TORTUGAS FLUORITE MINE

Dona Ana County, New Mexico

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LOCATION

The Tortugas Mountain Mine lies immediately east of Las Cruces, New Mexico. The location is more precisely described as lying in the western half of Section 24, T. 23 S., R. 2 E., NMPM. The location of the vein, main shaft, and the four mining claims which cover the deposit are shown on Plate 1 (in pocket).

Access is via the Dripping Springs Road which leads eastward from the New Mexico State University, thence southward through a research facility and then up the west face of Tortugas Mountain along a steep road to the twin astronomic observatories owned by the University. At that point a truck road extends back to the north towards the main shaft.

HISTORY

Numerous prospect pits dot the slopes of the Tortugas Mountain, but the only significant occurrence that has been discovered is a north trending fluorite vein that constitutes the Tortugas Mine. The exact date of discovery is not known. The principal periods of mining were in 1919-1921 and again in 1942-1943. The underground workings were examined and mapped by H. E. Rothrock and J. O. Fisher in 1943, at which time the main shaft was equipped with a hoist, Rothrock, et al, 1946. Inspection of only the upper part of the mine is now possible because this equipment has long since been removed. Records of the State Mine Inspector have not recorded any output from the mine since the 1950's.

MINING CLAIMS

The mining claims were surveyed by plane table and alidade method in early September, 1979. Four unpatented mining claims cover the vein system and are shown on Plate 2 (in pocket). The names and pertinent information of recordation are:

Name	Date	Record
Alma No. 1	26 Feb 1959	Mining Location Book 22, p.454
Alma No. 2	26 Feb 1959	" " " 22, p.455
Alma No. 3	26 Feb 1959	" " " 22, p.456
Alma No. 4	26 Feb 1959	" " " 22, p.443

The four claims were registered with the U. S. Bureau of Land Management in September, 1979.

REGIONAL GEOLOGIC SETTING

Tortugas Mountain is an isolated fault block of Permian limestone surrounded by alluvial fan deposits. The "mountain" has a relief of about 650 feet and is only one mile in length by half mile wide. The hill lies in the Rio Grande Valley at the southern end of the Jornado del Muerto. The nearest outcrop of other rocks lies in the Organ Mountains about five miles to the east. To the west is the flood plain of the Rio Grande.

The general attitude of the Permian limestone is north striking with moderate dip to the west. A geologic map of the hill is given as Figure 1. The map was prepared by King and Kelly (1980). Accurate assignment of the age of sediments is difficult because extensive dolomitization and silicification has destroyed most fossils. Fusilinid collected by King and Kelly on the northern end of the mountain are thought to be of Wolfcampian age. In southern New Mexico Permian rocks of this age are assigned to the Bursum Formation. Kottlowski (1960) believed that the beds were mainly that of the slightly younger Hueco Formation. This is entirely possible because the fusilinid collected by King and Kelly were collected from the base of the exposed section.

Silicification and dolomitization has greatly altered the original lithology. Limestones predominate, but some shale is also present. The general attitude is N 10°-25° W strike and 20° W dip, but the local attitude of individual blocks between faults vary somewhat.

The hill has been cut by numerous north to northwest trending faults, see Figure 1. Actual displacement of the faults is difficult to decipher because of the lack of stratigraphic markers in the altered limestones. Recent work by Seager and Brown (1978) has led to the recognition of a large caldera

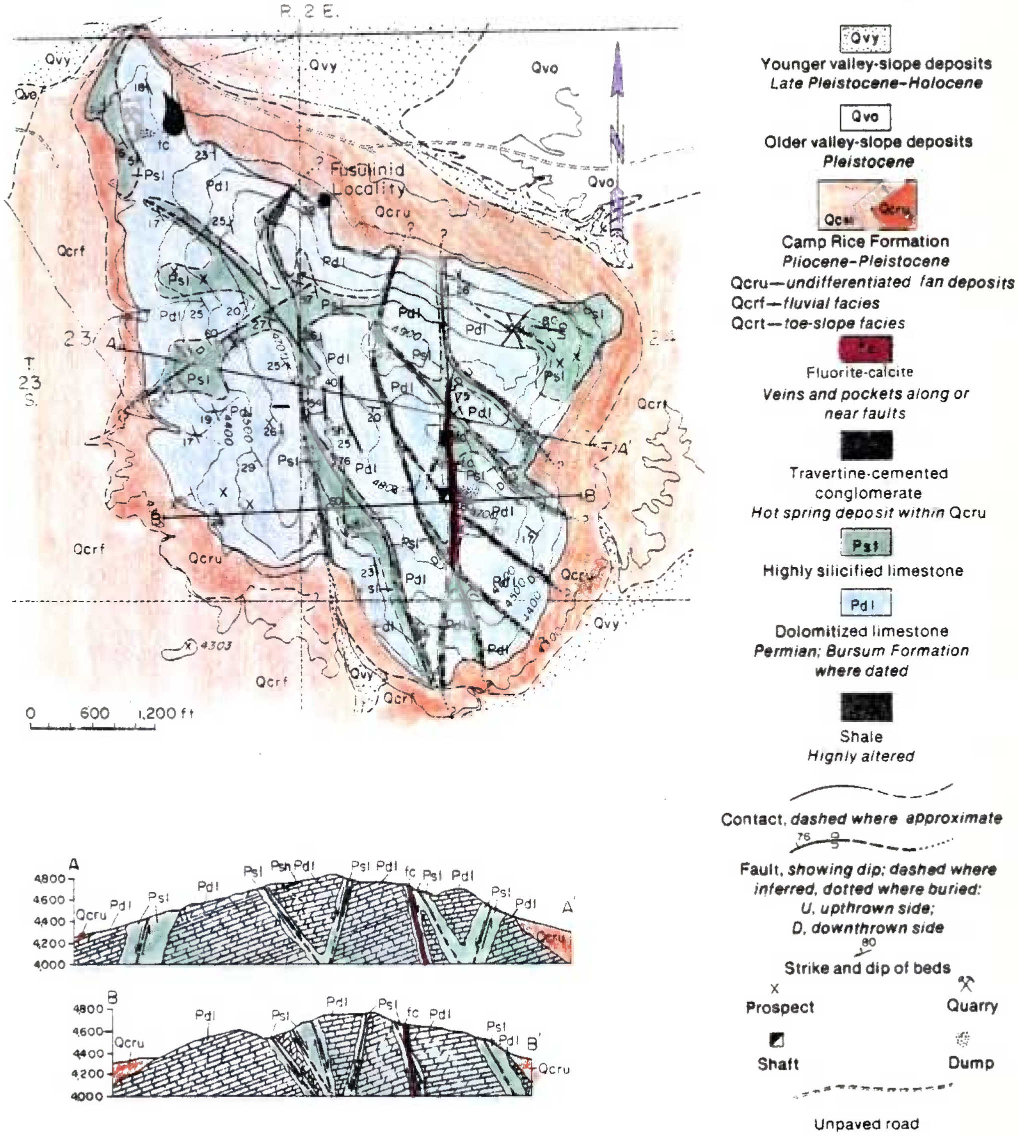
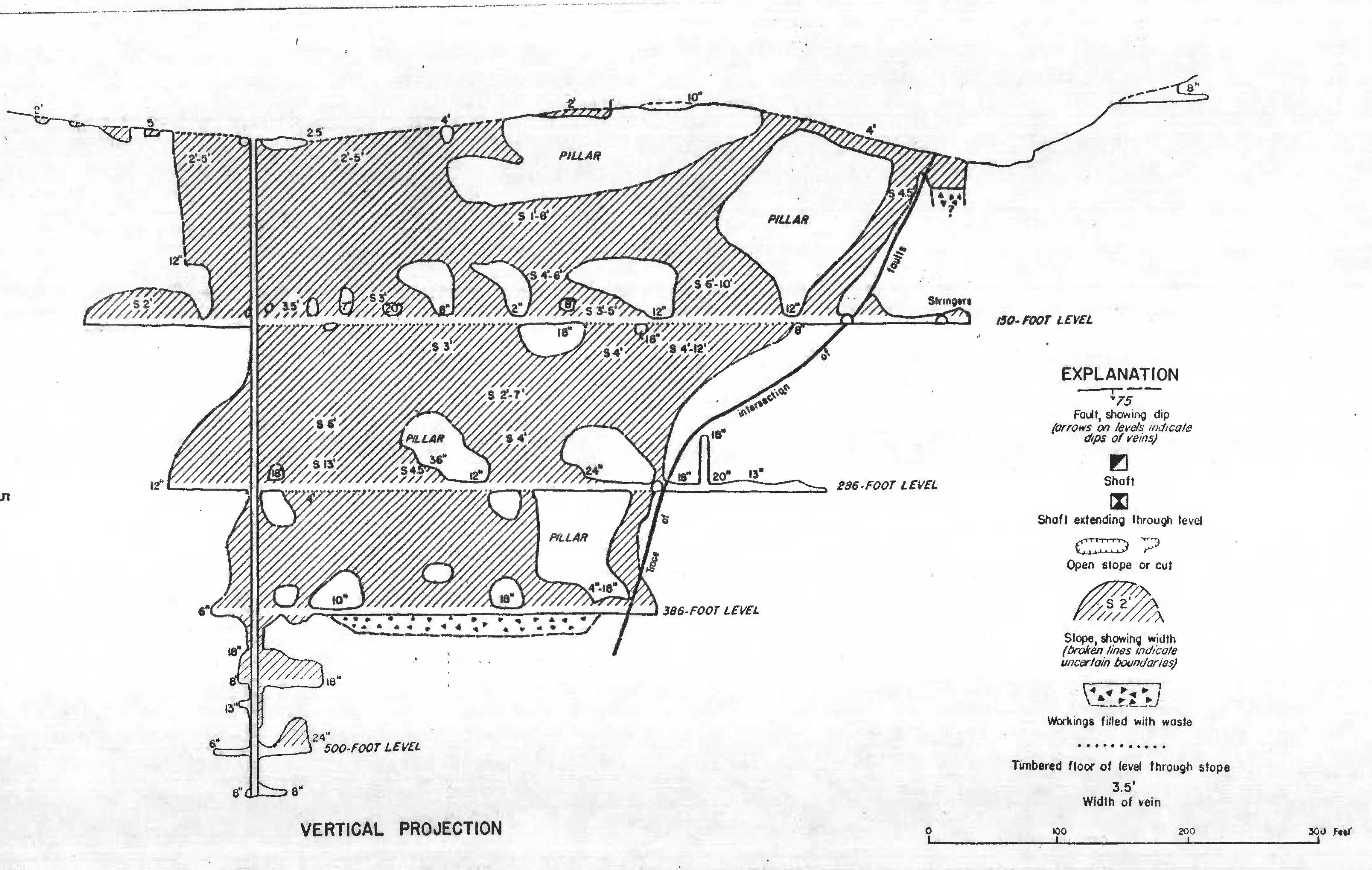


FIGURE 1—GEOLOGIC MAP AND CROSS SECTIONS, TORTUGAS MOUNTAIN.

From King and Kelley, 1980



By H. E. Rothrock and J. O. Fisher, 1943

Tortugas mine, Dona Ana County

Figure 2

structure east of Las Cruces. If their interpretation is correct then Tortugas Mountain lies on the western margin of the Caldera ring. The postulated position of the ring is shown on Plate 1. Arcuate and "horsetail" type faulting is common along the outer margins of calderas, and the pattern of movements shown in Figure 1 appears to be quite in agreement with Seager and Brown's hypothesis.

GEOLOGIC DETAILS OF THE TORTUGAS MINE VEIN

The Tortugas Mine was developed along a simple north trending vein. The strike is essentially due north with steep (70°-80°) dip to the east. In addition, the vein mineralogy is simple, consisting essentially of quartz-calcite-fluorite. Barite is present in minor amounts. The quartz is limited mainly to either silicification of the wall rock or as thin selvage stringers that separate the calcite-fluorite vein material from the walls. In that the bulk of the vein consists of just calcite and fluorite and that the fluorite occurs as relatively coarse crystals made the ore amenable to simple jigging operations in order to make a reasonable separation of the two minerals.

The vein is easily traceable on the surface. It commences at the edge of alluvial cover at the south end of the mountain as a thin stringer of quartz which abruptly enlarges just south of the shaft into a calcite-fluorite vein ranging from several inches to as much as five feet wide. It continues as such for another 650 feet north of the shaft at which point a minor north-northeast striking fracture merges into the vein. Fluorite is present only sparingly to the north of this point. The vein can continue to be traced until it passes under alluvium at the north end of the hill.

Field evidence favors early faulting and silicification followed by subsequent reopening of certain faults into which calcite and fluorite were injected. The basic pieces of evidence to substantiate this conclusion are the presence of the numerous barren quartz faults shown on Figure 1 and the absence of large amounts of calcite-fluorite breccia that would indicate substantial post mineral movement.

UNDERGROUND WORKINGS

The Tortugas Mine has been developed through a shaft located near the center of Alma No. 1 Claim, see Plate 2. The shaft was sunk on the vein. Mine workings are shown in longitudinal section on Figure 2. Levels were developed at depths of 150, 286, 386, and 500 feet. Stoping was almost continuous north of the shaft above the 386 foot level to the intersection of the north-northeast trending fault and the main vein. In the stoped area the vein ranged in thickness from 1 to 13 feet. The vein width apparently thins below the 500 foot level to less than 1 foot. No development was attempted to the south, again due to thinning of the vein. A rough calculation of the area and thickness mined indicates that a total of 45,000 tons of raw ore was produced.

Access into the mine workings would be possible only by rappeling with ropes down the main shaft. Partial access can be gained by entering through open stopes from the north end of the workings thence downward to the 150 foot level. Ground conditions are excellent, but waste fill and removal of timber prevented further examination of the mine.

Mining operations were conducted by over and underhand stoping methods using stalls for support of the working crews. Mining was done with exceptional care; little was taken out other than vein material. At times, the mining width was less than two feet. Run of the mine ore contained 77.4% $Ca F_2$, 15.68% $Ca CO_3$, and 6.51% $Si O_2$ according to Ladoo (1927). The ore now left in pillars or exposed in surface trenches will not meet that which was mined in the past.

RECOMMENDATIONS FOR FURTHER DEVELOPMENT

Appreciable amounts of ore are not in sight in the existing workings. Chances of finding new ore shoots similar to what was mined in the past are probable, but extensive drilling followed up with underground excavation would be required to prove up a minable reserve. Thin siliceous veins are common in the Tortugas Mountains; however, calcite-fluorite mineralization is not common. The latter appears to be due to a later and much more restricted pulse of hydrothermal fluids. Vein extensions are quite probable under alluvial cover both north and south of Tortugas Mountain. Inclined diamond drilling would be the only appropriate means of exploration under the alluvium because known geophysical methods are not capable of detecting non-conductive bodies such as fluorite and calcite.

Today's mining, concentrating and shipping costs do not justify mining of a fluorite vein equivalent to what was apparently successfully mined in the past. To qualify as metallurgical grade fluorspar the "effective" $Ca\ F_2$ content must be at least 70%. The effective content takes into account silica. A penalty of 2½% CaF_2 is deducted for each 1% S_iO_2. The mine run ore contained 77.4% CaF_2 and 6.51% S_iO_2. Therefore the net effective CaF_2 content = 77.4-6.51 x 2.5 = 64.4%. A concentrator would need to be installed to treat the ore. Mining costs have kept abreast of recent inflationary trends. Costs for thin vein mining would cost anywhere from $50 to $150 per ton, unless migrant labor is used. Added to this must be the initial shaft and level development. Based on past mining, 500 feet of shaft and 1540 feet of horizontal development was required to produce 45,000 tons or ore.

The estimated cost of developing a new mine plant capable of producing 100 tons per day would approximate the following:

<u>Fixed Cost</u>

Surface mine plant	$150,000
Roads, power, etc.	100,000
Gravity Concentrator	250,000
Initial development	200,000
Underground equipment	150,000
Working Capital	100,000
Initial Investment	$950,000

<u>Operating Costs</u>

Shafting @ $700/ft x 0.01 ft/ton	$ 7.00/ton
Drifting @ $150/ft x 0.03 ft/ton	4.50
Stoping (ideal conditions)	50.00
Haulage (ore)	5.00
Gravity concentration	15.00
Haulage (concentrate to El Paso)	7.50
Profit to give ROI of 30%	11.60
	$100.60/ton

The $100.60 per ton is close to current market conditions indicating a successful operation would be possible. The difficulty is that the economic model just given requires a mine capable of producing 100 tons per day for 15 years. The total reserve required would be 375,000 tons which is more than a factor of 8 over the reserves mined in the past! Little hope is seen for such a discovery on Tortugas Mountain.

OTHER RESOURCES

Uranium is known to be associated with certain caldera structures. A detailed radiometric survey was made of the surface trace of the vein. The survey was conducted during September 1-2, 1979, using two Geometrics Model GR-101A gamma ray scintillometers. Readings were taken every ten feet along the vein with cross-lines 100 feet long taken perpendicular to vein every 400 feet. The vein was surveyed in this manner for 1250 feet north and 600 feet south of the shaft. In all, 235 separate readings were taken. Unfortunately, the readings were low, ranging from 13 to 25 cps. The calibration factors for the scintillometers were 0.35 resulting in an equivalent U_3O_8 content of only 4.6 to 8.8 ppm. This range is typical for normal limestones.

Abnormal geothermal conditions are likely to exist at Tortugas Mountain because it lies on the rim of a caldera and the fact that the entire Rio Grande Rift in which the caldera lies is known for the occurrence of hot springs. The Geological Survey has declared Known Geothermal Resource Areas at Kilbourne Hole and Radium Springs and the State Land Office has declared most of the southern Rio Grande Valley, including Tortugas Mountain, within Known Geothermal Resource Field No. 8. Thermal waters ranging from 77° to 113° F are common in Las Alturas Estates Subdivision located southeast of Las Cruces (Summers, 1976). The subdivision is in Section 34 , T 23 S., R. 2 E., which is only two miles southeast of Tortugas Mountain. See Plate 1 for the location of these areas. Deep drilling to intercept high temperature groundwater in fractured limestone under and adjacent to Tortugas Mountain is worthwhile.

REFERENCES

King, W. E. and Kelley, R. E., 1980, Geology and paleontology of Tortugas Mountain, Dona Ana County, New Mexico, in New Mexico Geology, V. 2, No. 3, p. 33-35.

Ladoo, R. B., 1927, Fluorspar, its mining, milling, and utilization, U. S. Bureau of Mines Bulletin 244.

Rothrock, H. E., Johnson, C. H., and Hahn, A. D., 1946, Fluorspar Resources of New Mexico, N. M. Bureau of Mines and Mineral Resources Bulletin 21, p. 49-56.

Saeger, W. R., and Brown, L. F., 1978, The Organ Caldera, in N. M. Geological Society Special Publication No. 7, p. 139-149.

Summers, W. K., 1976, Catalog of Thermal Waters in New Mexico, N. M. Bureau of Mines and Mineral Resources Hydrologic Report 4, p. 58-61.

TORTUGAS MOUNTAIN AREA
PLATE NO. 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TORTUGAS MOUNTAIN QUADRANGLE
NEW MEXICO–DOÑA ANA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 ORGAN PEAK 15' QUADRANGLE

Mapped by the Army Map Service
Published for civil use by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system, central zone
1000-metre Universal Transverse Mercator grid ticks, zone 13, shown in blue

Dashed land lines indicate approximate locations

NM Mine File No. 806

UTM GRID AND 1955 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

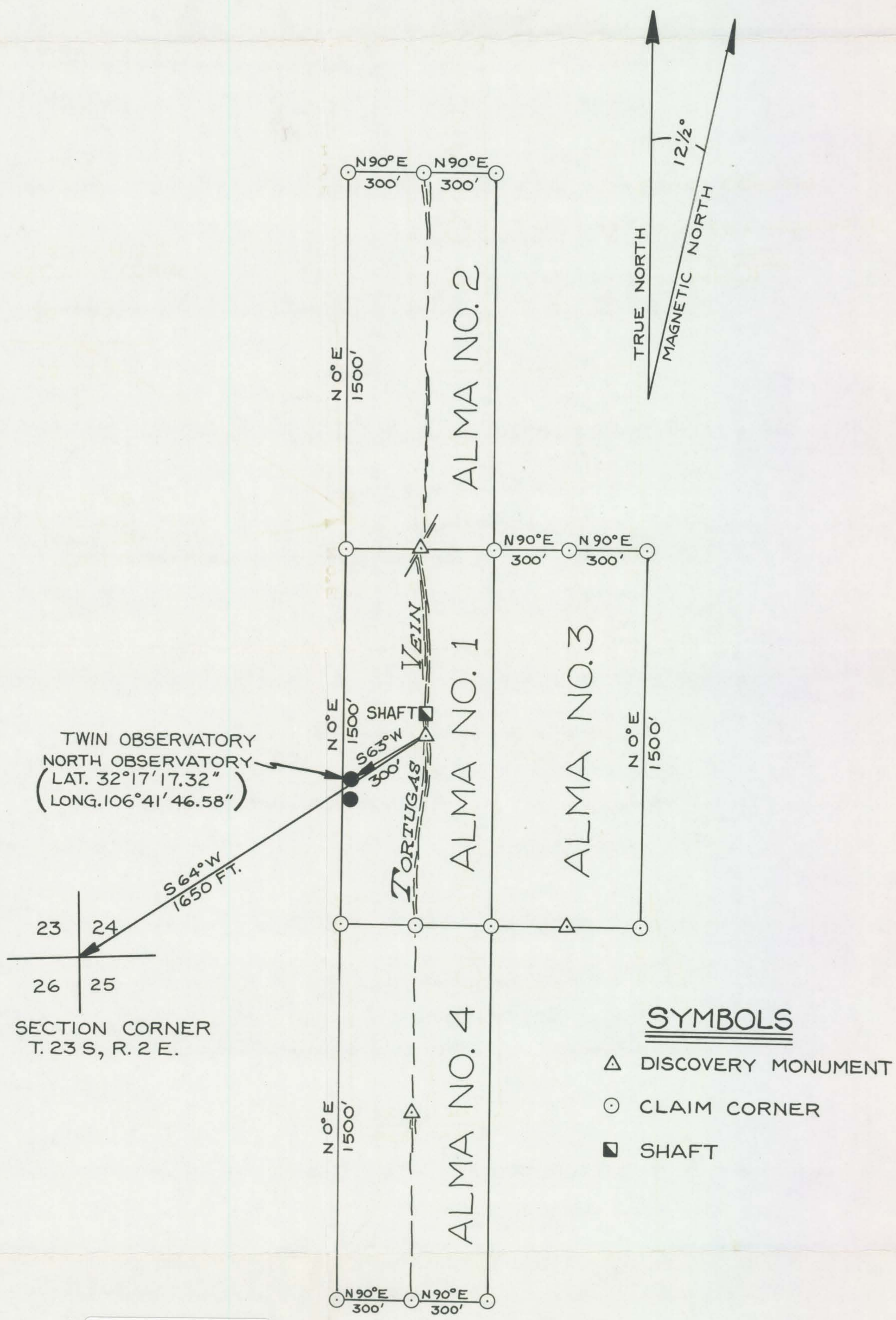
NEW MEXICO
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U.S. Route
State Route

TORTUGAS MOUNTAIN, N. MEX.
SW/4 ORGAN PEAK 15' QUADRANGLE
N3215—W10637.5/7.5

1955

AMS 4648 I SW—SERIES V881



NM Mine File No. 806

TORTUGAS FLUORITE MINE

JAMES T. MARTIN, OWNER

SCALE: 1 IN.= 400 FT.

TECOLOTE CORPORATION-ALBUQUERQUE, N.M.

SURVEYED SEPT. 1, 1979

PLATE NO. 2