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by *Virginia T. McLemore*, Geologist, and *David Menzie*, Geologist, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM

Introduction

The Sabinoso district is located in eastern San Miguel County approximately 35 mi east of Las Vegas, New Mexico (fig. 1) Uranium mineralization was discovered in the area by prospectors in 1952 (Wanek, 1962). Aerial and ground reconnaissance surveys by the federal government (U.S. Atomic Energy Commission [AEC], 1966) and prospecting by private mining companies located additional radioactive occurrences within 5–6 mi of Sabinoso (fig. 2; table 1). In 1956, two separate trial shipments of low-grade ore from the Bish No. 2 and Windy No. 9 mines were sent to Grants, New Mexico (table 2). After these low-grade shipments were made, only minor exploration occurred in the district because of 1) the small, low-grade nature of the deposits, 2) inaccessibility of the deposits, and 3) high production costs. Recently, part of the Sabinoso district was designated a Wilderness Study Area (WSA) by the U.S. Bureau of Land Management (BLM). To aid in appraisal of the WSA and as part of a statewide study of uranium occurrences, the New Mexico Bureau of Mines and Mineral Resources reevaluated the uranium potential of the Sabinoso area.

Regional geologic maps by Wanek (1962) and by Griggs and Hendrickson (1951) include the Sabinoso area, and numerous authors have described the various uranium occurrences (Reid and others, 1980; Finch, 1972; U.S. Atomic Energy Commission, 1970; Baltz, 1955a, 1955b). Reid and others (1980) discussed the uranium potential of the area and concluded that the depositional environment and sandstone lithology are not favorable for large-tonnage, high-grade, sandstone-type uranium deposits. Field investigations by the authors support this conclusion, but additional discoveries of low-grade, small to medium deposits are possible.

Geology

The oldest rocks exposed in the Sabinoso area (fig. 2) are in the Chinle Formation (Triassic) which consists of three members (Wanek, 1962): lower member (170 ft thick), middle sandstone member (300 ft thick), and upper member (180 ft thick). The majority of the uranium deposits and occurrences are in the middle sandstone member, although a few prospects occur in the upper portion of the lower member.

The lower member of the Chinle Formation consists of interbedded, grayish-red and greenish-gray shales and claystones, siltstones and sandstones with minor interbeds of thin, light-brown sandstones and gray, limestone-pebble conglomerates. Shales and siltstones are dominant. The sandstones are less than 5 ft thick, calcite cemented, fine grained, poor to medium sorted, and consist of sub-angular quartz (50–80%), feldspar (20–50%), and chert grains (up to 5%). Mica, gypsum (or anhydrite), and clay clasts are common.

The middle sandstone member consists of reddish-brown to maroon sandstones and gray limestone-pebble conglomerates separated by grayish-red and greenish-gray shales and siltstones. The sandstones are dominant, fine to medium grained, poor to medium sorted, crossbedded to massive, and calcite cemented. The individual beds are up to 30 ft thick and locally may contain thin lenses or stringers of mudstone, limestone-pebble conglomerate, or carbonaceous shale. The sandstones consist of quartz (50–80%), feldspar (10–20%), chert (up to 5%), clay clasts (10–20%), mica (0–2%), rock fragments (0–3%) and detrital calcite (trace). Distinct channel deposits grade laterally into siltstones and shales representing overbank deposits. Plant material and fossil wood such as roots, stems, and logs are common. The middle sandstone member is similar in character and stratigraphic position to the Cuervo Sandstone Member of Kelley (1972) which is exposed south of the Sabinoso area.

The upper member consists of thick beds ☞

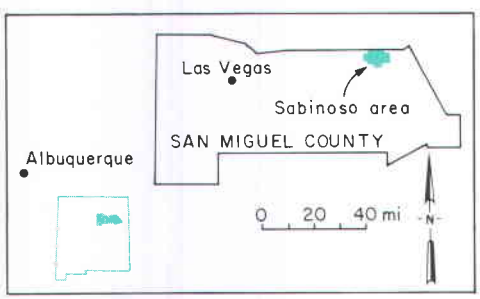

FIGURE 1—INDEX MAP SHOWING LOCATION OF SABINOSO DISTRICT, SAN MIGUEL COUNTY, NEW MEXICO.

TABLE 1—URANIUM OCCURRENCES IN SABINOSO DISTRICT, SAN MIGUEL COUNTY; [1]fig. 2, [2]members of Chinle Formation (Triassic), and [3]see references for full citation.

Map Number[1]	Name	Location (sec., T., R.)	Development	Host[2]	Information Source[3] FN-Field Notes
1	Windy No. 9	SE¼ 14 T17N R23E	81-ft adit	middle sandstone member	FN 8/19/82; Reid and others (1980, no. 37)
2	Sabinoso uranium	SW¼ 8 T17N R24E	38-ft adit, 30-ft bench cut	middle sandstone member	FN 8/16/82; Reid and others (1980, no. 26)
3	Cip Lujan	NW¼ 17 T17N R24E	10-ft adit 13-ft adit	middle sandstone member	FN 8/18/82; Reid and others (1980, no. 28)
4	Lujan Cattle Company	NW¼ 16 T17N R24E	bench cut	middle sandstone member	FN 8/18/82; Reid and others (1980, no. 29)
5	Hunt Oil Company	NW¼ 29 T17N R24E	15-ft adit	middle sandstone member	FN 8/18/82; Reid and others (1980, no. 32)
6	Bish No. 2	NE¼ 31 T17N R24E	75-ft adit	lower and middle sandstone member	FN 8/20/82; Reid and others (1980, no. 34)
7	El Villa	C 19 T17N R25E	shallow pit—outcrop	middle sandstone member	FN 8/18/82; Reid and others (1980, no. 30)
8	Locality No. 43	NE¼ 25 T17N R24E	10-ft cut	middle sandstone member	FN 8/18/82; Reid and others (1980, no. 33)
9	Lujan Ranch	NE¼ 25 T17N R24E	no workings—outcrop	middle sandstone member	FN 8/18/82
10	Lujan Ranch	SW¼ 24 T17N R24E	no workings—drill holes	middle sandstone member	FN 8/18/82
—	Key Claims	SE¼ SE¼ 1 T17N R23E	caved adit	lower sandstone member	U.S. Atomic Energy Comm. (1970, p. 132)
—	Mickie V Claims	27, 28 T17N R23E	pit—outcrop	lower sandstone member	U.S. Atomic Energy Comm. (1970, p. 151)
—	AEC Anomaly No. 3	28 T17N R23E	no workings—outcrop	lower or middle sandstone member	Meek (1953)
—	T Claims	10, 11 T16N R23E	pit—outcrop	middle sandstone member	U.S. Atomic Energy Comm. (1970, p. 127)

of reddish-brown siltstones and fine-grained sandstones separated by grayish-red and greenish-gray shales. Massive light-gray sandstones are common. The sandstones are fine to medium grained and less than 10 ft thick.

The Chinle Formation was probably deposited under arid conditions in a complex, fluvial system with adjacent floodplain and lacustrine (playa lakes?) deposits.

The Chinle Formation is overlain by the Entrada Sandstone (Jurassic) and Morrison Formation (fig. 2). The Entrada Sandstone is 50–60 ft thick and consists of thick, cliff-forming, orange, eolian sandstones (Wanek, 1962). The sandstones are crossbedded, fine grained, well sorted, and consist of subrounded-to-rounded frosted quartz grains.

The Morrison Formation overlies the Entrada Sandstone and consists of three members: red shale (lower), sandstone (middle), and green shale (upper). The Morrison Formation is approximately 350 ft thick and was deposited in stream channels, flood plains, and lacustrine environments (Wanek, 1962). Only two uranium occurrences are reported from the Morrison Formation in the Sabinoso area: the Mars claim and minor uranium mineralization associated with carbonaceous logs in a 30–40-ft-thick sandstone in sec. 19, T. 16 N., R. 23 E. (U.S. Bureau of Mines files, 1956).

The Jurassic rocks are overlain by the Mesa Rica Sandstone (Cretaceous) which caps the Canadian escarpment and the mesas in the Sabinoso area (fig. 2). The Mesa Rica Sandstone consists of calcareous, medium-grained, buff to orange, marine sandstones that were deposited as off-shore bars and beach sands along the margin of an advancing shallow sea (Wanek, 1962).

Flows of basaltic lavas that overlie the Triassic rocks along the Canadian and Mora Rivers originated from the Mayson cone vents west of Sabinoso (fig. 2). These flows are approximately 60 ft thick and probably represent the latest period of Quaternary volcanism in northeast New Mexico (Wanek, 1962).

Uranium mineralization

Uranium mineralization is found scattered throughout the middle sandstone member and the upper portion of the lower member of the Chinle Formation in eastern New Mexico (Finch, 1972). One of the areas containing numerous uranium occurrences is in the Sabinoso district, where the authors examined ten occurrences (fig. 2). At least four additional occurrences are reported in the district (table 2).

The Windy No. 9 mine, located 3 mi east of the Canadian River along Cañon Largo, is typical of the deposits of the Sabinoso district and it is one of the two mines that produced ore. A shipment of 19 tons, averaging 0.05% U_3O_8 and 0.33% V_2O_5, was produced by the San Carlos Uranium Company in the third quarter of 1956 (table 1). The 81-ft adit is still accessible and a plan map of the mine is shown in fig. 3. Mineralized lenses up to 1 ft thick, consisting of gray, calcareous clay and limestone-pebble conglomerate are interbedded with a gray, medium-grained, medium-sorted arenite. The arenite is truncated laterally by maroon to red sandstones and siltstones. Unmineralized gray conglomeratic sandstones overlie and underlie the mineralized arenite. Selected samples from the adit assayed between 0.031 and 0.406% U_3O_8 (table 3). The highest assay values were from a sample from the back of the adit (fig. 3). Drilling would be required to delineate any additional ore.

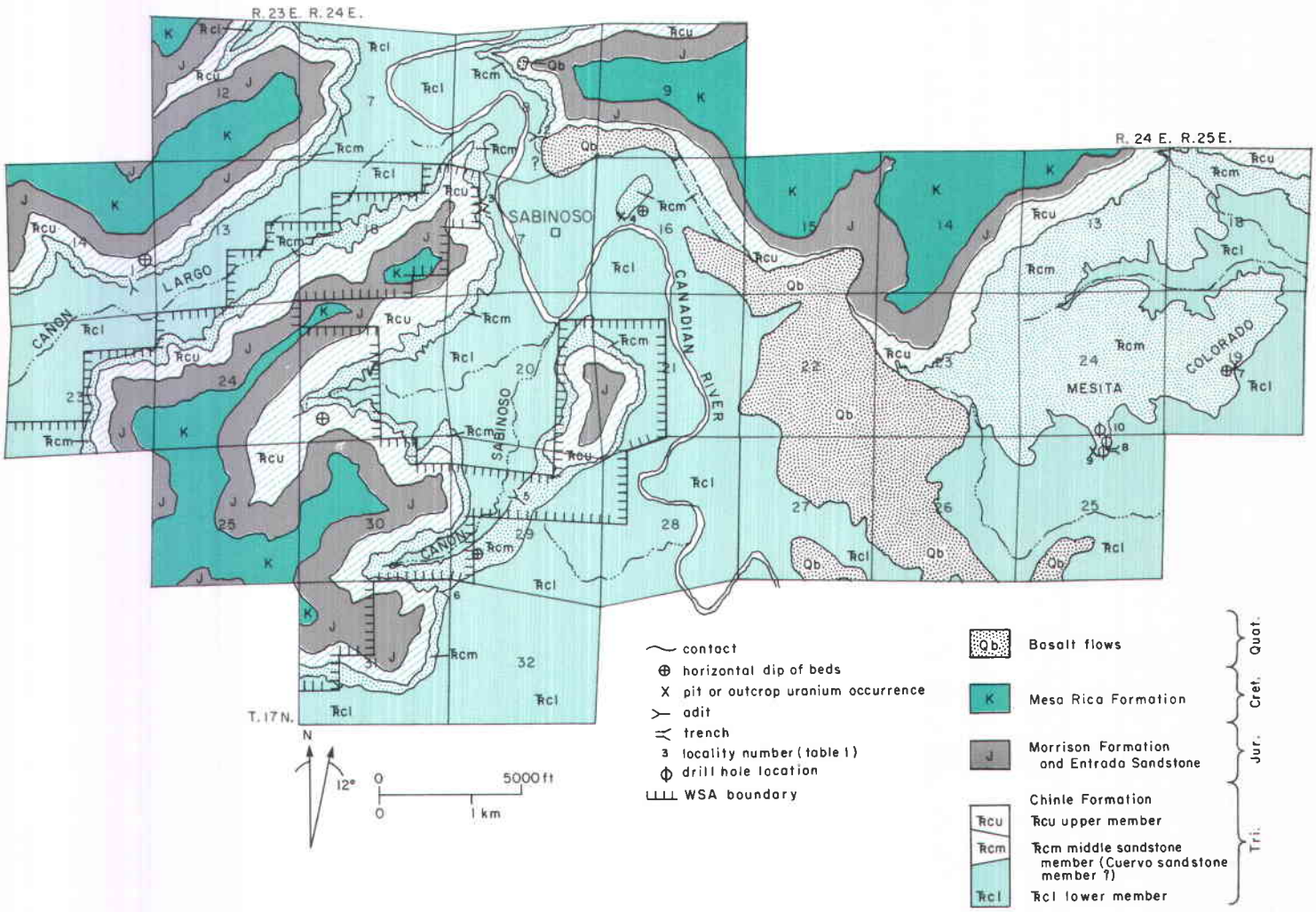

FIGURE 2—Geologic map of Sabinoso area, San Miguel County, New Mexico. Geology by V. T. McLemore and D. Menzie; modified from Wanek (1962). Base map from Sabinoso and Arroyo Alamocito 7½-min topographic quadrangles.

TABLE 2—URANIUM PRODUCTION (INCLUDING "NO-PAY" ORE) FROM SABINOSO DISTRICT, SAN MIGUEL COUNTY (from U.S. Atomic Energy Commission, government contracts only for years 1948–1970); fig. 2.

Map Number[1]	Name	tons ore	lbs U_3O_8	% U_3O_8	lbs V_2O_5	% V_2O_5	Shipper
1	Windy No. 9	19	19	0.05	147	0.38	San Carlos Uranium Co.
6	Bish No. 2	30	62	0.10	27	0.04	Swain, Brooks, and Holcomb
	TOTAL	49	81	0.08	174	0.18	

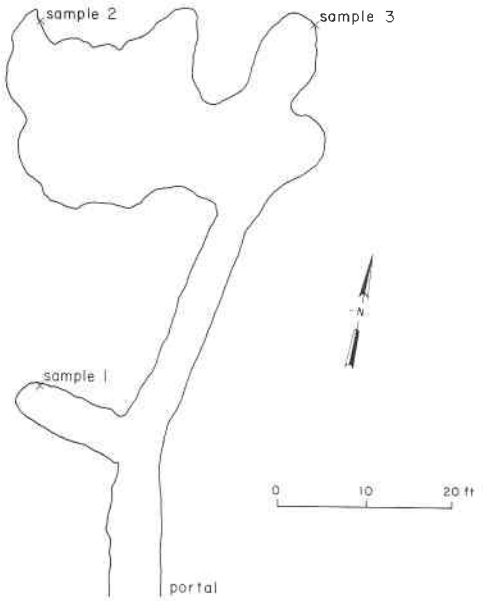

FIGURE 3—PLAN MAP OF WINDY NO. 9 MINE SHOWING SAMPLE LOCATIONS; chemical analyses given in table 3 (sampling by authors, August 19, 1982).

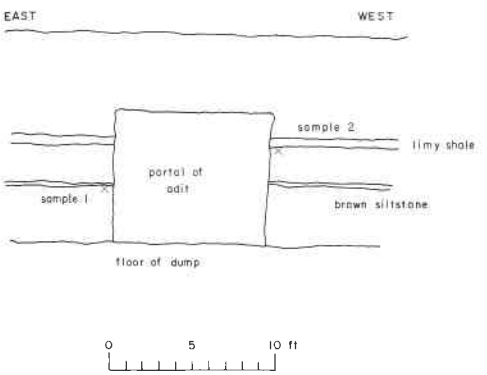

FIGURE 4—CROSS SECTION OF HUNT OIL COMPANY ADIT SHOWING SAMPLE LOCATIONS; chemical analyses given in table 3 (sampling by authors, August 17, 1982).

The Mickie V claims and AEC Anomaly No. 3 also occur in Cañon Largo (table 1) but were inaccessible during the field investigation, owing to high waters in the Canadian River. Uranium mineralization is reported to occur in gray, limestone-pebble conglomerates of the lower and middle sandstone members. An assay on a sample from the Mickie V claims contained 0.118% U_3O_8, 4.55% V_2O_5, and 0.12% Cu (U.S. Atomic Energy Commission, 1970, p. 151).

Three minor uranium occurrences are found along the Canadian River, near Sabinoso: Sabinoso Uranium Company, Cip Lujan, and

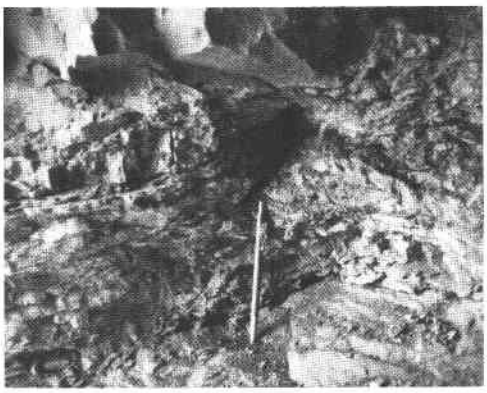

FIGURE 5—PHOTOGRAPH SHOWING MINERALIZED CARBONACEOUS MATERIAL (BLACK AREAS) IN SHALES AT HUNT OIL COMPANY ADIT; mineralized shale overlain by unmineralized sandstone (top of photograph).

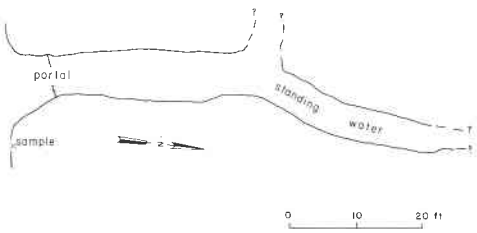

FIGURE 6—PLAN MAP OF BISH NO. 2 MINE SHOWING SAMPLE LOCATION; adit clearance less than 3 ft. Chemical analyses given in table 3 (sampling by authors, August 20, 1982).

Lujan Cattle Company (occurrences 2, 3, and 4). Uranium mineralization at the Cip Lujan and Sabinoso Uranium Company adits occurs at the base of the middle sandstone member and is intimately associated with organic material surrounded by a halo of limonitic alteration. Mineralization occurs in gray mudstones and limestone-pebble conglomerates which lie between red, calcite-cemented sandstones and siltstones. Selected samples from these adits assayed 0.02% U_3O_8 (table 3). Small bench cuts have exposed minor mineralization at the Lujan Cattle Company occurrence where slightly mineralized fossil logs occur at the base of a medium-grained, red sandstone.

The Hunt Oil Company adit (occurrence 5) and the Bish No. 2 mine (occurrence 6) are on opposite sides of a northeast-southwest-trending mesa which is capped by the moderately resistant middle sandstone member (fig. 2). Additional occurrences are reported to be located along both sides of the mesa (U.S. Atomic Energy Commission files, 1955–1960).

The Hunt Oil Company adit (fig. 4), on the northwest side of the mesa, is 15 ft long and exposes two horizontal, thin zones of mineralization. The mineralization is associated with limonitic alteration and organic debris in limy shales interbedded with brown siltstone (fig. 5). Selected samples assayed 0.015 and 0.89% U_3O_8, 0.40 and 8.80% V, less than 0.2% Mo, and 0.74 oz Ag/ton (table 3). Sample 2804 from the Hunt Oil Company adit contained the highest uranium and vanadium content of all 14 samples collected in the Sabinoso district.

The Bish No. 2 mine (fig. 2), on the southeast side of the mesa, consists of several small bench cuts and a 75-ft long adit which is currently flooded (fig. 6). Uranium mineralization occurs in the middle sandstone member at the adit level and minor mineralization in the lower member is exposed in the bench cuts. Mineralized lenses of gray, calcareous shale and gray limestone-pebble conglomerate are interbedded with a 10-ft thick conglomerate at the base of the middle sandstone member. Swain, Brooks, and Holcomb shipped 30 tons of ore averaging 0.10% U_3O_8 and 0.04% V_2O_5 in the fourth quarter of 1956 from this mine (table 2). Selected samples from near the portal (fig. 5) and from the dump of the Bish No. 2 mine assayed 0.005 and 0.071% U_3O_8 (table 3).

Possibly a low-grade, small tonnage deposit may exist underneath the Bish No. 2–Hunt Oil Company mesa (fig. 2). The widespread occurrence of low-grade mineralization along both sides of the mesa is a favorable condition; however, a closer examination of the geology in order to determine any deposit trends and close-spaced drilling along the mesa would be needed to discover any additional deposits.

Four occurrences are located east of Sabinoso on the Lujan Ranch (fig. 7): El Villa, Locality 43, Lujan Ranch, and Lujan Ranch drill holes. Additional occurrences are reported along Mesita Colorado in secs. 23 and 24, T. 17 N., R. 24 E. and secs. 18 and 19, T. 17 N., R. 24 E. (Perhac, 1953; Perhac and others, 1953; Wolfe and Perhac, 1953). These occurrences are within a gray conglomerate up to 10 ft thick which lies between red to maroon sandstones and siltstones (fig. 8). The conglomerate may be up to 200 ft in width and is truncated laterally by unmineralized red to maroon sandstones. Five selected samples from the Lujan Ranch area (fig. 7) assayed from 0.001 to 0.054% U_3O_8 (table 3). Up to 0.51% Cu and 0.41% V are present in sample 2814 (table 3). A total of 20 holes were drilled at Mesita Colorado by prospectors on 500 ft or 1,000 ft centers; some of these drill holes are plotted in fig. 7. No ore-grade material was encountered during drilling (U.S. Atomic Energy Commission files, late 1950's).

The T claims are located in secs. 10 and 11, T. 16 N., R. 23 E., south of the Bish No. 2 mine (table 1). No visible workings were seen by the authors on August 20, 1982, although trenches and a pit had been reported to occur (U.S. Atomic Energy Commission files, late 1950's). Uranium mineralization was re-

TABLE 3—CHEMICAL ANALYSES OF SELECTED SAMPLES FROM SABINOSO DISTRICT; [1]fig. 2, also fig. 3 (Windy No. 9), fig. 4 (Hunt Oil), and fig. 7 (Locality No. 43 and Lujan Ranch); [2]sample number and chemical analyses provided by Lynn Brandvold and associates, New Mexico Bureau of Mines and Mineral Resources, chemical laboratory.

Map Number[1]	Name	Sample Number[2]	% U_3O_8	% Cu	% V	% Mo	Ag oz/ton
1–1	Windy No. 9	2809	0.037	—	0.35	—	—
1–2		2810	0.031	<0.01	<0.04	—	—
1–3		2811	0.406	<0.01	0.88	—	—
2	Sabinoso Uranium Co.	2806	0.021	<0.01	0.07	—	—
3	Cip Lujan	2817	0.020	<0.01	<0.04	—	—
5–1	Hunt Oil	2805	0.015	0.64	0.40	<0.15	0.74
5–2	Hunt Oil	2804	0.890	<0.01	8.80	0.19	—
6	Bish No. 2	2807	0.005	—	0.06	—	—
6	Bish No. 2—dump	2808	0.071	—	<0.04	—	—
8–6	Locality No. 43	2812	0.006	0.18	<0.04	—	—
8–7		2813	0.033	—	<0.04	—	—
9–	Lujan Ranch	2814	0.023	0.51	0.41	—	—
4b		2815	0.001	0.08	<0.04	—	—
9–5	El Villa	2816	0.054	0.22	0.21	—	—
9–							
4a							

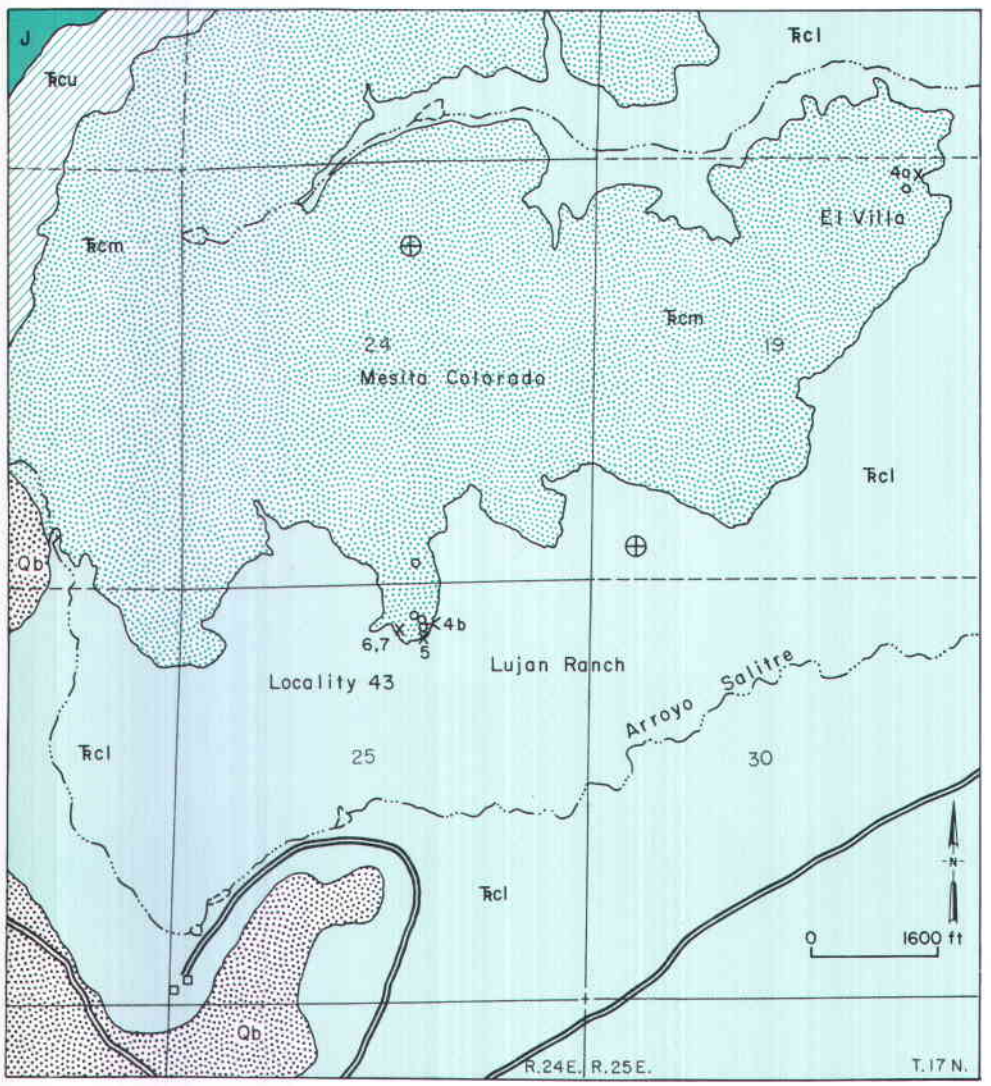

FIGURE 7—GEOLOGIC SKETCH MAP OF LUJAN RANCH AREA SHOWING URANIUM OCCURRENCES (x), DRILL HOLES (o), AND SAMPLE LOCATIONS; chemical analyses given in table 3. **Trcl**—lower member of Chinle Formation, **Trcm**—middle sandstone member, **Trcu**—upper member, **J**—Entrada Sandstone and Morrison Formation, **Qb**—basalt flows (sampling by authors, August 18, 1982).

ported to occur in a 3-ft-thick, gray conglomeratic lens in gray sandstone of the middle sandstone member.

Additional uranium occurrences were reported in the Sabinoso area (table 1) but were not examined by the authors. The Key claims are located north of Cañon Largo in Cañon Gonzales (table 1). Reid and others (1980, No. 25) found no visible workings except for an ore dump. A grab sample from the dump assayed 0.04% U_3O_8 and 1.0% V_2O_5. The host rock is a gray, fine-grained arenite. A local rancher, J. S. Upton, reported that radioactive outcrops similar to the T claims occur in sec. 36, T. 17 N., R. 23 E.

FIGURE 8—PHOTOGRAPH SHOWING 3-FT-THICK MINERALIZED CONGLOMERATE LENSE ON LUJAN RANCH.

Conclusion

The majority of the uranium occurrences and deposits in the Sabinoso area are in the middle sandstone member of the Chinle Formation (Triassic). The mineralization is associated with 1) carbonaceous organic material, 2) calcareous clay lenses or interbeds, and 3) limestone-pebble conglomerates or interbeds. Although the exposed mineralization is low grade (table 3), at least three areas are favorable for low- to medium-grade small- to- medium-tonnage deposits: Windy No. 9, Bish No. 1–Hunt Oil Company, and Lujan Ranch areas. Ore-grade mineralization in these areas is spotty but proven; although economic ore bodies have never been discovered, large areas have not been adequately examined.

High-grade uranium deposits (greater than 0.10% U_3O_8) probably do not occur in the Sabinoso area because of 1) thinness of the sandstones, 2) low permeability and porosity, and 3) lack of abundant organic material. The inaccessibility of the deposits, the high development and production costs, and the small low-grade nature of the deposits will hinder exploration or development of these Sabinoso deposits in the future. However, Triassic rocks crop out in large areas of northeast New Mexico. Thus similar undiscovered, low-grade uranium deposits (less than 0.10% U_3O_8) may exist in that large region.

ACKNOWLEDGMENTS—The authors are grateful to Robert Weber and Frank Kottlowski who reviewed this manuscript.

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(*continued on p. 40*)

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MINING REGISTRATIONS
(AUG. 6, 1982 THROUGH SEPT. 8, 1982)

State Mine Inspector 2340 Menaul N.E. Albuquerque, NM 87107

Date and operation	Operators and owners	Location
8–6–82 metal	Operator—Ortiz, Mountain States Constructor's, Station B, Box 6098, Albuquerque, NM 87107; Gen. Mgr.: Steve Benoit, same address, phone: 345-4401; Person in charge: Gayle Hampton, Box 825, Moriarty, NM, phone 242-1064; Other official: Fidel Sanchez; Property owner—Goldfields Operating Co.	Santa Fe Co.; sec. 19, T. 17 N., R. 7, 8 E.; private land; from town of Cerrillos, turn off NM–14, drive approximately 1 mi west, turn south on improved dirt road and drive approximately 7 mi to mine site; gold-copper; surface-open pit
8–5–82 tails pond	Operator—#1 Tails Pond, West Arc Welding & Machine Works, 212 S. Bullard, Silver City, NM 88061; Gen. Mgr.: Ray F. Leon, Jr., same address, phone: 538-2671; Person in charge: Gene Gallassini, same address and phone; Gen. Supt.: Thomas D. McArthur, same address and phone; Property owner—Kennecott Minerals Company	Grant Co.; secs. 31, 6, T. 18 S., 19 S., R. 12 W.; private land; Hurley
8–26–82 silver, gold	Operator—Center shaft, Summit Minerals, Inc., Box W, Duncan, AZ 85534; Gen. Mgr.: Fred Dollarhide, same address, phone: 359-2239; Person in charge: D. E. Hanson, phone: 359-2835; Property owner—Summit Minerals, Inc.	Grant Co.; sec. 1, T. 16 S., R. 21 W.; Steeple Rock mining district; underground; private land; 12 mi north of Duncan, down Carlisle Road
8–26–82 silver, gold	Operator—Summit mine, Summit Minerals, Inc., Box W, Duncan, AZ 85534; Gen. Mgr.: Fred Dollarhide, Duncan, phone: 359-2239; Person in charge: D. E. Hanson, phone: 359-2835; Property owner—Summit Minerals, Inc.	Grant Co.; sec. 16, T. 16 S., R. 21 W.; Steeple Rock mining district; underground; private land; 13 mi north of Duncan, down Carlisle Road
8–26–82 silver, gold	Operator—East Camp, Summit Minerals, Inc., Box W, Duncan, AZ 85534; Gen. Mgr.: Fred Dollarhide, Duncan, phone: 359-2239; Person in charge: D. E. Hanson, phone: 359-2835; Property owner—Summit Minerals, Inc.	Grant Co.; sec. 8, T. 16 S., R. 21 W.; Steeple Rock mining district; underground; private land; 16 mi north of Duncan, down Carlisle Road
9–8–82 gold, silver	Operator—Woodlawn, Carl Davis, Rt. 8, Box 290, Silver City, NM 88061; Gen. Mgr.: Carl E. Davis, same address, phone: 538-2769; Other official: P. L. Hunter, Box 1162, Silver City, NM 88062; Property owner—B. H. Tiller, 11000 Dyer, El Paso, TX 79924	Grant Co.; sec. 25, T. 16 S., R. 15 W.; Juniper Hill mining district; underground; federal land; down Walnut Creek, approximately 6 mi from Little Walnut Forest Service campground

(TO BE CONTINUED NEXT ISSUE)

Sabinoso district

(*continued from p. 38*)

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