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Virginia T. McLemore

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URANIUM IN THE ALBUQUERQUE AREA NEW MEXICO

VIRGINIA T. McLEMORE
New Mexico Bureau of Mines and Mineral Resources
Socorro, New Mexico 87801

INTRODUCTION

Uranium in the Albuquerque area occurs as minor deposits in various host rocks, as small ore bodies along a fault zone in the Ladron Mountains, and as small to large ore bodies within Permian, Jurassic, and Eocene sediments in the Scholle, Laguna, and Hagan basin areas (fig. 1). These occurrences are briefly described in this paper, are arranged by geographic areas, and are listed in Table 1. Numerous uranium deposits and occurrences are found just outside the Albuquerque area in the Zuni Mountains, Ambrosia Lake subdistrict (Grants uranium district), La Bajada, and Nacimiento Mountains, but these are not

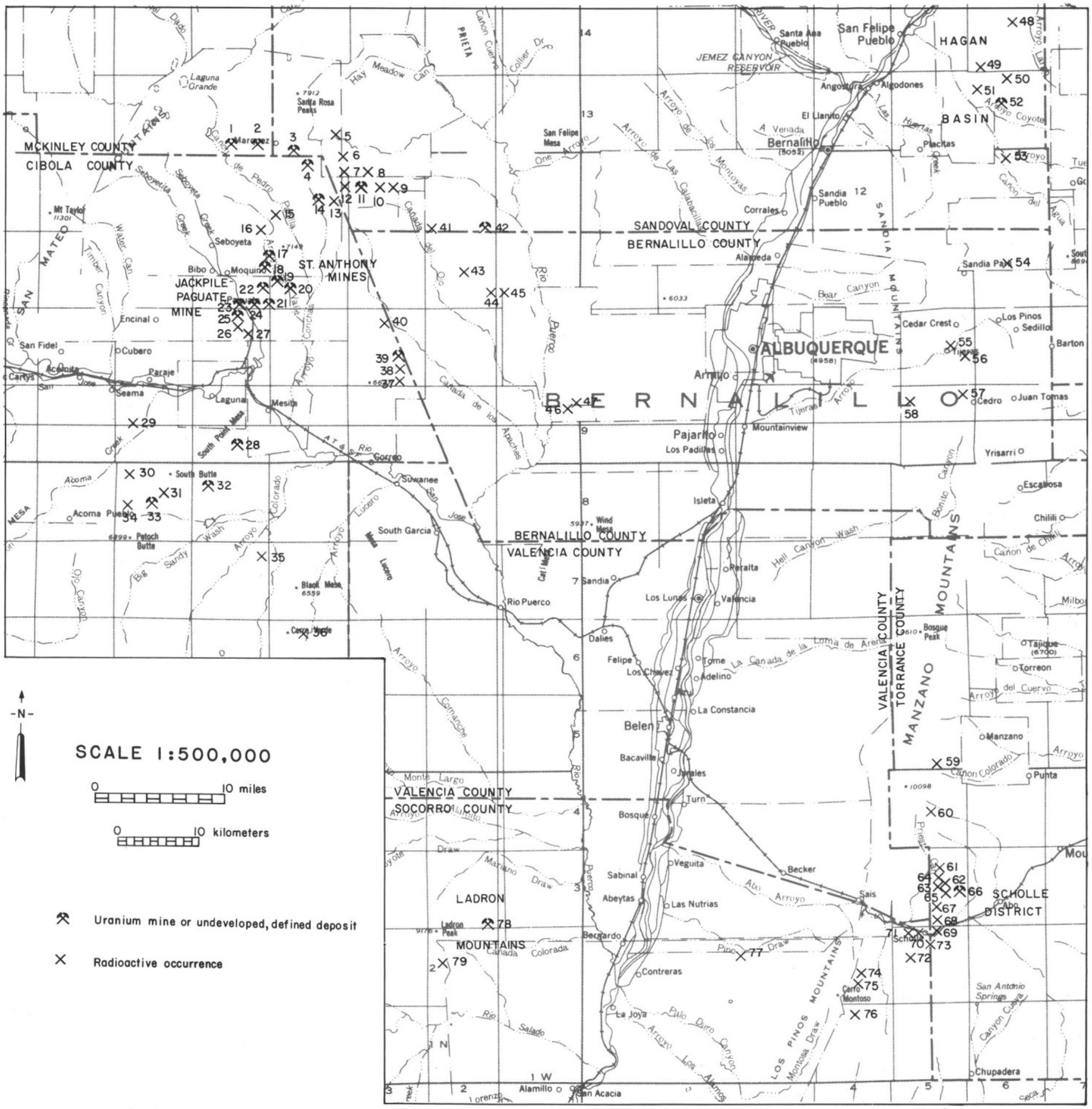


Figure 1. Map showing uranium mines and radioactive occurrences in the Albuquerque area, New Mexico; numbers represent localities given in Table 1.

Table 1. Uranium occurrences and mines in the Albuquerque area shown on Figure 1. Name: UN–United Nuclear Corporation; [2]Host: P€–Precambrian rocks, P–Permian Abo Formation; Trc–Triassic Chinle Formation, Jm–Jurassic Morrison Formation (Jmw–Westwater Canyon Member, Jmr–Recapture Member, Jmb–Brushy Basin Member, Jmj–Jackpile sandstone), Jt–Jurassic Todilto Limestone, K–Cretaceous strata, Tv–Tertiary volcanics or intrusives, Ts–Tertiary Santa Fe Group, and Tg–Tertiary Galisteo Formation; [3]Status: 1–occurrence (radioactive anomaly or radioactive minerals), 2–undeveloped uranium deposit (reserves given in parenthesis as kilograms U_3O_8), 3–producing mine (years in production in parentheses), 4–radium ore shipped in 1916; [4]Source of data: FN–field notes.

Map No. on Fig. 1	Name[1]	Location	Type of Deposit	Host[2]	Status of Deposit[3]	Source of Data[4]
1	Marquez Canyon (Kerr McGee)	T13N R5W	sandstone	Jmw	2(3.1 mill kg)	TVA written comm. 9/11/81
2	Marquez Canyon Mine (Bokum)	T13N R5W	sandstone	Jmw	2(4.9 mill kg)	Livingston, 1980; Hatchell and Wentz, 1981
3	Marquez Grant (Bokum)	SW¼ 32 T13N R4W	sandstone	Jmw	2(341,000 kg)	Livingston, 1980; Hatchell and Wentz, 1981
4	San Antonio Valley (Exxon)	SW¼ 4 T12N R4W	sandstone	Jmw	2	Chapman, Wood, and Griswold, Inc., 1979
5	Unknown	E½ 25 T13N R4W	sandstone	Jmj	1	Hilpert, 1969, p. 48
6	Unknown (Base Metals)	NE¼ 1 T12N R4W	sandstone	Jmj	1	Hilpert, 1969, p. 48
7	Unknown	W½ 12 T12N R4W	sandstone	Jmj	1	Hilpert, 1969, p. 48
8	Dory	NE¼ 8 T12N R3W	sandstone	Jmj	1	Hilpert, 1969, p. 48
9	B and G	SW¼ 15 T12N R3W	sandstone	Jmj	1	Hilpert, 1969, p. 48
10	Brookhaven, Betty	16,17 T12N R3W	sandstone	Jmj	1	Hilpert, 1969, p. 48
11	Rio Puerco (Kerr McGee)	17,18 T12N R3W	sandstone	Jmw	3(1.5 mill kg)	Perkins, 1979; Hatchell and Wentz, 1981
12	Section 13 (UN)	NE¼ 13 T12N R4W	sandstone	Jmb	1	Hilpert, 1969, p. 48
13	Unknown	E½ 23 T12N R4W	sandstone	Jmb	1	Hilpert, 1969, p. 58
14	San Antonio Valley (Exxon)	22 T12N R4W	sandstone	Jmw	2	Moore, S. C. and Lavery, 1980
15	Unknown	SE¼ 30 T12N R4W	sandstone	Jmj	1	Hilpert, 1969, p. 58
16	Unknown	N½ 35 T12N R5W	sandstone	Jmj	1	Hilpert, 1969, p. 58
17	J.J. #1 (L-Bar, Sohio)	13,24 T11N R5W	sandstone	Jmj	3(5.0-5.4 mill kg)	Jacobsen, 1980; Hatchell and Wentz, 1981
18	St. Anthony Underground (UN)	23,24 T11N R5W	sandstone	Jmj	3(3.8 mill kg)	Baird and others, 1980
19	St. Anthony Open Pits (UN)	NW¼ 30 T11N R4W	sandstone	Jmj	3(1975-80)	Baird and others, 1980
20	St. Anthony (Bibo, M-6, Hanosh)	19,30 T11N R4W	sandstone	Jmj	3(1953-60)	Moench and Schlee, 1967
21	Woodrow Mine	36 T11N R5W, 1 T10N R5W	sandstone pipe	—	3(1953-56)	Anderson, 1980; Wylie, 1963
22	Jackpile (Anaconda)	T11N R5W	sandstone	Jmj	3(1952-81)	Beck and others, 1980
23	PW2/3, P-10, H-1 (Anaconda)	33 T11N R5W, 3 T10N R5W	sandstone	Jmj	3(1977-82)	Beck and others, 1980
24	Windwhip Mine	NW¼ 35 T11N R5W	sandstone	Jmj	3(1954)	Moench and Schlee, 1967
25	Paguate (Anaconda)	4,5 T10N R5W, 33 T11N R5W	sandstone	Jmj	3(1963-80)	Moench and Schlee, 1967
26	Oak Creek Canyon	NE¼ 10 T10N R5W	sandstone	Jmj	1	Moench and Schlee, 1967
27	Unknown	NW¼ 14 T10N R5W	sandstone	Jmj	1	Hilpert, 1969, p. 59
28	Sandy Mine (Anaconda)	22,27 T9N R5W	limestone	Jt	3(1955)	Moench and Schlee, 1967; Anderson, 1980
29	Paraje	NW¼ 17 T9N R6W	sandstone	Jmb	1	Hilpert, 1969, p. 57
30	Unknown	NW¼ 5 T8N R6W	limestone	Jt	1	Hilpert, 1969, p. 56
31	Unknown	SW¼ 10 T8N R6W	limestone	Jt	1	Hilpert, 1969, p. 56
32	Crackpot	7,8 T8N R5W	limestone	Jt	3(1955)	Moench and Schlee, 1967; Anderson, 1980
33	Paisano Mine	NW¼ 16 T8N R6W	limestone	Jt	3(1957)	Moench and Schlee, 1967; Anderson, 1980
34	Balo Mining Company	S½ 18 T8N R6W	limestone	Jt	1	Hilpert, 1969,p. 56
35	Sonoro (Windy)	1,12 T7N R5W	contact-metasomatic	Trc	1	Hilpert, 1969, p. 56
36	Brownlow-Heath Prospect	N½ 4 T6N R4W	sandstone	Trc	1	Hilpert, 1969, p. 56
37	Unknown	NW¼ 34 T10N R3W	sandstone	Jmb	1	Hilpert, 1969, p. 56
38	Unknown	NE¼ 27 T10N R3W	sandstone	Jmw	1	Hilpert, 1969,p. 57
39	Chavez Lease	SE¼ 22 T10N R3W	sandstone	Jmw	3(1955)	Moench and Schlee, 1967
40	Section 4	E½ 4 T10N R3W	sandstone	Jmr	1	Hilpert, 1969, p. 57
41	Herrera Ranch	SE¼ 31 T12N R2W	sandstone	K	1	Chenoweth, 1957
42	Bernabe Montaño (Conoco)	NE¼ 35 T12N R2W	sandstone	Jmw	2(4.5-9.1 mill kg)	Kozusko and Saucier, 1980; Perkins, 1979
43	Herrera Ranch	NE¼ 16 T11N R2W	sandstone	K	1	Chenoweth, 1957
44	Angell	25 T11N R2W	coal	K	1	Green and others, 1980, #277
45	Angell	30 T11N R1W	coal	K	1	Green and others, 1980, #276
46	White Lovelace	12 T9N R1W	hydrothermal-vein	Tv	1	Green and others, 1980, #332
47	Cerro Colorado-Archuleta	1,12 T9N R1W	hydrothermal-vein	Tv	1	Hilpert, 1969, p. 32
48	Blackshire	10 T14N R6E	sandstone	Ts	1	Hilpert, 1969, p. 48
49	We Hope, Rabac	32 T14N R6E, 4 T13N R6E	sandstone	Tg	1	Chenoweth, 1979
50	We Hope No. 4	4 T13N R6E	sandstone	Tg	1	Chenoweth, 1979
51	Dial Exploration Claims (Blackshire)	9 T13N R6E	sandstone	Tg, K	1	Hilpert, 1969, p. 48, U.S. Bureau of Mines
52	Diamond Tail (Union Carbide)	16 T13N R6E	sandstone	Tg	2(0.4 mill kg)	Moore, J. C., 1979; Perkins, 1979
53	Mimi No. 4	NE¼ 4 T12N R6E	hydrothermal-vein	Tv	1	Hilpert, 1969, p. 48
54	Monte Largo carbonatite	16 T11N R6E	carbonatite	P€	1	FN 2/23/82
55	Unknown	22,23 T10N R5E	sandstone	P	1	Hilpert, 1969, p. 32
56	Lucky Strike Claim	N½ 25 T10N R4E	pegmatite	P€	1	U.S. Atomic Energy Comm., 1970
57	Tijeras Canyon	2 T9N R5E	?	P	1	Anderson, 1957
58	Cerro Pelon	6,7 T9N R5E	hydrothermal-vein	P€	1	Anderson, 1957
59	McCandless Prospect	34 T5N R5E	sandstone	P	1	U.S. Atomic Energy Comm., 1970
60	Copper Girl 1-6	NW¼ 28 T4N R5E	sandstone	P	1	FN 6/17/81; Anderson, 1980
61	Scholle 1	10 T3N R5E	sandstone	P	1	FN 7/2/80

Table 1 (continued)

Map No. on Fig. 1	Name[1]	Location	Type of Deposit	Host[2]	Status of Deposit[3]	Source of Data[4]
62	Thelma	SE¼ 15 T3N R5E	sandstone	P	1	FN 6/24/81
63	Pioneer Mine	SE¼ 15 T3N R5E	sandstone	P	1	FN 6/24/81
64	Rattlesnake	NE¼ 15 T3N R5E	sandstone	P	1	FN 6/24/81
65	Unknown-Scholle (gravel pits)	SW¼ 21 T3N R5E	sandstone	P	1	FN 6/26/81
66	Abo Mining Claims	NW¼ 23 T3N R5E	sandstone	P	4	FN 6/24/81
67	Old Abo Claims	27 T3N R5E	sandstone	P	1	FN 6/24/81
68	Abo Milling and Manufacture Co.	NE¼ 33 T3N R5E	sandstone	P	1	FN 6/24/81
69	Abo Mine	SE¼ 3 T2N R5E	sandstone	P	1	FN 7/2/80
70	Unknown-Scholle	4 T2N R5E	sandstone	P	1	Pierson and others, 1981, #58
71	Contreras Mining Co.	5 T2N R5E	sandstone	P	1	Pierson and others, 1981, #57
72	Unknown	17 T2N R5E	sandstone	P	1	Pierson and others, 1981
73	Scholle	10 T2N R5E	sandstone	P	1	Pierson and others, 1981, #56
74	Parker Ranch	21 T2N R4E	sandstone	P	1	U.S. Atomic Energy Comm., 1970, p. 215
75	Parker Ranch	28 T2N R4E	hydrothermal-vein	P€	1	U.S. Atomic Energy Comm., 1970, p. 216
76	Rayo area	4,9 T1N R4E	sandstone	P	1	Pierson and others, 1981, #55
77	Black Butte	12 T2N R2E	volcanogenic	Tv	1	Pierson and others, 1981, #54
78	Jeter Mine	NE¼ 35 T3N R2W	vein	P€, Ts	3(1954-58)	FN 6/28/80; Anderson, 1980
79	Juan Torres	SE¼ 18 T2N R2W	hydrothermal-vein	P€	1	FN 9/11/81

described here. The reader is referred to Hilpert (1969) for discussions of the geology and mineral deposits of these areas.

In the Albuquerque area, uranium production has been confined to the Laguna subdistrict of the Grants uranium district and the Jeter mine in the Ladron Mountains (Table 2), although some radium ore was shipped from the Scholle district in 1916 (U.S. Bureau of Mines unpublished report). Most of the uranium produced in New Mexico from 1948 to 1970 was sold to the federal government and these production figures are given in Table 2. The amount of uranium produced after 1970 is considered proprietary information and generally is not available. The last producing mine in the Albuquerque area, the Jackpile-Paguate mine, closed in March, 1982, after shipping over 36 million kg of uranium oxide (Hoppe, 1978). Several large ore bodies have been delineated and may be mined in the future (Table 1). The future status of the uranium industry in the Albuquerque area, as elsewhere in the state, is uncertain due to high production costs, lack of demand for uranium, taxation, and declining market conditions.

DESCRIPTION OF AREAS

Laguna Subdistrict, Cibola, Sandoval, McKinley, and Bernalillo Counties

The Laguna subdistrict forms the eastern end of the Grants uranium district in Cibola, Sandoval, McKinley, and Bernalillo counties and accounts for approximately 29 percent of the total pre-1970 uranium production in New Mexico (Table 2). The largest producing mine in this district, Anaconda's Jackpile-Paguate mine, has shipped 24.1 million metric tons of ore since its discovery in 1951 (Grants Beacon, February 12, 1982) and is the world's largest uranium mine, consisting of four contiguous open pits, several adits, and one decline. Most of the uranium mineralization in this district occurs in the Brushy Basin and Westwater Canyon Members of the Jurassic Morrison Formation and in the Jurassic Todilto Limestone (Table 1). Minor occurrences are found in the Triassic Chinle Formation (localities 35 and 36, fig. I), Jurassic Recapture Member (locality 40, fig. 1), and in Cretaceous

Table 2. Uranium production from ore deposits in the Albuquerque area, New Mexico; data from U.S. Atomic Energy Commission ore production reports, government contracts only, for the years 1948-1970. This includes total ore that was received at the buying stations and mills. Ore grades represent an average of the total shipments. V_2O_5 analyses are incomplete; not all of the ore shipments were assayed for V_2O_5.

Map No. on Fig. 1	Name	Years In Production	Metric Tons Ore	%U_3O_8	Kilograms U_3O_8	Kilograms V_2O_5	Type of Deposit
	Laguna Subdistrict - Grants Uranium District						
20	St. Anthony Mine	1953-1960*	71,415.65	0.20	145,576.62	45.42	sandstone
21	Woodrow	1953-1956	4,831.96	1.26	60,787.56	2,220.38	breccia pipe
22	Jackpile	1954-1970*	6,566,745.38	0.21	14,224,059.50	2,410,950.88	sandstone
25	Paguate	1963-1970*	2,050,328.29	0.33	6,729,345.26		sandstone
24	Windwhip	1954	2,529.00	0.31	7,858.47	4,217.39	sandstone
28	Sandy Mine	1955	852.02	0.17	1,007.32	1,169.74	limestone
32	Crackpot	1955	2,916.11	0.13	3,808.33	9,683.41	limestone
33	Paisano	1957	8.55	0.18	15.38		limestone
39	Chavez Lease	1955	174.36	0.21	372.57	981.91	sandstone
	Total Laguna Subdistrict		8,699,801.32		21,172,831.01	2,429,269.13	
78	Jeter	1954-1958	8,006.63	0.33	26,563.47	1,452.47	vein
	Total New Mexico	1948-1970	35,586,950.67	0.22	77,459,816.66	4,063,636.02	

*Denotes mines which continued production after 1970.

coals (localities 44 and 45, fig. 1) and sandstones (localities 41 and 43, fig. 1). A stratigraphic section of the Laguna-Paguate area is shown in Figure 2.

Uranium mineralization occurs in the Jackpile sandstone at the Jackpile-Paguate mine (localities 22-26, fig. 1), Sohio's J.J. #1 (locality 17, fig. 1), and United Nuclear's St. Anthony mine (localities 18-20, fig. 1). Several minor uranium occurrences are reported from the Jackpile sandstone and Brushy Basin Member (Table 1). Ore occurs as lenses or horizons of uranium-bearing carbonaceous material in the fluvial host sandstone. Ore occurs throughout the entire thickness of the host sandstone in the Jackpile pits and underground areas (locality 23, fig. 1) and occurs within the uppermost one- to two-thirds of the host in the Paguate pit (Beck and others, 1980). Uranium mineralization at the Jackpile-Paguate mine appears to be independent of lithology or primary sedimentary structures (Moench and Schlee, 1967); however, mineralization at the J.J. #1 and St. Anthony mines appears to be related to primary sedimentary structures associated with a braided stream environment (Jacobsen, 1980; Baird and others, 1980). Ore at the J.J. #1 and St. Anthony mines occurs at all levels of the Jackpile sandstone. Uraninite and coffinite are the primary uranium minerals, although secondary uranium minerals are present.

Uranium mineralization occurs within sandstones of the Westwater Canyon Member at the Marquez Canyon area (localities 1-3, fig. 1), San Antonio Valley (localities 4 and 14, fig. 1), Rio Puerco (locality 11, fig. 1), Chavez Lease (locality 39, fig. 1), Bemabe Montano (locality 42, fig. 1), and in section 27 (locality 38, fig. 1). Ore occurs as tabular and lenticular bodies within paleochannel sandstones, generally concordant with bedding and closely associated with organic material or humates (Livingston, 1980; Kozusko and Saucier, 1980; Moore and Lavery, 1980). Coffinite and uraninite are the primary ore minerals.

In 1979, J.J. #1, St. Anthony, and Jackpile-Paguate mines were active and at least seven additional ore bodies in the Laguna subdistrict were delineated and in various stages of development (Table 1). Today, all of these operations are either closed or on standby status, waiting for an improvement in economic conditions. Anaconda's Jackpile-Paguate mine ceased production in February, 1982. Sohio's J.J. #1 and United Nuclear's St. Anthony mines are on standby status. Kerr-McGee ceased operations at Rio Puerco; however, Kerr-McGee is actively drilling in the Marquez Canyon area (locality 1, fig. 1). Exxon cancelled plans for a pilot leach plant at San Antonio Valley (locality 14, fig. 1) and Bokum has postponed further development of the Marquez Canyon mine (locality 2, fig. 1) indefinitely.

Uranium ore occurs in the Jurassic Todilto Limestone and locally in the underlying Entrada Sandstone and is believed to have been emplaced before lithification in a sabkha environment. Uranium-bearing ground water moved through the permeable Entrada Sandstone and was drawn upward through the stromatolitic zones of the Todilto Limestone where uranium was precipitated (Rawson, 1980). Ore deposits were mined from the Todilto Limestone during the 1950's at the Sandy (locality 28, fig. 1), Crackpot (locality 32, fig. 1), and Paisano mines (locality 33, fig. 1). Several minor uranium occurrences are reported in the Todilto Limestone (Table 1).

The Woodrow mine (locality 21, fig. 1) is a unique mineralized cylindrical breccia pipe about 7 to 10 m in diameter (Wylie, 1963). The upper part of the pipe is fairly high grade (1.53 percent U308), and the ore is mostly in the fault zone. The ore is lower grade (0.32 percent U30,) in the lower part of the pipe and is in the core of the pipe. Coffinite is the major uranium mineral.

Hagan Basin, Sandoval County

Two radioactive occurrences were located in the Hagan basin near the San Felipe Indian Reservation, Sandoval County, by an aerial radiometric survey in 1954 (U.S. Atomic Energy Commission, 1966). These anomalies at the Mimi No. 4 claim (locality 53, fig. 1) are associated with latite dikes and sills containing autunite along joints and fractures. Additional prospecting revealed uranium mineralization in the Tertiary Galisteo and Santa Fe formations (localities 48-52, fig. 1). In 1977, Union Carbide Corporation began development of the Diamond Tail deposit (locality 52, fig. 1). A 76-m decline (19°) was sunk, and some ore stockpiled. The company suspended operations before shipping any ore due to high production costs and declining market conditions.

The larger ore deposits, one being the Diamond Tail, occur in the Galisteo Formation, which consists of fluvial-lacustrine sandstones, siltstones, conglomerates, and interbedded tuffs. The Galisteo Formation rests unconformably on top of the Cretaceous Mancos Shale and Mesaverde Group and is overlain unconformably by the Eocene Espinaso Volcanics. Uraninite, coffinite, and selenium occur in two distinct gray sandstone units in the Galisteo Formation. An estimated 0.4 million kg of uranium at an average grade of 0.09 percent U308 occurs at depths of 3 to 122 m at the Diamond Tail deposit (locality 52, fig. 1) and three smaller ore bodies (localities 49-51, fig. 1) have been delineated by Union Carbide Corporation (Moore, 1979).

Scholle District, Valencia, Socorro, and Torrance Counties

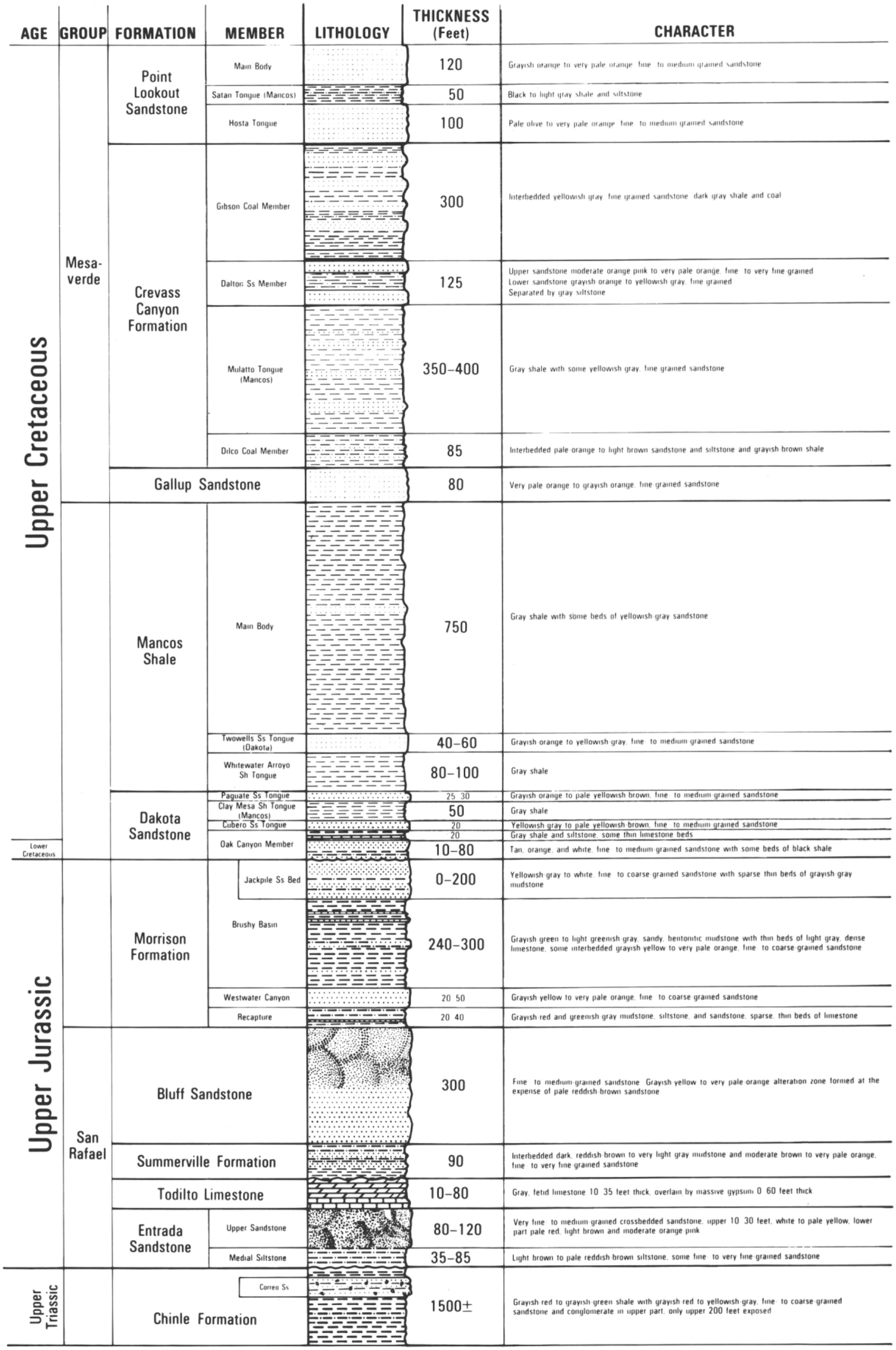
In 1916, about $700 worth of radium ore was shipped from the Scholle district in the southern Manzano and northern Los Pinos Mountains, Valencia, Socorro, and Torrance counties (fig. 1). At least 18 copper-uranium prospects or occurrences are found in this district (localities 59-76, fig. 1) and 9,417 metric tons of ore containing 456,318 kg of copper, 223,167 grams of silver, and some gold were produced between 1915 and 1943 (Anderson, 1957). Prospecting for uranium resumed during the 1950's when a local prospector discovered a thin seam assaying 13.0 percent U308 (Wolfe and Collins, 1954).

The mineralization of the Scholle district is typical of most red-bed deposits. Most of the uranium and copper mineralization appears to be controlled by meandering channels in the Permian Abo Formation (Collins and Nye, 1957b), where uranium and copper occur as (1) disseminations within bleached arkosic sandstones, limey conglomerates, and gray siltstones; (2) along bedding planes within sandstones and underlying siltstones and shales; and (3) as replacements of woody and organic material. Locally, thin, discontinuous seams of uranium and copper minerals occur along fractures, joints, or faults, such as the high-grade seam reported by Wolfe and Collins (1954). Copper oxides, chalcopyrite, and chalcocite are the dominant copper minerals present. Metatyuyamunite, tyuyamunite, carnotite, and uraninite are the only uranium minerals identified (Gibson, 1952; Collins and Nye, 19576).

The uranium and copper mineralization is low-grade and discontinuous along outcrop. Four selected samples from the area range from 0.001 to 0.005 percent U308; one sample contains 99.4 mg/kg of silver (Table 3). Subsurface drilling of the area resulted in locating several small but scattered lenses of low-grade uranium mineralization (Collins and Nye, 1957b). High uranium and copper anomalies occur in water and stream-sediment samples from the immediate vicinity of the mineralized area, but only weak anomalies occur down dip (Pierson and others, 1981; Planner, 1980). This evidence suggests that the copper and uranium mineralization is low-grade and not of significant enough tonnage to warrant further exploration.

Ladron Mountains, Socorro County

Two apparently unrelated uranium anomalies occur in the Ladron Mountains in northern Socorro County (localities 78 and 79, fig. 1) and one, the Jeter mine, produced 8,007 metric tons of ore containing



AGE	GROUP	FORMATION	MEMBER	LITHOLOGY	THICKNESS (Feet)	CHARACTER
Upper Cretaceous	Mesa-verde	Point Lookout Sandstone	Main Body		120	Grayish orange to very pale orange fine- to medium-grained sandstone
			Satan Tongue (Mancos)		50	Black to light gray shale and siltstone
			Hosta Tongue		100	Pale olive to very pale orange fine- to medium-grained sandstone
		Crevass Canyon Formation	Gibson Coal Member		300	Interbedded yellowish gray, fine-grained sandstone, dark gray shale and coal
			Dalton Ss Member		125	Upper sandstone moderate orange-pink to very pale orange, fine- to very fine-grained Lower sandstone grayish orange to yellowish gray, fine-grained Separated by gray siltstone
			Mulatto Tongue (Mancos)		350–400	Gray shale with some yellowish-gray, fine-grained sandstone
			Dilco Coal Member		85	Interbedded pale-orange to light brown sandstone and siltstone and grayish-brown shale
		Gallup Sandstone			80	Very pale orange to grayish-orange, fine-grained sandstone
		Mancos Shale	Main Body		750	Gray shale with some beds of yellowish-gray sandstone
			Twowells Ss Tongue (Dakota)		40–60	Grayish-orange to yellowish-gray, fine- to medium-grained sandstone
			Whitewater Arroyo Sh Tongue		80–100	Gray shale
		Dakota Sandstone	Paguate Ss Tongue		25–30	Grayish-orange to pale yellowish-brown, fine- to medium-grained sandstone
			Clay Mesa Sh Tongue (Mancos)		50	Gray shale
			Cubero Ss Tongue		20	Yellowish-gray to pale yellowish-brown, fine- to medium-grained sandstone
					20	Gray shale and siltstone, some thin limestone beds
Lower Cretaceous			Oak Canyon Member		10–80	Tan, orange, and white, fine- to medium-grained sandstone with some beds of black shale
Upper Jurassic		Morrison Formation	Jackpile Ss Bed		0–200	Yellowish-gray to white, fine- to coarse-grained sandstone with sparse thin beds of grayish-gray mudstone
			Brushy Basin		240–300	Grayish-green to light greenish-gray, sandy, bentonitic mudstone with thin beds of light gray, dense limestone, some interbedded grayish-yellow to very pale orange, fine- to coarse-grained sandstone
			Westwater Canyon		20–50	Grayish-yellow to very pale orange, fine- to coarse-grained sandstone
			Recapture		20–40	Grayish-red and greenish-gray mudstone, siltstone, and sandstone, sparse, thin beds of limestone
	San Rafael	Bluff Sandstone			300	Fine- to medium-grained sandstone. Grayish-yellow to very pale-orange alteration zone formed at the expense of pale reddish-brown sandstone
		Summerville Formation			90	Interbedded dark, reddish-brown to very light gray mudstone and moderate brown to very pale orange, fine- to very fine-grained sandstone
		Todilto Limestone			10–80	Gray, fetid limestone 10–35 feet thick, overlain by massive gypsum 0–60 feet thick
		Entrada Sandstone	Upper Sandstone		80–120	Very fine- to medium-grained crossbedded sandstone, upper 10–30 feet, white to pale yellow, lower part pale red, light brown and moderate orange-pink
			Medial Siltstone		35–85	Light brown to pale reddish-brown siltstone, some fine- to very fine-grained sandstone
Upper Triassic		Chinle Formation	Correo Ss		1500±	Grayish-red to grayish-green shale with grayish-red to yellowish-gray, fine- to coarse-grained sandstone and conglomerate in upper part, only upper 200 feet exposed

Figure 2. Stratigraphic section of Mesozoic strata, Laguna-Paguate area, Valencia County, New Mexico; from Chenoweth and Learned (1980).

Table 3. Uranium, copper, lead, zinc, and silver analyses of selected samples from the Scholle district (Lynn Brandvold and associates, New Mexico Bureau of Mines and Mineral Resources, analysts).

Map No. on Fig. 1		%U_3O_8	%Cu	%Pb	%Zn	Ag mg/kg
60	Copper Girl 1-6	0.005	0.83	0.05	0.02	15.6
63	Pioneer Mine	0.002	4.18	0.02	0.05	17.5
66	Abo Mining Claims	0.001	6.36	0.05	0.02	99.4
66	Abo Mining Claims	0.002	11.11	0.02	0.01	93.7

0.33 percent uranium oxide (Table 2). The Juan Torres occurrence is an undeveloped quartz-fluorite vein which intrudes the Precambrian Capirote granite.

At the Jeter mine, uranium and copper minerals occur within a carbonaceous mudstone that forms a fault breccia along the footwall of the Cerro Colorado fault, separating the Precambrian Capirote granite and the Tertiary Popotosa Formation (Collins and Nye, 1957a). The primary uranium mineral is coffinite, although several minor uranium minerals are present. The mineralization appears to be confined to the fault breccia along Cerro Colorado fault, although a halo of low-grade ore generally surrounds the known ore bodies (Collins and Nye, 1957a). Two ore bodies were mined from 1954 to 1958 by an open pit and a 79-m decline (15°). Anomalous uranium concentrations in water and stream-sediment samples from the area around the Jeter mine indicate that additional ore bodies may occur along Cerro Colorado fault (Pierson and others, 1981; Planner, 1980).

Miscellaneous Occurrences

Uranium occurrences or anomalies are also found in the Tijeras Canyon—Sandia Mountains area (localities 54-58, fig. 1), at Cerro Colorado (localities 46 and 47, fig. 1), and at Black Butte (locality 77, fig. 1). The Monte Largo carbonatite (locality 54, fig. 1) is an undeveloped, radioactive carbonatite dike and consists of calcite, dolomite, apatite, and mica. Other radioactive anomalies in the Tijeras Canyon—Sandia Mountains area occur in the Permian Abo Formation with copper minerals (localities 55 and 57, fig. 1). A radioactive pegmatite (locality 56, fig. 1) and radioactive hydrothermal-vein (locality 58, fig. 1) also occur in this area. Radioactive occurrences are found in Tertiary volcanic rocks at Cerro Colorado and Black Butte. It is doubtful if any of these minor radioactive occurrences would result in economic deposits.

URANIUM RESOURCES IN THE ALBUQUERQUE AREA

Uranium resources are defined as the sum of known uranium reserves and estimated potential uranium resources (U.S. Department of Energy, 1980). Reserves are known quantities of uranium ore delineated by drilling or direct sampling and are generally considered proprietary information. However, estimated reserve figures are available for a number of deposits in the Laguna and Hagan basin areas and are given in Table 1. A minimum of 22 million kg of U,08 is estimated to occur in the Laguna subdistrict and 0.4 million kg of U308 are estimated to occur in the Hagan basin area.

Estimated potential uranium resources are the quantities of ore estimated or believed to occur in known uranium districts or in favorable areas containing potential uranium deposits. Potential uranium resources are divided into three classes (in order of decreasing reliability): probable, possible, and speculative. They are further divided into selected maximum forward cost categories ($30, $50, and $100 per pound of U308) by the U.S. Department of Energy (1980) to cover current economic conditions. Potential resources have been calculated by the Department of Energy (1980) for geographic areas in New Mexico, including the Albuquerque area, and amount to 1,237 metric tons of U,08 at $30/1b (Table 4). The majority of the uranium resources in the

Table 4. Potential uranium resources in the Albuquerque area based on U.S. Department of Energy (1980) assessment reports (also discussed by McLemore, 1981).

			Unconditional economic potential					
		Potential	mean metric tons U_3O_8			assigned average grade		
Locality	Host Formation	Class	$30/lb	$50/lb	$100/lb	$30/lb	$50/lb	$100/lb
Laguna subdistrict	Jackpile sandstone[1]	probable	449	668	8,401	.27	.17	.10
		possible	69	108	1,419	.30	.19	.12
	Westwater Canyon Member[1]	probable	213	465	7,686	.28	.16	.09
		possible	205	447	7,784	.23-.36	.13-.20	.08-.10
	Todilto Limestone	probable	53	83	1,047	.19	.12	.08
		possible	51	118	1,805	.23	.14	.09
	Recapture Member[1]	probable	--	--	--			
		possible	28	57	53	.31	.17	.10
	Total Laguna subdistrict	probable	715	1,216	17,134			
		possible	353	730	11,861			
		total	1,068	1,946	28,995			
La Bajada-Hagan area	Galisteo Formation	probable	168	362	5,923	.25	.16	.10
Ladron Mountains	Popotosa Formation (magmatic-hydrothermal deposits)	possible	2	3	34	.37	.24	.16
	Total Albuquerque area		1,238	2,311	34,952			
	Total New Mexico		26,716	54,964	880,770			

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[1] Member of the Morrison Formation (late Jurassic).

Albuquerque area are in the Jackpile sandstone and the Westwater Canyon Member in the Laguna subdistrict, although a small amount of potential resources are believed to occur in the Ladron Mountains and Hagan basin area (Table 4). McLemore (1981) further discusses the potential uranium resources in New Mexico.

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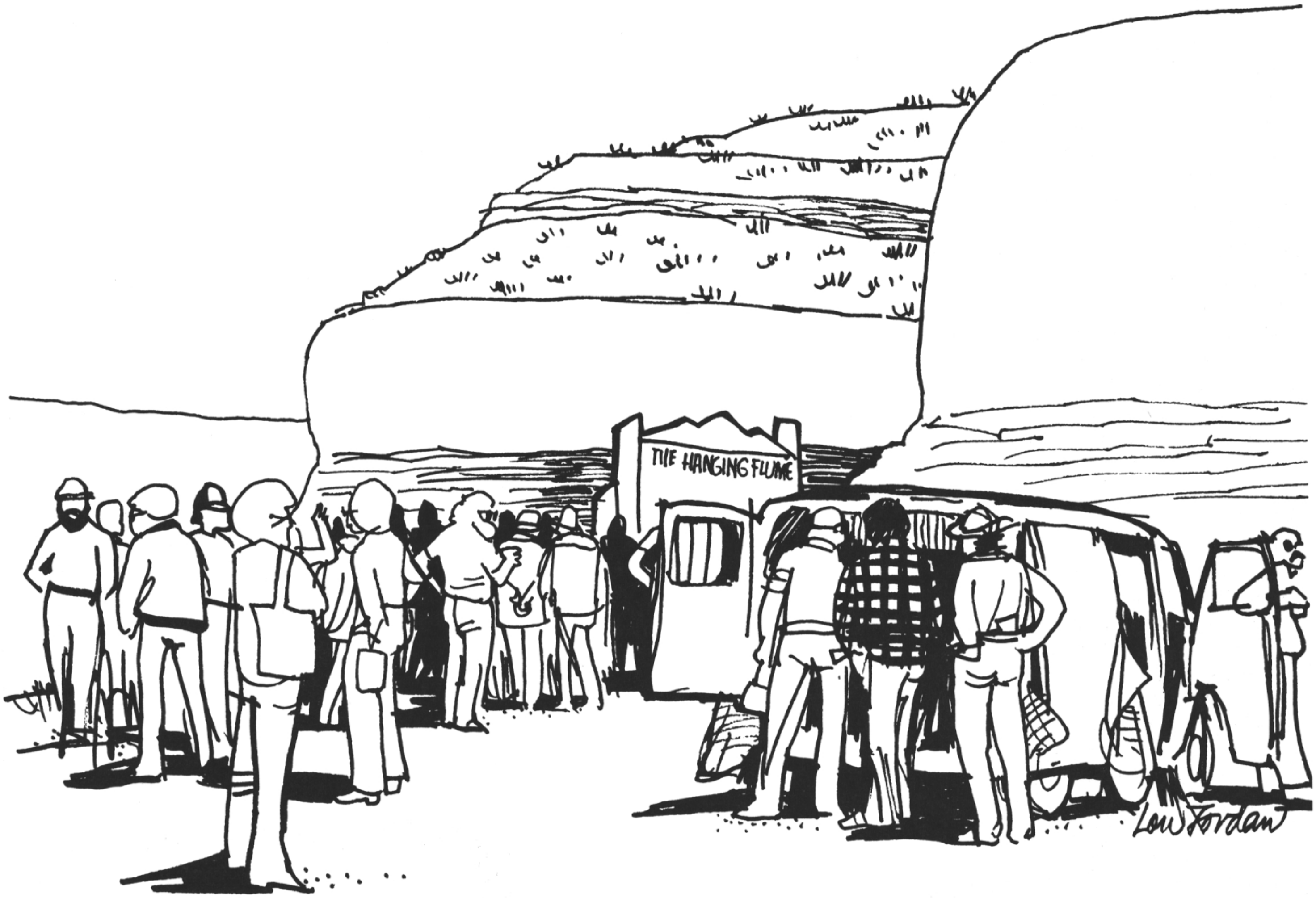

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