.21	21,916.63	1.32

Source: Unpublished AEC ore production records.

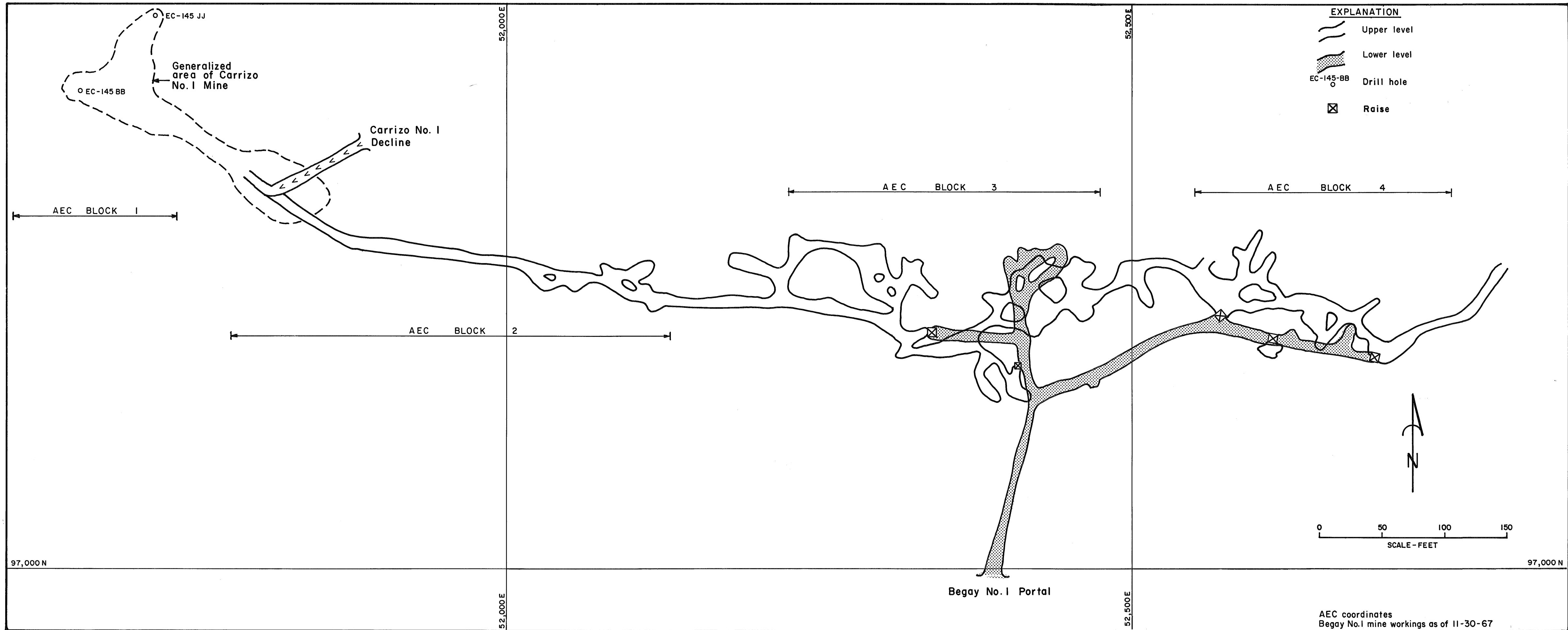


Figure 2. Plan map of the Begay No. 1 and Carrizo No. 1 uranium-vanadium mines, San Juan County, New Mexico