URANIUM OCCURRENCES ON THE ZHEALY TSO MINING PERMIT NEAR CHINLE, APACHE COUNTY, ARIZONA

by

William L. Chenoweth
Consulting Geologist, Grand Junction, Colorado

Arizona Geological Survey
Contributed Report 90-B
January 1990

Arizona Geological Survey
416 W. Congress, Suite #100, Tucson, Arizona 85701

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

This report is preliminary and has not been edited
or reviewed for conformity with Arizona Geological Survey standards

URANIUM OCCURRENCES ON THE ZHEALY TSO MINING PERMIT NEAR CHINLE, APACHE COUNTY, ARIZONA

INTRODUCTION

During 1955, several uranium occurrences were discovered in the Shinarump and Monitor Butte members of the Chinle Formation near the village of Chinle, in Apache County, Arizona. The principal occurrences were located on the rim of Slim Canyon, about 6 mi. northeast of Chinle, near the east quarter corner (center of eastern edge of section) of section 6, T. 5 N., R. 9 W., Navajo Baseline and Meridian, projected (Figure 1). Slim Canyon is the first canyon north of Canyon del Muerto on the west flank of the Defiance uplift.

Mr. Zhealy Tso, of Chinle, Arizona, controlled the principal occurrences for over four years. Exploration drilling, rim stripping, and test pitting indicated the uranium mineralization to be very spotty and low grade. There has been no recorded production from the area. Scarborough (1981, p.133) misspelled the permittee's name as Zealy Tso.

LAND STATUS

The area is part of the Navajo Indian Reservation and is under the jurisdiction of the Bureau of Indian Affairs, U.S. Department of the Interior, and the Navajo Tribal Council. Prospecting, exploration, and drilling permits can be issued to Navajos and non-Navajos. Mining permits are issued only to individual Navajos. A permit holder can assign his mining rights to a company or individual under tribal regulations. Mining permits are issued for two years and can be renewed for an additional two years. The maximum amount of ground an individual Navajo can hold is 960 acres.

SOURCE OF INFORMATION

Much of the information presented here was recently located in the old records of the U.S. Atomic Energy Commission (AEC) in the archives of the U.S. Department of Energy's Grand Junction Projects Office, Grand Junction, Colorado.

Included in the information that was located and reviewed were the author's field notes from the 1950's-1960's when he was employed as a geologist by the AEC in Arizona. Mr. Leo L. Denetsone of the Navajo Tribal Minerals Department, Window Rock, Arizona, provided the AEC with considerable information for the Department's files.

EARLY SURVEYS

During the fall of 1952, the U.S. Geological Survey (USGS) made an aerial radiometric survey of the Defiance Uplift. A DC-3 aircraft was used with north-south flight lines spaced 1/4 mile apart. This survey located two radioactive anomalies northeast of Chinle, Arizona, within the boundaries of Canyon de Chelly National Monument (Johnson and Moxham, 1953). No ground investigations were made by the USGS.

Anomaly No. 1-71.8 was located on the north rim of Chinle Wash, approximately 5 and 1/4 miles southwest of the junction of Slim and Cottonwood Canyons (Zhealy Tso), and anomaly No. 5-34.5 was located 4 miles south-southwest of the same point, on the west rim of Canyon del Muerto. The strongest radioactivity on the Zhealy Tso permit was probably missed due to the wide spacing of the flight lines.

HISTORICAL BACKGROUND

Early in 1955, the Arizona Giant Mining Company, of Flagstaff, Arizona, located a few uranium-bearing exposures northeast of Chinle, Arizona, adjacent to Canyon de Chelly National Monument. Mr. Zhealy Tso of Chinle, former Vice Chairman of the Navajo Tribe, was

retained as Arizona Giant's local representative. The most promising exposures were in the Shinarump Member of the Chinle Formation. Some radioactivity was also located at the base of the overlying Monitor Butte Member.

Arizona Giant was issued a 120-day exploration and drilling permit in June(?), 1955, by the Navajo Tribal Minerals Department. During the next four months, the company drilled some 75 shallow (25-30 ft.) holes behind the mineralized outcrops. Charles G. Evensen, a geologist with the AEC's Flagstaff field office, examined the property on June 30, 1955, prior to any exploration by Arizona Giant (Evensen, 1970).

In September 1955, Mr. Tso reported to the AEC's Flagstaff field office that Arizona Giant had shipped some 40 tons of ore averaging 0.25% U_3O_8 from the property. This reported shipment was never delivered to any of the AEC's ore-buying stations in the Four Corners area, according to the AEC's ore purchasing records for 1955 and 1956.

Irving B. Gray, a AEC geologist from Flagstaff, examined the property in the fall of 1955. In addition to the exposures explored by Arizona Giant on the Zhealy Tso permit, he described three other uranium occurrences in the area. Gray (1956) noted a stockpile of some 40 tons of material, which he estimated to average 0.30% eU_3O_8 . This could possibly be the material that Zhealy Tso thought was shipped.

Late in 1955, Arizona Giant applied to the Defense Minerals Exploration Administration (DMEA), U.S. Department of the Interior, for a financial loan to continue exploration and development of the property. The application was apparently denied as Arizona Giant abandoned the property in early 1956.

Arizona Giant reported to the Tribal Minerals Department that of the 75 holes drilled, 18 were barren, 54 encountered some radioactivity, and 3 penetrated material containing about one foot of 0.10% eU_3O_8. The negative results of the drilling were probably the reason DMEA denied funding any additional exploration.

Records of the Tribal Minerals Department show that Mining Permit No. 395 was approved to Zhealy Tso on January 17, 1956. This permit covered 456.81 acres and contained three separate parcels (Figure 1).

Navajo Tribal Mining Permit No. 395

Parcel	Acres
1	160.00
2	160.00
3	136.81
Total Acres	456.81

Source: Navajo Tribal Minerals Department files.

At the time the mining permit was granted, Arizona Giant had apparently decided to abandon the project and were never assigned the mining rights to the permit. The author contacted Mr. Tso in Chinle in September 1958. At that time he was still trying to get mining companies interested in his property. He regretted doing business with Arizona Giant Mining Co., since they "stole his ore" and he didn't receive any royalty.

A year later, on October 8, 1959, the author examined the property. The workings on the No. 1 parcel consisted of approximately 300 feet of rim stripping, numerous bulldozer cuts and prospect pits, and two small open pits 25 x 50 feet, and 15 feet deep (Figure 1). Radiometric scanning of the 40 ton stockpile at the north pit indicated that this material would average only 0.07% eU_3O_8, not the 0.30% eU_3O_8 mentioned by Gray (1956). A grab sample (No. 4201) of visible mineralization from the face of the north pit was analyzed by the AEC laboratory in Grand Junction as containing 0.05% U_3O_8, 0.03% V_2O_5, and 4.20% Cu.

Records of the Tribal Minerals Department indicate that Mining Permit No. 395 expired on January 17, 1960. During the four years it was held by Zhealy Tso he was unable to generate any interest in the property.

During the Department of Energy's National Uranium Resource Evaluation (NURE) program, Robert E. Thaden of the U.S. Geological Survey examined several of the occurrences on September 11, 1978. The results of his sampling are given in the Appendix.

GEOLOGIC SETTING

In the area of the uranium occurrences the rocks of the Chinle Formation strike approximately north-south and dip 3 degrees to the west off of the Defiance Uplift. On the Defiance uplift, the Shinarump Member of the Triassic Chinle Formation rests directly on the Permian De Chelly Sandstone, as the Triassic Moenkopi Formation is missing due to pre-Chinle uplift and erosion.

In the Chinle area, the Shinarump Member is exposed on canyon rims, and to lesser extent, on mesa caps between canyons. The member is composed of approximately 160 ft. of yellowish-grey to yellowish-orange, fluvial, crossbedded, medium- to very coarse-grained sandstone and conglomeratic sandstone beds. Granule and small-pebble conglomerates are common. Interbedded with the sandstone and conglomerate beds are thin beds of variegated mudstone and siltstone. Carbonized fossil plant material is common in the Shinarump Member. Near occurrence A (Figure 1), Thaden (1962) noted a bed of reworked De Chelly Sandstone within the basal Shinarump.

Overlying the Shinarump Member is the Monitor Butte Member of the Chinle Formation. It forms low hills and slopes on the Shinarump-capped mesas. This member appears to be more extensive in the Chinle area than mapped by Cooley and Steven (1961). The Monitor Butte is composed of approximately 200 ft. of variegated mudstone and siltstone with thin beds of sandstone.

Access to the occurrences is by a series of unimproved roads and jeep trails that leave the Canyon del Muerto rim road (Navajo Route 64) near the settlement of Del Muerto (Figure 1).

ZHEALY TSO'S MINING PERMIT

The strongest mineralization known in the area is along the east rim of Slim Canyon, north of the junction with Cottonwood Canyon, in the western part of Parcel 1 (Figure 1). Arizona Giant stripped about 100 ft. of the rim and dug two small pits 25 x 50 ft. and 15 ft. deep. The host rock is light buff to gray, coarse-grained to granular, crossbedded sandstone that is approximately 30 to 50 ft. above the base of the Shinarump Member.

Yellow uranium minerals, and blue and green copper minerals, are disseminated in the sandstone and also are associated with carbonaceous plant material in the sandstone. The normally reddish-gray sandstone is bleached to a lighter color in areas of mineralization. Visible uranium mineralization exposed in the walls of the pits is only a few inches thick with a lateral extent of only a few feet.

In the northern part of Parcel 1 (Figure 1), scattered bulldozer cuts and prospect pits have exposed weakly radioactive rock (up to 2x background) over an area area 150 x 30 ft. along the south rim of Slim Canyon. The host rock is a 2-ft.-thick, yellowish-brown, medium-grained sandstone lense in the basal Monitor Butte Member. The sandstone lense is overlain and underlain by greenish-gray siltstone. Analyses of a sample collected by Thaden (1982) are given in Table 1 in the Appendix.

In the southern part of Parcel 1 (Figure 1), an area of 150 x 20 ft. has been stripped along the north rim of Cottonwood Canyon. Strong radioactivity, up to 10x background, characterizes a sandstone bed at the top of the Shinarump Member. The host rock is pale brown, medium- to coarse-grained sandstone containing abundant carbonaceous plant material. No uranium minerals were observed, but azurite, malachite, and hematite were noted in association with fossil plant material. The results of a sample collected by Thaden are given in Table 2 in the Appendix.

OTHER URANIUM OCCURRENCES NOT IN ZHEALY TSO'S MINING PERMIT

Occurrence A

This occurrence is located about 2 mi. northwest of the junction of Slim and Cottonwood Canyons (Figure 1). It is on the south rim of the first canyon (unnamed) north of Slim Canyon. Here, sparse yellow uranium minerals occur in a light gray to tan, medium- to coarse-grained conglomeratic sandstone in the upper part of the Shinarump Member. Radioactivity up to 15x background is associated with some carbonaceous plant material. This occurrence was never explored since it was outside the area of Arizona Giant's permit.

While attempting to locate this occurrence, Thaden (1982) noted radioactivity, up to 5x background in a 9-foot-thick, clayey, pebble conglomerate that contains carbonaceous plant material and is at the base of the Shinarump Member. Thaden's occurrence was located in the canyon, while the occurrence examined by Gray and Chenoweth is on the canyon rim. Both occurrences appear to be close together. The results of a sample collected by Thaden are given in Table 3 in the Appendix.

Occurrence B

According to Gray (1956) this occurrence is located 2 mi. east, southeast of the junction of Slim and Cottonwood Canyons, within the Canyon de Chelly National Monument (Figure 1). It was described by Gray as occurring in a carbonaceous sandstone filling a paleochannel in the lower part of the Shinarump Member. The author was unable to locate this locality in 1959. Thaden (1982), while attempting to locate this occurrence, found radioactive rocks (up to 4x background) in the southwestern part of a stripped area 500 x 470 ft. across and 10 ft. deep. The radioactivity occurred in a 5-ft.-thick, pale pinkish-brown, feldspathic, fine-grained sandstone in the basal Monitor Butte Member. The sandstone lense was enclosed in a greenish-gray, bluish-green to pale yellowish-green, micaceous, clayey siltstone (Thaden, 1982). The results of a sample collected by Thaden is given in Table 4 in the Appendix. The locality described by Thaden in the borrow pit is on the northwest side of Far Spiral Canyon, whereas Gray's locality was on the southeast side of the canyon (Figure 1).

On the Del Muerto, Arizona, 7 1/2 minute, provisional 1982, topographic quadrangle, the scraped area is labeled as a borrow pit and is located 2,300 ft. southeast of the settlement of Del Muerto, and outside the boundaries of the National Monument. The boundary, as shown by Cooley and Stevens (1961) on Figure 1 is apparently incorrect.

Occurrence C

This occurrence is located approximently 3/4 mi. south, southwest of the junction of Slim and Cottonwood Canyons (Figure 1). At this locality, strong radioactivity, up to 5x background, was observed in a thin sandstone lense in the basal Monitor Butte Member. Arizona Giant did a small amount of rim stripping but did not expose the host rock. Although not examined by Thaden (1982), this occurrence is very similar to the one described by him in the borrow pit at occurrence B.

TOM WILSON PROSPECT

The Tom Wilson prospect is the only other uranium occurrence that the author is aware of in the Shinarump Member of the Chinle Formation on the Defiance Uplift. This occurrence is located approximately 18 miles north of the Zhealy Tso permit. The uranium on the Tom Wilson prospect is on the east rim of the canyon of Agua Sal Creek, approximately 1 mile south of its junction with Bihilinie Canyon (see the Five Dance Mesa, 7 1/2 minute topographic quadrangle). The ground was informally held by Tom Wilson of Rough Rock Trading Post, since he never applied for a mining permit for the occurrence.

At this occurrence, coarse-grained to conglomeratic sandstone of the basal Shinarump has filled a paleochannel cut into the underlying De Chelly Sandstone. The channel is approximately 200 ft wide and has a maximum depth of 40 ft. Based on exposures on both rims of the Agua Sal canyon, the channel is orientated N30°E. On the south flank of the channel, yellow uranium minerals are associated with a zone of clay galls and small clay lenses in the basal Shinarump. A 14 inch chip-channel sample (No. 46954) collected by the author on September 20, 1960, across the area of strongest radioactivity assayed 0.33% eU_3O_2 and 0.36% cU_3O_2. Based on radiometric scanning, an estimated 15 tons of material averaging 0.22% U_3O_8 are present in the outcrop.

Howard L. Stanley, an independent uranium miner, obtained a Navajo Tribal drilling permit for the area immediately east of the mineralized outcrop. During the fall of 1956, Stanley drilled 20 holes with an average depth of 60 ft. The holes were drilled in three north-south fences, with the fences spaced 75 ft apart. No commercial ore was located (R.K. Nestler and R.W. Hershey, unpublished AEC report, December, 1956).

SUMMARY

Exploration for uranium in 1955 resulted in discovery of several uranium occurrences on the west flank of the Defiance Uplift, northeast of Chinle, Arizona. The principal occurrence was found near the junction of Slim and Cottonwood canyons. Host rocks for the uranium and copper mineralization are carbonaceous sandstones in the Shinarump Member of the Triassic Chinle Formation, and sandstone in the basal part of the overlying Monitor Butte Member. Exploration drilling, rim stripping and test pitting indicated the uranium mineralization was very spotty and too low grade to be mined economically.

ACKNOWLEDGMENT: Reviews of this report by John W. Welty and Jon E. Spencer, Arizona Geological Survey, greatly improved it.

REFERENCES

Cooley, M.E., and Stevens, P.R., 1961, Preliminary geologic map of the quadrangle Sonsala Butte 3, Arizona: U.S. Geological Survey Open File Report 61-58, scale 1:31,680.

Evensen, G.G., 1970, Zhealy Tso drill block, preliminary reconnaissance report ED: R-521, *in* Preliminary reconnaissance of uranium in Apache and Cochise Counties, Arizona, 1950 to 1957: U.S. Atomic Energy Commission and U.S. Geological Survey, Raw Material Exploration Report RME-154, p. 24-25.

Gray, I.B., 1956, Zhealy Tso property: U.S. Atomic Energy Commission, unpublished memorandum dated January 9, 1956, 2 p.

Johnson, R.W., and Moxham, R.M., 1953, Airborne radioactivity survey of portions of the Defiance Uplift and Carrizo Mountains, Apache County, Arizona: U.S. Geological Survey Trace Elements Memorandum Report TEM-607, scale 1:62,500.

Scarborough, R.B., 1981, Radioactive occurrences and uranium production in Arizona, final report: Arizona Bureau of Geology and Mineral Technology Open File Report 81-1, 297 p.

Thaden, R.E., 1982, Uranium occurrence reports no's. 283-287, *in* Green, M.W. and others, National uranium resource evaluation, Shiprock quadrangle, Arizona, New Mexico, Colorado, and Utah: U.S. Department of Energy Preliminary Folio PGJ/F-024(82), Appendix C, p. 98-129.

APPENDIX

Tables 1-4 are analytical results of samples collected by the U.S. Geological Survey, 1978, for the National Uranium Resource Evaluation program (Thaden, 1982).

TABLE 1
Zhealy Tso, North prospect
Sample No. - MD0-013
Type - Grab

Element	Parts Per Million (ppm)
Uranium	8.21
Manganese	740
Nickle	42
Zinc	200

TABLE 2
Zhealy Tso, South prospect
Sample No. - MDO-012
Type - Grab

Element	Parts Per Million (ppm)
Uranium	98.9
Silver	50
Copper	1000
Lead	44
Vanaduim	680
Yttrium	110
Zirconium	300

TABLE 3
(Occurrence A)
Sample No. MDO-014
Type 2 ft. chip

Element	Parts Per Million (ppm)
Uranium	244
Copper	270
Lead	500
Yttrium	100
Zinc	240

TABLE 4
(Occurence B)
Sample No. MDO-010
Type Grab

Element	Parts Per Million (ppm)
Uranium	3.22
Thorium	6.73
Chromium	27
Strontium	230
Vanadium	47
Zirconium	240

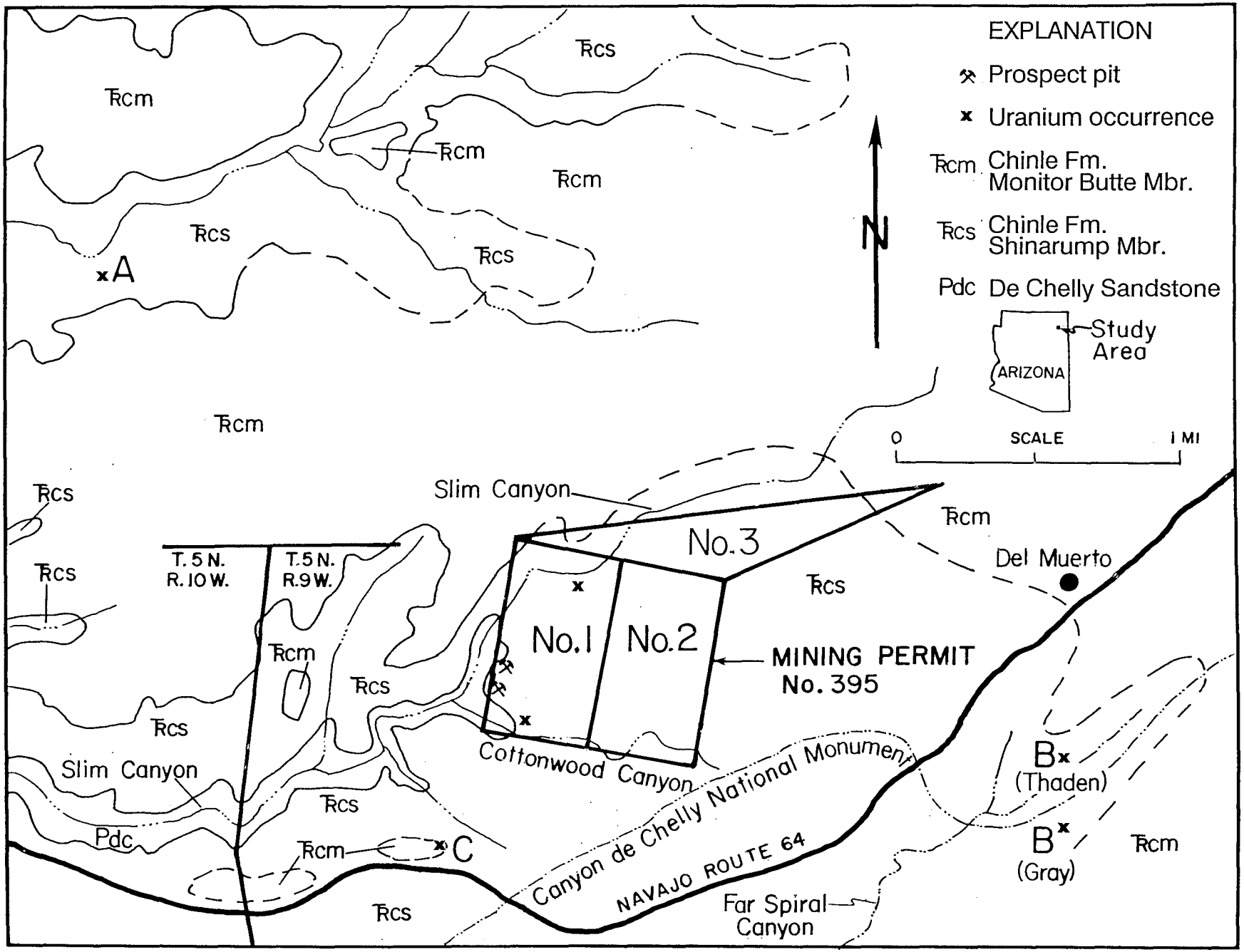

Figure 1. Index map showing the location of the Zhealy Tso mining permit and uranium occurrences, Apache County, Arizona. Base and geology from Cooley and Stevens (1961).