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Introduction

The number of wells drilled in New Mexico for oil and gas in 1984 was less than the number drilled in 1983. Statistics obtained from the New Mexico Oil Conservation Division indicate that 1,794 wells were completed in 1984, down 4.01% from the 1,869 wells completed in 1983 and down 37% from the record 2,867 wells completed in 1981. In the Permian Basin, southeast New Mexico, 1,154 wells were completed in 1984, down from 1,178 completions in 1983; 759 wells were completed as oil producers, 180 were completed as gas producers, and 215 were plugged and abandoned, resulting in a success rate of 82%. In the San Juan Basin, northwest New Mexico, 640 wells were completed in 1984, down from 691 completions in 1982; 224 wells were oil producers, 337 were gas producers, and 79 were plugged and abandoned, resulting in a success rate of 85%. In addition, 45 wells were drilled to further develop the Bravo Dome carbon dioxide gas field, and a high level of exploration and drilling activity continued in the Tucumcari Basin. Significant exploratory wells were drilled in the not-yet-productive Raton, Albuquerque, Acoma, Española, and Pedregosa Basins and in Lincoln and Doña Ana Counties (Fig. 1).

Total footage of hole drilled in 1984 was 9,776,000 ft, up from 9,441,000 ft drilled in 1983. The average depth of wells drilled in 1984 was 5,449 ft, 400 ft more than the average depth of wells drilled the previous year.

The location of significant wildcat wells drilled in 1984 is shown in Fig. 1. Table 1 summarizes the significant wildcat discoveries, and Table 2 summarizes the significant wildcat dry holes. For purposes of this report, a *significant wildcat discovery* is defined as 1) a well in which commercial amounts of oil or gas were discovered in a formation more than 5 mi from the limits of previously discovered pools with commercial production from that formation, or 2) a well that had an unusually high initial potential (more than 1,000 bbls oil per day or 10,000 ft^3 gas per day) and is 1–5 mi from the limits of previously discovered pools with commercial production from that formation. A *significant wildcat dry hole* is defined as a dry hole drilled in a not-yet-productive basin or a part of a basin in which wells were drilled through potential petroleum reservoirs. Table 3 lists significant wildcat wells that were being drilled, were not completed, or were held "tight" at the end of 1984.

All numbers in parentheses that follow refer to a location in Fig. 1 and a description in Table 1, 2, or 3.

Southeast New Mexico

Drilling activity in 1984 was high in the three geologic subdivisions of the Permian Basin: the Delaware Basin, the Central Basin platform, and the Northwest shelf. Drilling activity was also high on the Roosevelt uplift. The Permian Basin yielded several significant oil and gas discoveries in 1984 (Fig. 1; Table 1). Kinney (1967, p. 26–27) presented stratigraphic charts of oil- and gas-producing rock units in southeast New Mexico.

The Delaware Basin, the deep-marine part of the Permian Basin, yielded several significant wildcat discoveries. Oil was discovered in two wells in Pennsylvanian rocks. The Sun No. 1 State O (6) had an initial potential of 296 bbls of oil per day (BOPD) from the Cisco Series. The H. L. Brown, Jr. No. 1 State 32 (8), a workover of an abandoned Morrowan (Pennsylvanian) gas well, had an initial potential of 182 BOPD from the Canyon Series. Oil was found in the Cities Service No. 1 State DW (10) in the Bone Spring Formation (Permian), and this well had an unusually high initial potential of 1,026 BOPD and 25 bbls of water per day (BWPD). The Bone Spring usually produces less than 200 BOPD from individual wells. Oil was discovered in Siluro–Devonian rocks in the Getty Oil Co. No. 1 Bunker Hill State (3), and the well had an initial potential of 87 BOPD and 73 BWPD. Gas was found in the Amoco Production Co. No. 1 Federal DH (5) in the Strawn Series (Pennsylvanian).

Development drilling in the Delaware Basin was almost exclusively for oil in 1984; the slack gas market was the major factor that dampened development of gas reservoirs. Major targets for oil drilling were sandstones and limestones of the Bone Spring Formation (Permian) and sandstones of the Delaware Mountain Group (Permian).

Several Bone Spring and Delaware Mountain oil pools have been discovered in the last 5 yrs, and development wells drilled in those pools are usually successful; wells with initial potentials of 100–300 BOPD are com- ☞

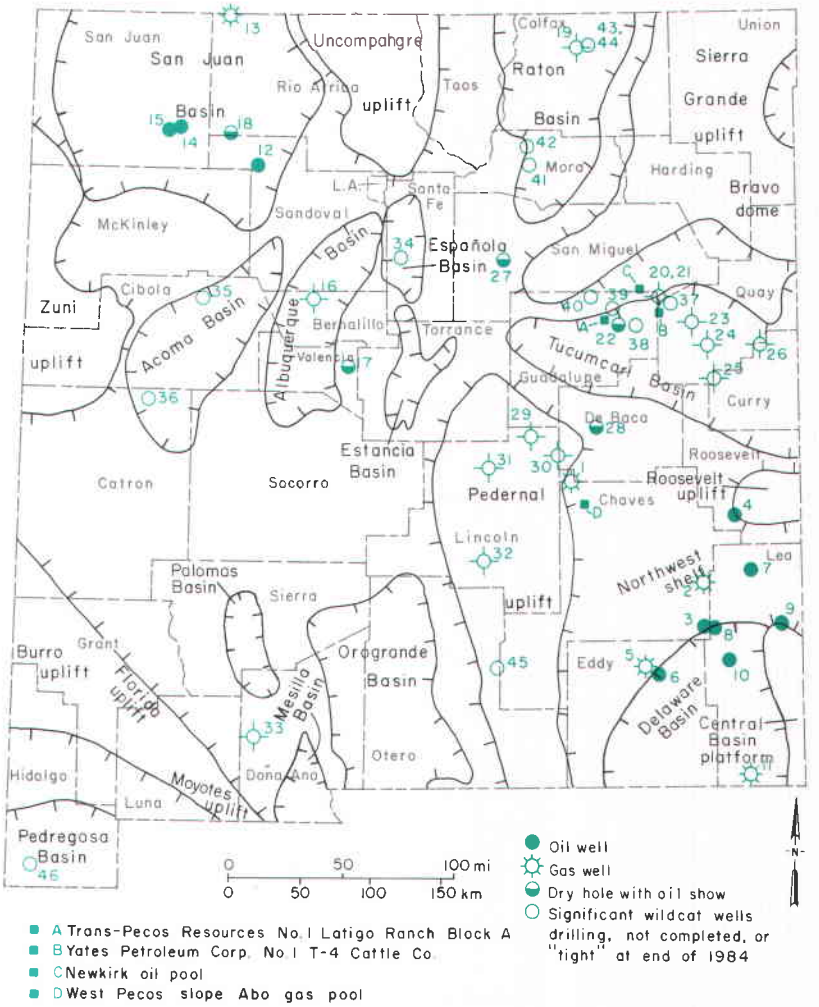

FIGURE 1—Significant oil and gas discoveries and wildcat dry holes drilled in New Mexico in 1984. Major geologic features are taken from Kelley (1978), Kottlowski and Stewart (1970), Meyer (1966), Molenaar (1977), Roberts et al. (1976), Thompson and Jacka (1981), and Woodward et al. (1978).

TABLE 1—Significant wildcat discoveries in New Mexico in 1984; the term formation is used in an informal sense. **BOPD**, barrels of oil per day; **BWPD**, barrels of water per day; **MCFGPD**, thousand ft^3 of gas per day; **owwo**, old well worked over.

Number on Fig. 1	Location (section–township–range, county)	Operator, well number, and lease	Completion date (mo/yr)	Total depth (ft)	Formation at total depth	Producing formation	Producing interval (ft)	Initial potential	Oil gravity (degrees API)
1	26–4S–20E, Chaves	Yates Petroleum Corp. No. 2 Experanza Federal XP	1/84	3,900	Precambrian	Abo (Permian)	2,512–2,569	170 MCFGPD	—
2	13–12S–31E, Chaves	Enserch Exploration No. 1 State 13	4/84	12,060	Devonian	Morrowan (Pennsylvanian)	10,904–10,946	2,003 MCFGPD	—
3	33–15S–31E, Chaves	Getty Oil Co. No. 1 Bunker Hill State	9/84	13,577	Devonian	Devonian	13,538–13,566	87 BOPD + 73 BWPD	51
4	11–7S–33E, Roosevelt	Yates Petroleum Corp. No. 1 Smith ZJ (owwo)	6/84	10,016	Precambrian	Wolfcampian (Permian)	8,238–8,256	70 BOPD + 160 BWPD	40
5	11–18S–27E, Eddy	Amoco Production Co. No. 1 Federal DH	10/84	11,915	Ellenburger (Ordovician)	Strawn (Pennsylvanian)	9,295–9,308	9,293 MCFGPD	—
6	12–19S–28E, Eddy	Sun Exploration & Production Co. No. 1 State O	1/84	11,465	Mississippian	Cisco (Pennsylvanian)	9,526–9,546	296 BOPD	—
7	19–11S–35E, Lea	Yates Petroleum Corp. No. 1 Lone Star State AAI (owwo)	11/84	10,625	Pennsylvanian	Permian–Pennsylvanian	10,373–10,395	37 BOPD + 120 BWPD	—
8	32–15S–32E, Lea	H. L. Brown, Jr. No. 1 State 32 (owwo)	3/84	13,380	Devonian	Canyon (Pennsylvanian)	10,498–10,508	182 BOPD	—
9	16–15S–37E, Lea	Newmont Oil No. 1 State 16	2/84	12,168	Atokan (Pennsylvanian)	Pennsylvanian	11,231–11,426	20 BOPD + 10 BWPD	46
10	12–18S–33E, Lea	Cities Service No. 1 State DW	4/84	11,094	Wolfcampian (Permian)	Bone Spring (Permian)	8,803–8,883	1,026 BOPD + 25 BWPD	40
11	29–26S–34E, Lea	Gulf Oil Corp. No. 1 Wilson Federal C	8/84	15,562	Atokan (Pennsylvanian)	Atokan (Pennsylvanian)	15,401–15,424	1,143 MCFGPD	—
12	3–20N–4W, Sandoval	Gary Williams Oil Producer Inc. No. 9 Penistaja 3	6/84	5,003	Cretaceous	Gallup (Cretaceous)	4,493–4,525; 4,589–4,840	40 BOPD	—
13	9–32N–6W, San Juan	Sovereign Oil No. 1 Sovereign 32–6	4/84	3,181	Lewis (Cretaceous)	Pictured Cliffs (Cretaceous)	2,826–3,020	891 MCFGPD	—
14	12–23N–10W, San Juan	Dugan Production Co. No. 1 Witty	2/84	1,690	Chacra (Cretaceous)	Pictured Cliffs (Cretaceous)	965–970	66 MCFGPD	—
15	17–23N–10W, San Juan	Dugan Production Co. No. 1 McDougall	1/84	5,512	Dakota (Cretaceous)	Gallup (Cretaceous)	4,160–4,423	20 BOPD	40

mon. Improved artificial-fracturing techniques using a methanol–foam system have minimized formation damage to the clay-bearing sandstones of the Delaware Mountain Group and have resulted in increased production. Because of this increased production, drilling for oil in Delaware sand reservoirs has boomed (Mickey, 1983). Mickey (1984) reported on development of the Avalon Delaware pool. Other major targets for development drilling of oil in the Delaware Basin are the shallow (less than 6,000 ft) San Andres, Grayburg, and Queen Formations (Permian) and the moderately deep (8,000–12,000 ft) upper Pennsylvanian and Wolfcampian (Permian) reservoirs. A few development oil wells were completed in the Penrose zone (Permian) and in Devonian reservoirs. The only major targets of gas drilling were the deep (11,000–15,000 ft) Morrowan and Atokan (Pennsylvanian) reservoirs. Hills (1984) discussed the relationship of hydrocarbon generation to sedimentation and tectonics in the Delaware Basin.

A high level of development drilling also took place in the Central Basin platform, but no significant wildcat discoveries were made in this mature, densely drilled area. Development drilling was done mostly for oil in the San Andres, Grayburg, and Queen Formations and in the Blinebry, Tubb, and Drinkard zones of the Yeso Formation (Permian). Several San Andres and Grayburg pools will produce oil with the aid of waterflood operations, which continued to be developed in southeast New Mexico. Eventually, carbon dioxide flooding will be used in enhanced-oil-recovery operations from carbonate reservoirs of the San Andres and Grayburg Formations, but not until waterflood operations are no longer capable of producing oil economically. Taber and Martin (1983) summarized the carbon dioxide flooding process.

The Northwest shelf was drilled actively, and several significant wildcat discoveries were made. Oil was found in the Newmont Oil No. 1 State 16 (9) in the Atokan Series, which had an initial potential of 20 BOPD and 10 BWPD; oil gravity was 46° API. Oil also was found in the Yates Petroleum Corp. No. 1 Smith ZJ (4) in Wolfcampian rocks. Gas was found in the Yates Petroleum Corp. No. 2 Experanza Federal XP (1) in Abo (Permian) "tight" gas sands in the northwest part of the Northwest shelf. This discovery extended Abo production northwest from the west Pecos slope Abo pool (Fig. 1, D) in northwest Chaves County. Scott et al. (1983) and Broadhead (1984a) reported on the petroleum geology of the "tight" Abo gas sands.

The south flank of the Roosevelt uplift was drilled actively, but no significant wildcat discoveries were made. Development drilling was done mainly for oil in Pennsylvanian rocks and in the Fusselman Formation (Siluro–Devonian). Pitt (1973) reported on the hydrocarbon potential of pre-Pennsylvanian rocks in Roosevelt County.

Elsewhere in southeast New Mexico, exploratory drilling was done in Lincoln County on the late Paleozoic-age Pedernal uplift (29–32). Those exploratory wells were used to test the Abo and Yeso Formations, but no discoveries were made. The Yates Petroleum Corp. No. 1 Dog Canyon Federal YF (45), also located on the Pedernal uplift, was drilled "tight."

Northwest New Mexico

In 1984, 640 wells were completed in northwest New Mexico; 691 wells were completed in 1983. Almost all of the wells drilled were in the San Juan Basin, which is the only productive basin in this part of the state. The diminished rate of drilling in 1983 and 1984 was caused by a decreased market for gas, which is the primary petroleum product of the San Juan Basin.

Most drilling for oil was concentrated in the Gallup and Dakota Sandstones (Cretaceous) in San Juan and Rio Arriba Counties. In many wells, Gallup and Dakota oil is commingled with oil produced from Graneros Shale, Greenhorn Limestone, and the lower and upper parts of Mancos Shale (all Cretaceous). Many recently completed Gallup wells are located in southwest Rio Arriba County and southeast San Juan County along the main northwest trend of Gallup production. The main Gallup trend produces oil from northwest-trending bar-shaped sandstones. Many wells northeast of the main trend produce oil from sandstones that are less permeable and porous than sandstones in the main Gallup trend (Reese, 1977). Significant oil discoveries in the Gallup were made in the Dugan Production Co. No. 1 McDougall (15), which was drilled southwest of the main Gallup trend, and in the Gary Williams Oil Producer No. 9 Penistaja 3 (12).

Development drilling for gas was limited mostly to the Dakota, Chacra, Point Lookout, and Pictured Cliffs Sandstones and to shallow (<1,500 ft) low-volume reservoirs in the Fruitland Formation. The Basin Dakota gas pool in San Juan and Rio Arriba Counties continued to be developed intensely. Stone et al. (1983) discussed the stratigraphy of Cretaceous rocks in the San Juan Basin.

The Gulf Oil Corp. No. 1 Gallo Canyon Federal–State Deep Unit (18) was spudded in 1983 and was completed and abandoned in 1984. The well is significant because it was drilled to a total depth of 12,500 ft and probably penetrated Paleozoic or Precambrian rocks. Only about 25 wildcat wells have been tested in the Paleozoic section in the New Mexico part of the San Juan Basin because most wells stop in shallower Cretaceous pay zones. Paleozoic production is limited to nine small fields in the northwest part of the Basin where the Paleozoic reservoirs are Devonian, Mississippian, and Pennsylvanian. Although no shows were reported from the Gallo Canyon (Paleozoic) section, oil was recovered in the Entrada Sandstone (Jurassic) through casing perforations from 7,434 to 7,435 ft. The little known stratigraphy of Paleozoic rocks in the San Juan Basin has been summarized by Armstrong and Mamet (1977), Jentgen (1977), and Baars and Stevenson (1977).

The Albuquerque Basin was the site of continued activity in 1984. The C. R. Robinson No. 1 Baca (17) was drilled on the Hubbell Bench, a shallow fault block; Pennsylvanian rocks between 1,830 and 1,850 ft were tested, and a small oil show was reported. In the deeper, central part of the basin, the Utex

TABLE 2—Significant wildcat discoveries in New Mexico in 1984; the term formation is used in an informal sense. **D&A**, dry and abandoned; **TA**, temporarily abandoned.

Number on Fig. 1	Location (section–township–range, county)	Operator, well number, and lease	Completion date (mo/yr)	Total depth (ft)	Formation at total depth	Status	Comments
16	1–10N–1E, Bernalillo	Utex Oil No. 1 Westland Development	9/84	17,500	Cretaceous	D&A	Deep test in Albuquerque Basin; no reported shows
17	3–5N–4E, Valencia	C. R. Robinson No. 1 Baca	1/84	2,360	Pennsylvanian	TA	Reported oil show in Pennsylvanian through perforations from 1,830–1,850 ft
18	26–23N–6W, Sandoval	Gulf Oil Corp. No. 1 Gallo Canyon Federal–State Deep Unit	3/84	12,500	Paleozoic or Precambrian	D&A	Recovered oil from Entrada Sandstone (Jurassic) through perforations from 7,343–7,442 ft
19	17–29N–21E, Colfax	Austra-Tex Oil No. 1–Y Phelps Dodge	6/84	4,295	Morrison (Jurassic)	D&A	Recovered oil from Entrada Sandstone (Jurassic) through perforations from 7,343–7,442 ft
20	32–11N–27E, Quay	Yates Petroleum Corp. No. 2 T–4 Cattle Co.	5/84	7,033	Precambrian	D&A	Offset to 1983 gas and oil discovery
21	31–11N–27E, Quay	Yates Petroleum Corp. No. 3 T–4 Cattle Co.	6/84	4,973	Pennsylvanian	D&A	Offset to 1983 gas and oil discovery
22	19–9N–24E, Guadalupe	Co_2-in-Action No. 1 Hicks	8/84	7,275	Pennsylvanian	D&A	Oil show in core from Pennsylvanian
23	10–9N–29E, Quay	Baker & Taylor No. 1 State	9/84	8,698	Precambrian	D&A	No reported shows
24	26–7N–30E, Quay	Gulf Oil Corp. No. 1 Caton	9/84	8,510	Pennsylvanian	D&A	No reported shows
25	3–4N–31E, Curry	DeSana Corp. No. 1 Allmand	9/84	7,160	Granite wash (Pennsylvanian?)	D&A	No reported shows
26	14–7N–34E, Curry	Pennzoil No. 1 Stanfield	4/84	7,525	Granite (Precambrian)	D&A	No reported shows
27	3–13N–15E, San Miguel	Midas Minerals No. 1 Midas	6/84	1,900	Pennsylvanian or Permian	D&A	Swabbed oil-cut water
28	26–1N–22E, De Baca	Diamond Shamrock No. 1–Y Fields 26	11/84	4,000	Abo (Permian)	D&A	Oil show in core of lower Yeso from 1,260–1,290 ft
29	12–1S–17E, Lincoln	Yates Petroleum Corp. No. 1 Inexco State YP	6/84	3,990	Precambrian	D&A	Tested Abo (Permian) with no reported shows
30	24–2S–19E, Lincoln	Yates Petroleum Corp. No. 1 Chisum state YN	7/84	4,058	Precambrian	D&A	Tested Abo (Permian) with no reported shows
31	23–3S–14E, Lincoln	Yates Petroleum Corp. No. 1 Bonita Federal ZC	7/84	2,101	Precambrian	D&A	No reported shows
32	16–10S–15E, Lincoln	Rio Petro Ltd. No. 1–Y Nosker	1/84	1,256	Yeso (Permian)	D&A	Completed as water well
33	13–23S–4W, Doña Ana	Exxon Corp. No. 1 Mason Draw Federal Unit	2/84	11,948	Precambrian	D&A	No reported shows

Oil No. 1 Westland Development (16) was abandoned at a total depth of 17,500 ft, but it was held "tight" at the end of 1984; principle objectives were probably Upper Cretaceous sandstones. This well was drilled 3 mi south of the Shell No. 1 West Mesa Federal, which was drilled to a total depth of 19,375 ft and abandoned in 1982 after encountering good shows of gas in Upper Cretaceous sandstones. Deep wells drilled in previous years have encountered promising shows of gas in the Albuquerque Basin (Black, 1982). Kelley (1977) and Black (1982) discussed the geology of the Albuquerque Basin.

Yates Petroleum Corp. announced plans to drill five wells in the Española Basin, which continues to be an important exploration target. Three wells will be drilled to depths of 5,000–7,000 ft; principle objectives are Cretaceous sandstones. Two wells will be drilled to depths of 7,000–8,200 ft; principle objectives are Pennsylvanian rocks. Black (1984a) discussed seismically defined Laramide-age folds and thrust faults in the subsurface of the Española Basin. Black (1984b) discussed the present status of petroleum exploration in the Española Basin.

Elsewhere in northwest New Mexico, two wells were drilled in the Acoma Basin. The Joe Salazar No. 1 State (35) was scheduled to be drilled to 2,900 ft to test the Entrada Sandstone (Jurassic), but was not completed at the end of 1984. The Samedan Oil No. 1 Laguna Federal (36) was drilled to a total depth of 5,450 ft and held "tight" at the end of 1984.

Northeast New Mexico

Several petroleum exploration wells were drilled in northeast New Mexico in 1984. Petroleum has not been produced in this area except for a brief period when marginally commercial amounts of gas were produced from the Morrison Formation (Jurassic) and the Dakota Sandstone (Cretaceous) at the currently inactive Wagon Mound field in Mora County (Brooks and Clark, 1978).

Some of the wells were drilled as a result of Pennsylvanian gas and oil discoveries made by Trans-Pecos Resources in 1982 (Fig. 1, A) and by Yates Petroleum Corp. in 1983 (Fig. 1, B) in the Tucumcari Basin. In 1984, the Yates Petroleum Corp. No. 2 T–4 Cattle Co. (20) was abandoned at a total depth of 7,033 ft in Precambrian rocks; Pennsylvanian rocks were tested without reported petroleum recovery. The Yates Petroleum Corp. No. 3 T–4 Cattle Co. (21) was abandoned at a total depth of 4,973 ft in Pennsylvanian rocks; these rocks were tested but results were not released. The CO_2-in-Action No. 1 Hicks (22) was abandoned at a total depth of 7,275 ft after an oil show was encountered in a core of Pennsylvanian rocks. The DeSana Corp. No. 1 Allmand (25) was abandoned at 7,160 ft in reported granite wash. Other wells drilled previously in west Curry County have had gas shows in the San Andres Formation (Permian). Pitt and Scott (1981) discussed porosity zonation in the San Andres Formation of east-central New Mexico.

Four significant tests drilled in the Tucumcari Basin were not completed or held "tight" at the end of 1984. The Yates Petroleum Corp. No. 1 T–4 Filly's Tooth (37) was drilled to a total depth of 7,700 ft. The Baker and Taylor No. 1 Reilly Minerals (38) was scheduled to be drilled to 7,500 ft. The Trans-Pecos Resources No. 1 Latigo Ranch Block D (39) was drilled "tight" to a total depth of 7,836 ft and attempts were made to complete that well in Pennsylvanian rocks. The McClellan Oil Corp. No. 2 Burner Fee (40) was drilled to 6,100 ft and reportedly encountered shows of oil and gas in rocks that are probably Pennsylvanian.

Trans-Pecos Resources initiated a gas-enhanced oil-recovery pilot project at the Trans-Pecos No. 1 Latigo Ranch Block A (Fig. 1, A); in 1982, a small gas discovery was made in Pennsylvanian rocks in a depth interval of 6,658–6,764 ft. The object of the enhanced-recovery project is to recover oil from Pennsylvanian rocks in a depth interval of 6,165–6,203 ft by injecting gas into the reservoir.

Rio Petro Limited continued efforts to recover heavy oil from Santa Rosa Sandstone (Triassic) at the Newkirk oil pool (Fig. 1, C). Rio Petro is operating two pilot steamflood projects, the O'Connell Ranch and the T–4 Ranch pilots, in an attempt to recover the oil. Neither pilot project has produced commercial quantities of oil yet. Martin (1984) reported on engineering aspects of the two pilot projects and McKallip (1984) reported on the subsurface geology of the Newkirk pool. Broadhead (1984b) discussed the petroleum geology of the Santa Rosa Sandstone in northeast New Mexico.

Amoco Production Co. drilled two wells (41, 42) to test the Pennsylvanian section in the late Paleozoic-age Taos trough. Casey (1980) discussed upper Paleozoic sediments of the Taos trough.

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TABLE 3—Significant wildcat wells that were drilling, not completed, or "tight" at end of 1984 in New Mexico; **owdd,** old well drilled deeper.

Number on Fig. 1	Location (section–township–range, county)	Operator, well number, and lease	Comments
34	31–14N–8, Santa Fe	Chace Oil Co. No. 1 Piñon Unit	Drilled to 3,200 ft to test Cretaceous rocks
35	36–11N–8W, Cibola	Joe Salazar No. 1 State (owdd)	Scheduled to be drilled to 2,900 ft to test Entrada Sandstone (Jurassic)
36	14–3N–12W, Catron	Samedan Oil No. 1 Laguna Federal	Drilled "tight" to 5,450 ft; scheduled to be drilled to Precambrian basement
37	12–10N–27E, Quay	Yates Petroleum Corp. No. 1 T–4 Filly's Tooth	Pennsylvanian test; drilled "tight" to total depth of 7,700 ft
38	34–9N–25E, Guadalupe	Baker & Taylor No. 1 Reilly Minerals	Scheduled to be drilled to 7,500 ft to test Pennsylvanian rocks
39	26–10N–23E, Guadalupe	Trans-Pecos Resources No. 1 Latigo Ranch Block D	Drilled to total depth of 7,836 ft in Pennsylvanian rocks
40	31–11N–22E, Guadalupe	McClellan Oil Corp. No. 2 Burner Fee	Drilled "tight" to total depth of 6,100 ft; oil and gas shows reported in Pennsylvanian rocks
41	3–20N–17E, Mora	Amoco Production Co. No. 1 Salmon Ranch A	Pennsylvanian test; drilled "tight" to total depth of 10,200 ft
42	21–21N–17E, Mora	Amoco Production Co. No. 1 Salmon Ranch B	Scheduled to be drilled to 10,200 ft to test Pennsylvanian rocks
43	12–29N–21E, Colfax	Perma Energy No. 3 Kaiser Steel	Drilled "tight" to 3,900 ft; tested Dakota Sandstone (Cretaceous)
44	18–29N–22E, Colfax	Perma Energy No. 1 Kaiser-Edson	Drilled "tight" to 3,510 ft; tested Dakota Sandstone (Cretaceous)
45	15–18S–15E, Otero	Yates Petroleum Corp. No. 1 Dog Canyon Federal YF	Drilled "tight" to total depth of 9,000 ft; scheduled to be drilled to Bliss Sandstone (Cambrian–Ordovician)
46	10–33S–20W, Hidalgo	Arco Oil & Gas Corp. No. 1 Fitzpatrick	Scheduled to be drilled to 15,000 ft

Exploration and drilling continued in the not-yet-productive Raton Basin. The Austra-Tex Oil No. 1–Y Phelps Dodge (19) was abandoned at a total depth of 4,295 ft without any reported shows of oil or gas. The Perma Energy No. 3 Kaiser Steel (43) was drilled "tight" to 3,900 ft in the Dakota Sandstone (Cretaceous) and had a gas show in the Dakota. The Perma Energy No. 1 Kaiser-Edson (44) was drilled "tight" to a total depth of 3,510 ft. Promising shows of gas were encountered in several wells drilled in previous years in Cretaceous rocks (Speer, 1976), but commercial production has not been established. Rose et al. (1984) discussed evidence for the presence of an undiscovered basin-centered gas accumulation in Cretaceous sandstones, and Woodward (1984) discussed the occurrence of possible fractured reservoirs in the basin. Exploration in the Raton Basin has been concentrated on the Dakota and Trinidad Sandstones (Cretaceous); deeper targets, the Entrada Sandstone (Jurassic), Triassic sandstones, and the Paleozoic section, remain unevaluated.

The Bravo dome carbon dioxide gas field continued to be developed and 45 wells were completed. The main reservoir is the Tubb sand (Permian). Carbon dioxide produced from the Bravo dome will be used for enhanced oil recovery in the Permian Basin of west Texas and southeast New Mexico; most of it will be transported by the Bravo pipeline, which was completed last November. The Sheep Mountain pipeline will transport carbon dioxide to the Permian Basin from the Bravo dome field and from the Sheep Mountain field in southeast Colorado (Broadhead, 1985).

Southwest New Mexico

Exploratory drilling for oil and gas continued in southwest New Mexico in 1984. The Exxon No. 1 Mason Draw Federal Unit (33) was drilled about 1 mi east of outcrops of epiclastic Tertiary-age volcanic rocks to a total depth of 11,948 ft before it was abandoned in reported Precambrian rocks. In late 1984, Arco began drilling the Arco No. 1 Fitzpatrick (46), which will be used to test the Lower Cretaceous and Paleozoic sections in the Pedregosa Basin.

Although there is no current petroleum production in southwest New Mexico, there is potential for future production (Greenwood et al., 1977; Thompson, 1980, 1981). Promising shows of both oil and gas have been encountered previously in several wells (Thompson, 1982). Many wells drilled in recent years were located on the assumption that southwest New Mexico is part of the Laramide-age Cordilleran overthrust belt, as proposed by Corbitt and Woodward (1973), Drewes (1978), and Woodward and DuChene (1981). More recent studies indicate that thrust faulting in southwest New Mexico is of local extent only; major Laramide-age structural features are high-angle reverse faults that form basement-cored block uplifts (Brown and Clemons, 1983; Seager, 1983). Recent work also has cast doubt on the presence of the Cordilleran overthrust belt in southeast Arizona (Dickinson, 1984). The well-documented shelf-edge reefs of the Pedregosa Basin (Thompson and Jacka, 1981) have not been drilled in the subsurface where they may contain excellent petroleum reservoirs.

Effect of discoveries on oil and gas production

In 1983, New Mexico was the seventh largest producer of crude oil and the fourth largest producer of natural gas in the United States (Energy Information Administration, 1984, pp. 20, 24). Although production of oil and gas in New Mexico has been declining in recent years, oil production increased in 1983 and 1984 and gas production increased in 1984. Production of crude oil and natural gas liquids in 1983 was 75.2 million bbls, an increase of 5.9% from the 71.0 million bbls produced in 1982. Oil production increased by approximately 4% in 1984 (New Mexico Oil Conservation Division data). Production of natural gas in 1983 was 899 billion ft^3, a decrease of 9.2% from the 990 billion ft^3 produced in 1982. Gas production increased by approximately 7% in 1984 (New Mexico Oil Conservation Division data). In 1983, 91% of the state's oil and 56% of the state's gas was produced in the Permian Basin; 9% of the state's oil and 44% of the state's gas was produced in the San Juan Basin. As of December 31, 1983, New Mexico had reserves of 857 million bbls oil and 15.7 trillion ft^3 gas. The oil reserves include oil that can be recovered by enhanced-recovery techniques.

The increases in oil production in 1983 and 1984 can be attributed to two factors. First, new oil reserves discovered and developed in the last 5 yrs increased the amount of oil available for production. Second, the market for produced oil was good, so that any oil produced could be sold. New Mexico's oil production should remain stable or increase by a few percent in 1985 because of good demand for oil. Although the short-term price of oil remains in doubt, the general consensus is that oil prices will rise over the long term (Wash, 1985, p. 17), which provides exploration incentive. Most Permian Basin operators predict that drilling activity in 1985 will be similar to what it was in 1984 (Drill Bit, 1985).

Continued oil discoveries in the Permian and San Juan Basins will encourage exploratory drilling and development and should help prevent production declines in the future. Oil play discoveries in the Delaware Mountain Group and the Bone Spring Formation (Permian Basin) in the last 5 yrs provide major new exploration targets and add new oil reserves and production that will supplant declining production from older oil pools. Production declines will be slowed in the more distant future by implementation of carbon dioxide flooding of existing fields; Foster (1980, p. 3) estimated that 4.6–11 million BOPD could be produced with carbon

dioxide flooding techniques by 1990. Such additional production would replace waning production from older fields, but would not reflect an increase in reserves. Significant increases in oil reserves may be made by the discovery of new fields in the not-yet-productive frontier areas, such as the Tucumcari, Española, Albuquerque, Acoma, and Pedregosa Basins, or in the Paleozoic section of the San Juan Basin.

The increase in gas production in 1984 was caused by an increased demand for gas, rather than an increased capability to produce gas. The large declines in gas production from 1981 to 1982 (11.5%) and from 1982 to 1983 (9.2%) were caused primarily by a decreased demand for New Mexico gas in California, the chief consumer of the state's gas. The future of gas production in New Mexico is uncertain because of the unknown demand for and price of gas in the future. A bad effect of decreased gas production in 1982 and 1983 was that exploration decreased markedly; some of the produced gas reserves were not replaced by new discoveries and reserves declined accordingly. Generally, only the very best gas prospects, or those gas prospects required to hold leases, will be drilled in 1985 (Drill Bit, 1985).

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