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Ronald F. Broadhead

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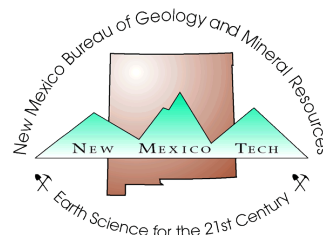
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## Oil and gas activities in New Mexico in 1997

by Ronald F. Broadhead, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801

### Introduction

Drilling for oil and natural gas in New Mexico increased in 1997. A total of 1,562 wells were completed in 1997, an increase of 19% from the 1,308 wells completed in 1996. In the Permian Basin, southeast New Mexico, 1,086 wells were completed in 1997,

up from 999 wells completed in 1996. In the San Juan Basin, northwest New Mexico, 474 wells were completed in 1997, up slightly from the 424 wells completed during 1996.

During 1997, there was significant exploratory activity in the producing Permian and San Juan Basins. There was also

significant exploratory activity in presently nonproductive frontier areas such as the Albuquerque–Belen Basin, the Tucumcari Basin, the Pedregosa Basin, the Tularosa Basin, and in the Carrizozo Basin of eastern Socorro and western Lincoln Counties. Rank wildcat wells were drilled in the Albuquerque–Belen and Tularosa Basins, and exploratory activities continued into 1998 in these areas. A CO<sub>2</sub> exploration play spread into west-central New Mexico from eastern Arizona.

The locations of significant exploratory wells completed in 1997 are shown in Fig. 1. Table 1 summarizes the significant exploratory discoveries, and Table 2 summarizes significant, but unsuccessful, exploratory wells. Table 3 lists significant exploratory wells that were being drilled at the end of 1997 or were scheduled to be drilled in 1998. Each well is designated by a number in parentheses that refers to its location in Fig. 1 and its description in Tables 1, 2, or 3.

### Permian Basin, southeast New Mexico

Drilling activity increased in 1997 in the three geologic subdivisions of the Permian Basin: the Delaware Basin, the Central Basin platform, and the Northwest shelf; 1,086 wells were completed in this area in 1997, an increase of 9% from the 999 wells completed during 1996; 779 of these wells were completed as oil producers and 168

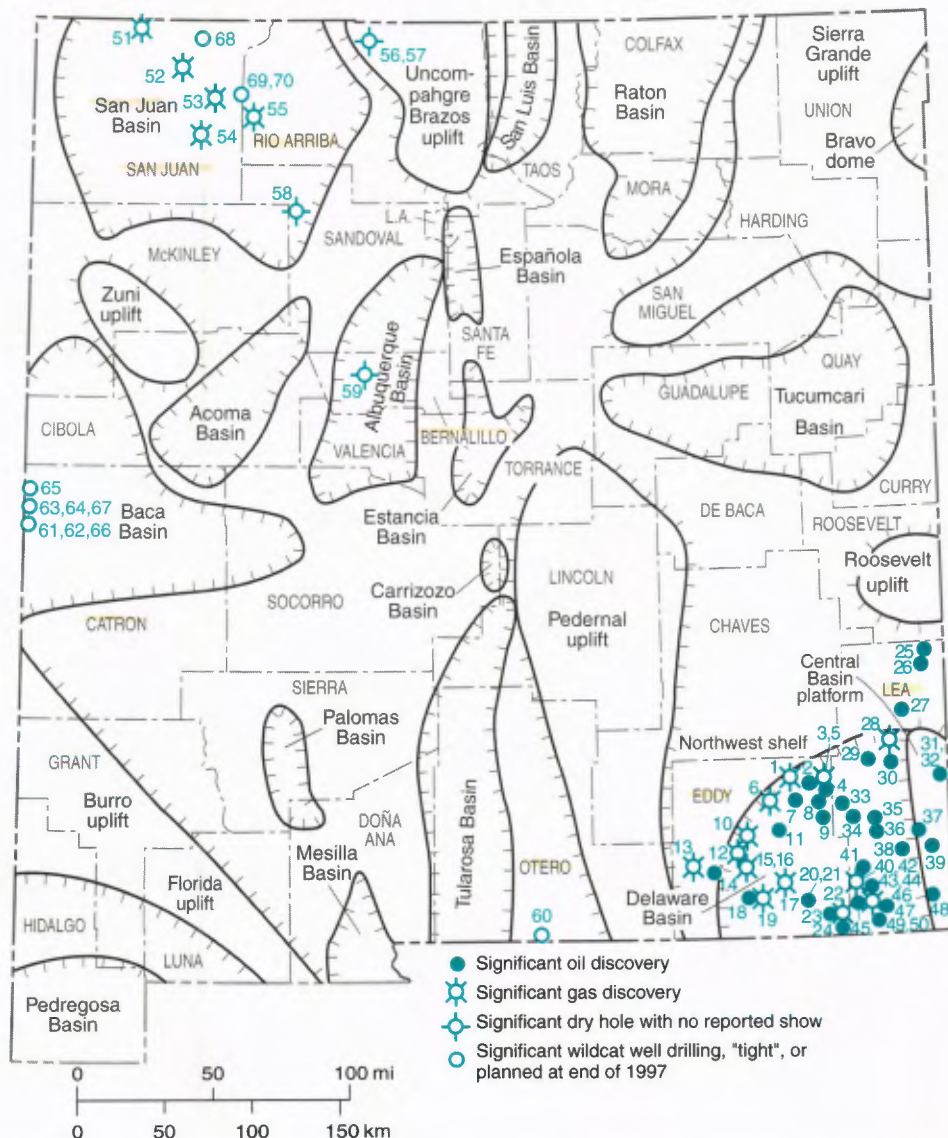


FIGURE 1—Significant oil and gas discoveries, dry holes, and frontier wildcat wells drilled in New Mexico in 1997. Major geologic features are from Broadhead and King (1988), Cather and Johnson (1984), Kelley (1978), Kottlowski and Stewart (1970), Meyer (1966), Molenaar (1977), Thompson and Jacka (1981), and Woodward et al. (1978).

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were completed as gas producers while 101 were dry and abandoned, resulting in a success rate of 90%. In addition, 38 other wells were drilled in southeast New Mexico in 1997; these other wells include injection wells for waterfloods and salt-water disposal wells. Drilling activity was concentrated in Permian reservoirs on the Northwest shelf and Central Basin platform and in the Delaware Basin.

### Upper Guadalupian reservoirs

Shallow (2,000–4,000 ft) oil and associated gas reservoirs of the Yates and Queen Formations (Permian: upper Guadalupian) were major targets of development drilling in 1997. Approximately 80 wells were completed in these zones. Drilling was primarily for development in mature fields on the Central Basin platform in Lea County. Activity was widespread, with many development wells completed in Yates and Queen reservoirs in the Langlie–Mattix, Jalmat, and Eumont pools of Lea County.

### San Andres and Grayburg reservoirs

Oil and associated gas reservoirs in the shallow (2,000–5,000 ft) San Andres and Grayburg Formations (Permian: lower Guadalupian) were primary targets of development drilling in 1997. Approximately 240 wells were completed in these zones. Drilling was primarily for development of mature fields on the south part of the Northwest shelf in northern Eddy and Lea Counties. Activity was widespread with wells drilled in 34 pools. Drilling was concentrated in the Grayburg–Jackson pool of Eddy County where 78 producing wells and 9 injection wells were drilled. Major development also took place in the Red Lake pool of northern Eddy County where 63 producing wells were drilled. Significant development drilling also took place in the Maljamar, Vacuum, and Eunice–Monument pools of Lea County and in the Millman East pool of Eddy County. Although exploration along the mature San Andres and Grayburg trends was limited, two significant discoveries were made. Production was established from the Grayburg Formation in the JKR Oil & Gas No. 1 Byers (32) well in east-central Lea County, and oil was discovered in the Mallon Oil No. 7 Mallon Federal (35) well in central Lea County.

### Delaware Mountain Group sandstones

Basinal sandstone reservoirs of the Delaware Mountain Group (Permian: Guadalupian) continued to be one of the most active plays in southeast New Mexico. During 1997, approximately 150 wells were drilled in search of oil in these reservoirs in the Delaware Basin. Depth to production typically ranges from 5,000 to

8,000 ft but can be as shallow as 2,000 ft in the north part of the Delaware Basin. Exploration was somewhat less active than in previous years, with nine exploratory wells drilled. Development was mostly by infill drilling and conservative stepouts from known production; the development success rate of Delaware reservoirs was 95% in 1997. Development wells were drilled in 48 oil pools. The Ingle Wells, Red Tank West, Cedar Canyon, and Lea Northeast pools were the most intensely developed Delaware reservoirs in 1997. As in the past few years, most drilling was for oil in the Brushy Canyon Formation, the lowermost of the three sandstone-bearing formations that constitute the Delaware.

Eight significant discoveries of oil in the Delaware were made during 1997. Oil was discovered in Delaware sandstones in the north part of the Delaware Basin in three wells (9, 34, 36). Oil was discovered in Delaware sandstones in the central part of the Delaware Basin in five wells (18, 20, 23, 24, 41).

### Bone Spring basinal sediments

Basinal allochthonous carbonates and sandstones of the moderately deep (6,000–10,000 ft) Bone Spring Formation (Permian: Leonardian) were intensely drilled in 1997. Approximately 50 wells were drilled for oil in these reservoirs within the Delaware Basin. The Bone Spring play had been relatively inactive for the past few years, as shallower targets in the Delaware Mountain Group were given preference for exploration and development drilling. Development wells were drilled in 25 oil pools in eastern Eddy and western Lea Counties. Drilling activity was most intense in the Pierce Crossing East pool of southeast Eddy County where 15 development oil wells were successfully completed.

Exploration for hydrocarbons in Bone Spring reservoirs surged in 1994 and this exploratory activity continued through 1995 and 1996 and into 1997. Unlike past years where many Bone Spring discoveries were made by reentering older wells that had produced from deeper reservoirs, most of the discoveries made during 1997 involved the drilling of new wells. Six discoveries were made in Bone Spring reservoirs during 1997 (21, 43, 45, 47, 49, 50). All six of these wells were drilled in the southeast part of the Bone Spring play.

### Yeso shelf sediments

Shallow shelf-carbonate reservoirs of the Yeso Formation (Permian: Leonardian) were primary targets in 1997 with 180 development wells drilled in 36 pools. Most activity was on the Central Basin platform in southern Lea County, but there was also some minor development of oil pools astride the shelf edge in south-

ern Eddy County. Production was obtained from all four members of the Yeso (descending): Paddock, Blinebry, Tubb, and Drinkard members. In many of the pools, production from two or all three of these zones is commingled. In some pools, Yeso production is commingled with oil production from underlying Abo (Permian: Wolfcampian) carbonates. Pools with the most drilling activity in 1997 were the Blinebry, Warren, Justis, Teague, Vacuum, and Warren East pools of southeast Lea County.

There was limited exploration for hydrocarbons in Yeso reservoirs. One significant discovery was made. Oil was found in two zones in the Yates Petroleum No. 2 Sacahuiste KE Federal (14). This discovery is 25 mi southwest of the west margin of the Yeso play in areas where Yeso production is sparse.

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## **Abo sandstone and carbonate reservoirs**

Development of sandstone reservoirs in the Pecos Slope and Pecos Slope West gas pools continued slowly in 1997 with 24 development wells completed in these "tight" gas reservoirs. There was also limited development of oil-bearing Abo carbonate reservoirs on the south edge of the Northwest shelf and on the Central Basin platform with 55 wells drilled in 13 reservoirs. Activity was concentrated in the Monument and Monument North pools of central Lea County where 27 development wells were successfully completed. Two significant exploratory discoveries were made in Abo shelf-margin reef reservoirs along the south margin of the Northwest shelf (4, 31). One significant discovery (37) was made in Abo carbonates on the north part of the Central Basin platform.

## **Wolfcamp carbonates**

Moderately deep (9,000–11,000 ft) carbonate reservoirs in the Wolfcamp Group (Permian: Wolfcampian) were developed at a limited rate in 1997. Thirteen development oil wells and one development gas well were completed successfully in 10 pools in northern and central Eddy County and in southern and central Lea Counties. Exploration for Wolfcamp hydrocarbons resulted in four significant exploratory discoveries during 1997. In Eddy County, oil was discovered in the Wolfcamp in the Myco No. 1 East Turkey Track Federal (7) and in the Penwell Energy No. 1 West Shugart 30 Federal (8) wells. Oil was discovered in the Wolfcamp in Lea County in the Yates Petroleum No. 1 Treat State Unit (38) and in the Santa Fe Energy No. 2 Thistle (44) wells.

## **Upper Pennsylvanian carbonates**

Moderately deep (7,000–10,000 ft) Cisco and Canyon (Upper Pennsylvanian) carbonate reservoirs continued to be developed in 1997 but at a lesser rate than in previous years. Fifty-one development wells were successfully completed in 21 reservoirs. Activity was concentrated in the Dagger Draw North pool where 17 development oil wells were successfully completed. The Dagger Draw North and Dagger Draw South pools are examples of underdeveloped reservoirs that produced minor volumes of oil for almost 20 yrs. Upon realization that substantial oil resources remained unproduced in these reservoirs and with better technology available to recover that oil, drilling programs were instituted to tap into those resources. The result was an immediate increase in production, and Dagger Draw North and Dagger Draw South quickly became two of the most productive oil pools in southeast New Mexico. In 1996, they produced almost 10 million bbls oil,

approximately 14% of the state's total oil production. There were five significant exploratory discoveries in Upper Pennsylvanian carbonates during 1997 (10, 11, 16, 17, 29).

## **Strawn reservoirs**

Development of moderately deep (10,000–12,000 ft) Strawn (Middle Pennsylvanian) reservoirs continued at a slow but steady pace in 1997. Development of existing reservoirs was moderately slow, with only 19 development wells successfully completed in 12 pools. Exploration for oil and gas in Strawn carbonate reservoirs was also subdued. Nevertheless, two discoveries were made. Oil was discovered in Strawn carbonates in the Chevron No. 1 Speare Federal well (33) in west-central Lea County. Modest amounts of oil in the Strawn were discovered in the Avra Oil No. 1 State well (29), also located in west-central Lea County.

## **Atoka and Morrow "deep gas" reservoirs**

The deep (10,000–14,000 ft) gas reservoirs in the Atoka and Morrow Groups (Lower Pennsylvanian) saw increased development in 1997. Six development gas wells were completed successfully in four Atoka reservoirs, and more than 60 development gas wells were completed successfully in 39 Morrow gas reservoirs. Drilling activity was widespread and evenly distributed among these gas pools. Exploratory drilling also increased over previous years and several discoveries were made. Exploration for gas in Morrow reservoirs resulted in seven discoveries (1, 3, 12, 13, 19, 40, 46), and exploration for gas in the shallower Atoka reservoirs resulted in four discoveries (5, 15, 28, 42). Although the Atoka produces gas throughout most of southeast New Mexico, an oil play of modest size has emerged from the Atoka during the past few years in northern Lea County; one significant oil discovery (30) was made in the Atoka in this play during 1997.

## **Devonian, Silurian, and Ordovician reservoirs**

Exploration for oil in seismically defined structural traps in the lower Paleozoic section was strong on the Central Basin platform and on the Northwest shelf. Many traps in the lower Paleozoic are formed by relatively small anticlinal and fault-bounded anticlinal closures. Three exploratory discoveries (25, 26, 27) were made in Devonian reservoirs in northern Lea County, and one gas discovery (22) was made in southeast Eddy County. In addition, oil was discovered in Fusselman dolostones (Silurian) in the Texaco No. 5 United Royalty A well (48) in southwest Lea County, and oil was discovered in the

Ordovician section in the Conoco No. 1 Deck Estate well (39), also drilled in south-east Lea County. Exploration for structural traps in the Devonian, Silurian, and Ordovician sections is expected to remain strong through 1998. Better definition of the relatively small structures that form traps in the lower Paleozoic has been made possible by 3-D seismic techniques, although this relatively new technology has not yet been fully utilized to define such factors as seal integrity or migration pathways. These factors are apparently important when considering entrapment of hydrocarbons in the lower Paleozoic section on the Northwest shelf.

## **Tularosa Basin area, south-central New Mexico**

In the Tularosa Basin area of south-central New Mexico, the Harvey E. Yates No. 1Y Bennett Ranch well (60) was drilled to a reported total depth of 8,400 ft. Although most information concerning the well is confidential, potential objectives are Permian and Pennsylvanian limestones and Silurian and Ordovician dolostones. Although commercial production has not been established from the Tularosa Basin area, promising shows of oil and gas have been encountered in exploratory wells drilled in the area. King and Harder (1985) discussed the petroleum geology of this region.

East of the Tularosa Basin area in southeast Otero County, another lease play emerged during 1997. In September and November, Daniel Gonzales, Xeric Oil & Gas Corp., Perry & Perry Inc., and Doug J. Schutz acquired leases on 30,000 acres of state trust lands. These leases are approximately 20 mi east of the Bennett Ranch well.

## **San Juan Basin, northwest New Mexico**

Drilling activity increased slightly during 1997 in the San Juan Basin. There were 474 completions during the year, an increase of 12% from the 424 completions in 1996. The success rate was 97%, with 435 wells completed as gas producers, 20 wells completed as oil producers, and 15 wells plugged and abandoned. An additional four wells were drilled for disposal of produced waters. Drilling concentrated on development of gas reservoirs in the Fruitland coals (Cretaceous), Pictured Cliffs and other Mesaverde sandstones (Cretaceous), and Dakota sandstones (Cretaceous).

## **Fruitland coalbed methane reservoirs**

Gas reservoirs of the Fruitland Formation (Upper Cretaceous) continued to be aggressively developed in 1997. Approximately 70 wells were completed in the

TABLE 1—Significant wildcat discoveries in New Mexico in 1997; the term formation is used in an informal sense. BOPD, bbls oil per day; MCFGPD, thousand ft<sup>3</sup> gas per day; BCPD, bbls condensate per day; BWPD, bbls water per day; IPP, initial potential pumping; IPF, initial potential flowing; 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	5-17S-29E, Eddy	Conoco No. 1 Jenna	3/97	11,820	Devonian	Morrow (Pennsylvanian)	10,442–10,491	IPF 2913 MCFGPD	
2	20-17S-30E, Eddy	Mack Energy No. 7 Jenkins B Federal	5/97	4,810	Paddock (Permian)	Paddock (Permian)	4,289–4,634	IPP 79 BOPD + 100 MCFGPD + 480 BWPD	38
3	15-17S-31E, Eddy	Texaco No. 902 Skelly Unit	5/97	12,300	Mississippian	Morrow (Pennsylvanian)	11,980–11,990	IPF 2027 MCFGPD + 19 BCPD	55
4	22-17S-31E, Eddy	Texaco No. 903 Skelly Unit	8/97	8,000	Abo (Permian)	Abo (Permian)	7,308–7,444	IPF 25 BOPD + 890 MCFGPD + 46 BWPD	53
5	33-17S-31E, Eddy	Texaco No. 2 Dow B-33 Federal (owwo)	3/97	12,100	Mississippian	Atoka (Pennsylvanian)	11,242–11,248	IPF 1576 MCFGPD + 11 BCPD	57
6	15-18S-28E, Eddy	Marathon No. 1 Travis WB 15 State Com.	12/97	11,150	Mississippian	Mississippian	11,040–11,056	IPF 1230 MCFGPD + 6 BCPD	57
7	23-18S-29E, Eddy	Myco Industries No. 1 East Turkey Track Federal (owwo)	1/97	11,496	Morrow (Pennsylvanian)	Wolfcamp (Permian)	9,409–9,438	IPP 54 BOPD + 135 MCFGPD	
8	30-18S-31E, Eddy	Penwell Energy No. 1 West Shugart 30 Federal	3/97	12,520	Morrow (Pennsylvanian)	Wolfcamp (Permian)	10,130–10,151	IPF 331 BOPD + 245 MCFGPD	
9	32-19S-31E, Eddy	Hanley Petroleum No. 1 State 32 (owwo)	9/97	9,180	Bone Spring (Permian)	Delaware (Permian)	6,687–6,724	IPP 50 BOPD + 27 MCFGPD + 95 BWPD	40
10	26-20S-26E, Eddy	Maralo No. 1 DS 26 Federal	6/97	10,588	Mississippian	Cisco (Upper Pennsylvanian)	8,182–8,191	IPF 539 MCFGPD + 1860 BWPD	
11	6-20S-28E, Eddy	Penwell Energy No. 1 Angell 6 Federal	9/97	11,207	Canyon (Pennsylvanian)	Cisco–Canyon (Upper Pennsylvanian)	9,360–9,378	IPP 100 BOPD + 159 BWPD	
12	17-21S-25E, Eddy	Marbob Energy No. 1 Como	5/97	10,450	Morrow (Pennsylvanian)	Morrow (Pennsylvanian)	10,259–10,318	IPF 1147 MCFGPD	
13	22-22S-22E, Eddy	Penwell Energy No. 1 Wagon Wheel 22 Federal	3/97	10,665	Mississippian	Morrow (Pennsylvanian)	7,418–7,678	IPF 1712 MCFGPD + 10 BCPD + 3000 BWPD	
14	34-22S-23E, Eddy	Yates Petroleum No. 2 Sacahuiste KE Federal	12/97	3,400	Bone Spring (Permian)	Yeso (Permian)	2,284–2,746	IPP 7 BOPD + 34 BWPD	
15	24-22S-25E, Eddy	Penwell Energy No. 1 Filaree 24	5/97	11,557	Atoka (Pennsylvanian)	Atoka (Pennsylvanian)	10,144–10,159	IPF 1516 MCFGPD	
16	1-23S-25E, Eddy	Louis Dreyfus Natural Gas No. 3 Federal (owwo)	4/97	11,670	Morrow (Pennsylvanian)	Cisco–Canyon (Upper Pennsylvanian)	9,754–9,770	IPF 711 MCFGPD + 15 BWPD	
17	7-23S-28E, Eddy	Oxy USA No. 1 Brantley A	2/97	12,545	Mississippian	Cisco (Upper Pennsylvanian)	10,506–10,531	IPF 1386 MCFGPD + 8 BCPD	58
18	9-24S-26E, Eddy	Mallon Oil No. 1 Wadi 9 Federal (owwo)	8/97	5,400	Delaware (Permian)	Delaware (Permian)	2,666–3,363	IPP 33 BOPD + 15 MCFGPD + 123 BWPD	
19	11-24S-26E, Eddy	Mallon Oil No. 1 O'Neill Federal	4/97	11,900	Mississippian	Morrow (Pennsylvanian)	11,198–11,206	IPF 1387 MCFGPD	
20	21-24S-29E, Eddy	Pogo Producing No. 2 Coyote 21	12/97	6,800	Bone Spring (Permian)	Delaware (Permian)	5,216–6,272	IPP 200 BOPD + 50 MCFGPD + 208 BWPD	39
21	30-24S-29E, Eddy	Nearburg Production No. 1 Ruby 30 State	2/97	13,400	Morrow (Pennsylvanian)	Bone Spring (Permian)	8,866–8,910	IPP 14 BOPD + 6 BWPD	40
22	1-25S-31E, Eddy	Texaco No. 76 Cotton Draw Unit	5/97	16,623	Devonian	Devonian	16,400–16,623	IPF 9981 MCFGPD	
23	2-25S-31E, Eddy	Texaco No. 81 Cotton Draw Unit	8/97	13,627	Wolfcamp (Permian)	Delaware (Permian)	7,620–7,671	IPP 27 BOPD + 40 MCFGPD + 364 BWPD	41

TABLE 1—continued

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)
24	10-26S-31E, Eddy	Texaco No. 1 Ross Ranch 10 Federal	12/97	8,400	Bone Spring (Permian)	Delaware (Permian)	6,958–7,022	IPP 13 BOPD + 7 MCFGPD + 23 BWPD	40
25	16-9S-37E, Lea	Cobra Oil & Gas No. 1Y State 16	10/97	12,585	Devonian	Devonian	12,551–12,585	IPF 193 BOPD	43
26	7-10S-37E, Lea	Cobra Oil & Gas No. 1 State 7	9/97	12,563	Devonian	Devonian	12,532–12,563	IPF 188 BOPD + 207 MCFGPD	
27	7-13S-36E, Lea	Saba Energy	4/97	14,031	Devonian	Devonian	13,980–14,031	IPF 297 BOPD	59
28	5-15S-35E, Lea	Yates Petroleum No. 1 Morton	2/97	13,593	Mississippian	Atoka (Pennsylvanian)	12,916–12,933	IPF 465 MCFGPD + 19 BCPD + 2 BWPD	55
29	7-16S-34E, Lea	Avra Oil No. 1 State 7 (owwo)	11/97	13,000	Morrow (Pennsylvanian)	Canyon (Upper Pennsylvanian)	10,901–11,073	IPF 43 BOPD + 340 MCFGPD	44
						Strawn (Pennsylvanian)	11,699–11,724	IPF 1 BOPD + 30 MCFGPD + 27 BWPD	44
30	11-16S-35E, Lea	Yates Petroleum No. 1 Shell Lusk ANB Com.	12/97	12,264	Mississippian	Atoka (Pennsylvanian)	12,029–12,214	IPF 32 BOPD + 665 MCFGPD + 1 BWPD	
31	29-16S-39E, Lea	Browning Oil No. 1 Byers	11/97	8,783	Abo (Permian)	Abo (Permian)	8,271–8,783	IPF 73 BOPD + 40 MCFGPD + 63 BWPD	40
32	7-17S-39E, Lea	JKR Oil & Gas No. 1 Byers	1/97	12,278	Devonian	Grayburg (Permian)	5,351–5,356	IPF 30 BOPD + 30 BWPD	
33	33-18S-32E, Lea	Chevron No. 1 Spear Federal	1/97	11,970	Strawn (Pennsylvanian)	Strawn (Pennsylvanian)	11,558–11,609	IPF 168 BOPD + 396 MCFGPD	
34	16-19S-33E, Lea	Basin Operating No. 1 Kimo Sabe	1/97	14,700	Woodford (Devonian)	Delaware (Permian)	7,177–7,194	IPF 25 BOPD + 25 MCFGPD + 205 BWPD	
35	34-19S-34E, Lea	Mallon Oil No. 7 Mallon 34 Federal	5/97	6,300	San Andres (Permian)	Grayburg (Permian)	5,104–5,236	IPF 50 BOPD + 6 MCFGPD + 10 BWPD	
36	25-20S-34E, Lea	Nearburg Production No. 1 Federal LS (owwo)	2/97	14,590	Devonian	Delaware (Permian)	8,276–8,316	IPF 31 BOPD + 187 BWPD	36
37	16-20S-37E, Lea	Marathon No. 7 Hansen State	8/97	7,600	Abo (Permian)	Abo (Permian)	7,034–7,244	IPF 182 BOPD + 1782 MCFGPD + 58 BWPD	
38	34-21S-35E, Lea	Yates Petroleum No. 1 Treat State Unit	6/97	12,930	Morrow (Pennsylvanian)	Wolfcamp (Permian)	10,400–11,500	IPF 24 BOPD + 53 MCFGPD + 117 BWPD	
39	7-21S-37E, Lea	Conoco No. 1 Deck Estate 7	4/97	11,100	Ordovician	Ordovician	9,600–9,950	IPF 240 BOPD + 117 MCFGPD + 180 BWPD	
40	15-23S-32E, Lea	Penwell Energy No. 1 Tomcat 15 Federal	8/97	16,050	Morrow (Pennsylvanian)	Morrow (Pennsylvanian)	14,850–15,009	IPF 2878 MCFGPD	
41	1-23S-32E, Lea	Yates Petroleum No. 2 Coriander AOC State	4/97	9,170	Bone Spring (Permian)	Delaware (Permian)	7,086–7,656	IPF 16 BOPD + 190 BWPD	
42	21-23S-32E, Lea	Penwell Energy No. 1 Tomcat 21 Federal	7/97	15,463	Morrow (Pennsylvanian)	Atoka (Pennsylvanian)	14,350–14,358	IPF 5006 MCFGPD	
43	26-23S-32E, Lea	Yates Petroleum No. 1 Parsley ARA Federal	5/97	10,325	Bone Spring (Permian)	Bone Spring (Permian)	8,971–10,075	IPF 40 BOPD + 134 MCFGPD + 90 BWPD	
44	28-23S-33E, Lea	Santa Fe Energy No. 2 Thistle	3/97	15,850	Morrow (Pennsylvanian)	Wolfcamp (Permian)	13,002–13,120	IPF 12 BOPD	47
45	18-24S-32E, Lea	Pogo Producing No. 1 Diaga 18 Federal	1/97	8,720	Bone Spring (Permian)	Bone Spring (Permian)	8,590–8,600	IPF 12 BOPD + 5 MCFGPD + 34 BWPD	42

TABLE 1—continued

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)
46	19-24S-33E, Lea	Cobra Oil & Gas No. 1 State 19	7/97	15,966	Morrow (Pennsylvanian)	Morrow (Pennsylvanian)	15,174–15,384	IPF 1760 MCFGPD	
47	28-24S-33E, Lea	Parker & Parsley No. 1 Getty 28 State (owwo)	2/97	16,225	Morrow (Pennsylvanian)	Bone Spring (Permian)	12,204–12,242	IPP 95 BOPD + 116 MCFGPD + 16 BWPD	
48	19-24S-38E, Lea	Texaco	1/97	11,307	Ordovician	Fusselman (Silurian)	9,014–9,018	IPP 326 BOPD	
49	10-25S-33E, Lea	BTA Oil Producers No. 1 9418 JV-P Vaca Draw	2/97	12,575	Wolfcamp (Permian)	Bone Spring (Permian)	12,196–12,242	IPP 78 BOPD + 84 MCFGPD + 96 BWPD	42
50	3-26S-34E, Lea	Yates Petroleum No. 1 Dean APQ Federal	1/97	12,850	Bone Spring (Permian)	Bone Spring (Permian)	12,475–12,706	IPF 71 BOPD + 12 BWPD	
51	30-32N-14W, San Juan	Burlington Resources No. 42 Ute Mountain	1/97	9,260	Barker Creek (Pennsylvanian)	Paradox (Pennsylvanian)	7918–9198	IPF 3579 MCFGPD	
52	6-29N-11W, San Juan	Burlington Resources No. 6 Cooper (owwo)	4/97	2,075	Pictured Cliffs (Cretaceous)	Fruitland sand (Cretaceous)	1,622–1,678	IPF 970 MCFGPD	
53	29-27N-9W, San Juan	Burlington Resources No. 4 Hudson (owwo)	1/97	6,890	Dakota (Cretaceous)	Fruitland sand (Cretaceous)	2,074–2,097	IPF 1065 MCFGPD	
54	29-25N-10W, San Juan	Holcomb Oil & Gas No. 2 Brookhaven A	9/97	5,350	Gallup (Cretaceous)	Fruitland (Cretaceous)	1,588–1,598	gas	
55	23-26N-7W, Rio Arriba	Caulkins Oil No. 377 Breech	12/97	7,565	Dakota (Cretaceous)	Gallup (Cretaceous)	6,455–6,892	IPF 1311 MCFGPD	

TABLE 2— Significant wildcat dry holes in New Mexico in 1997; the term formation is used in an informal sense. D&amp;A, dry and abandoned; perf, perforated.

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
56	18-31N-2E, Rio Arriba	Spur Oil No. 1 Gonzales 18	8/97	1,380	Mancos (Cretaceous)	D&A	Perf 515–600 ft (Cretaceous), no reported shows.
57	13-31N-1E, Rio Arriba	Spur Oil No. 1 Gonzales	8/97	1,445	Dakota (Cretaceous)	D&A	Drilled to test Dakota Sandstone (Cretaceous).
58	16-20N-4W, Sandoval	Merrion Oil & Gas No. 1 Hakuna Matata	2/97	6,487	Entrada (Jurassic)	D&A	Drilled to test Entrada Sandstone (Jurassic).
59	21-10N-1E, Bernalillo	Burlington Resources No. 1Y Westland Development	9/97	7,778	Jurassic	D&A	Drilled in Albuquerque Basin.

Fruitland. Most of these wells were drilled in coalbed methane reservoirs of the giant Basin pool in eastern San Juan County and western Rio Arriba County. There were three exploratory discoveries (52, 53, 54) in the Fruitland in 1997. Two of these discovery wells (52, 53) are believed to have been completed in Fruitland sandstone reservoirs.

#### Pictured Cliffs Sandstone

Gas reservoirs in the Pictured Cliffs Sandstone (Upper Cretaceous) were major targets for exploratory and development drilling in 1997. Approximately 70 wells were completed in these reservoirs. Development drilling was concentrated in the Ballard, Fulcher Kutz, Aztec, and Kutz West pools of northeast San Juan County. Exploration for gas in Pictured Cliffs sand-

stones was subdued in 1997 with most exploratory drilling concentrated on developing and extending previously discovered gas.

#### Mesaverde sandstones

Development of gas reservoirs in Mesaverde sandstones (Upper Cretaceous) remained strong during 1997. Approximately 140 development gas wells were completed in Mesaverde sandstones. Almost all of these wells were completed in the Blanco pool of northeast San Juan and northwest Rio Arriba Counties.

#### Gallup sandstone

Oil reservoirs in the Gallup sandstone (Upper Cretaceous) saw mild development activity during 1997. Seven develop-

ment wells were completed successfully in seven reservoirs, and an additional five development wells were plugged and abandoned. Activity was scattered among the Bisti, Bisti South, and Horseshoe pools. One significant exploratory discovery was made. Gas was discovered in the Gallup in the Caulkins Oil No. 377 Breech well (55).

#### Dakota sandstones

Oil and gas reservoirs in sandstones of the Dakota Group (Upper Cretaceous) were developed aggressively in 1997. Four oil wells and 146 gas wells were completed in Dakota reservoirs. Drilling for gas was concentrated in the giant Basin pool of northeast San Juan and west Rio Arriba Counties. Oil drilling was concentrated in the Lindrith West pool of southeast Sando-



TABLE 3—Significant wildcat wells being drilled or scheduled to be drilled at the end of 1997.

Number on Fig. 1	Location (section-township-range, county)	Operator, well number, and lease	Comments
60	14-26S-12E, Otero	Harvey E Yates No. 1Y Bennett Ranch	Drilled to total depth of 8,400 in August 1997. Tight hole.
61	16-1S-21W, Catron	Ridgeway Arizona Oil No. 1 State 1-16	Drilled to total depth of 2,841 ft. CO <sub>2</sub> exploration well.
62	36-1S-21W, Catron	Ridgeway Arizona Oil No. 1 South State 36	Drilled to total depth of 3,030 ft. CO <sub>2</sub> exploration well.
63	4-1N-21W, Catron	Ridgeway Arizona Oil No. 1 State 1-4	Drilled to total depth of 2,530 early in 1998. CO <sub>2</sub> exploration well.
64	16-1N-20W, Catron	Ridgeway Arizona Oil No. 1 North State 16	Drilled to total depth of 2,871 ft in early 1998. CO <sub>2</sub> exploration well.
65	13-2N-21W, Catron	Ridgeway Arizona Oil No. 2 State	Drilled to total depth of 2,670 ft early in 1998. CO <sub>2</sub> exploration well.
66	2-1S-21W, Catron	Ridgeway Arizona Oil No. 1 State 1-2	Scheduled to be drilled to total depth of 3,000 ft. CO <sub>2</sub> exploration well.
67	36-1N-21W, Catron	Ridgeway Arizona Oil No. 2 State North 36	Scheduled to drill to depth of 2,880 ft. Horizontally drilled CO <sub>2</sub> exploration well.
68	8-31N-10W, San Juan	Burlington Resources No. 2 Marcotte	Drilled to total depth of 14,020 ft. Paleozoic test.
69	1-27N-8W, San Juan	Conoco No. 1 Stove Canyon	Drilling at end of 1997. Scheduled to be drilled to 13,800 ft.
70	6-27N-7W, Rio Arriba	Conoco No. 2 Stove Canyon	Scheduled to be drilled to 13,500 ft in Pennsylvanian strata.

val County. In many wells, production from the Dakota is commingled with production from Mesaverde and Gallup sandstones (Upper Cretaceous).

#### Entrada Sandstone

There was minor development of oil reservoirs in the Entrada Sandstone (Jurassic) in northwest New Mexico during 1997. Two development wells were drilled, one in the Media pool and one in the Eagle Mesa pool of northwest Sandoval County. One exploratory well, the Merriam Oil & Gas No. 1 Hakuna Matata (58), was drilled to a total depth of 6,487 ft in the Entrada without establishing production.

#### Pennsylvanian carbonates

Exploration for hydrocarbons in Pennsylvanian carbonate reservoirs was resurgent during 1997. Although modest production of oil and gas is obtained from Pennsylvanian reservoirs on the west flank of the San Juan Basin, the Pennsylvanian section has been tested by relatively few wells throughout most of the basin and remains a promising exploratory target. One extension gas well (51) was successfully completed in the Barker Creek field of northwest San Juan County. Burlington Resources and Conoco have cooperative ongoing exploratory programs targeted at Pennsylvanian reser-

voirs. The Burlington Resources No. 2 Marcotte well (68) was drilled in the north-central part of the basin to a depth of 14,020 ft to test Pennsylvanian and Mississippian reservoirs. Although complete results were not available at the time this report was written, it is known that gas flowed from an interval in the Pennsylvanian section at a rate of 750 MCFGPD (thousand ft<sup>3</sup> gas per day) during a production test. Carbon dioxide gas was recovered during a production test of the Leadville Limestone (Mississippian). An additional exploratory well (69) was spudded by Conoco late in 1997 in the central part of the basin. A second well (70) is scheduled to be drilled by Conoco during 1998.

#### Albuquerque Basin

Exploratory efforts continued in the Albuquerque-Belen Basin of central New Mexico. The Burlington Resources No. 1Y Westland Development well (59) was drilled to a total depth of 7,778 ft in Jurassic strata and abandoned without establishing production. It was drilled to test Upper Cretaceous sandstones, the primary targets in the basin.

Exploratory interest in the Albuquerque Basin has been intermittent. The Burlington No. 1Y Westland Development well is the latest in a series of wells drilled by Burlington, Davis Oil Company, Vastar Resources, and Twining Oil Company

during the last three years. In the early 1980s, Shell and UTEX Oil Company drilled eight wildcat wells in the basin in search of hydrocarbons in the Cretaceous section. Although production was not established by those wells, significant shows of gas were encountered, and analyses of drilling indicate that the necessary parameters for commercial production are present within the basin. Black (1982, 1989) and Molenaar (1988) summarized the petroleum geology and the history of oil and gas exploration in the Albuquerque Basin.

#### Northeast New Mexico

Exploratory activity in northeast New Mexico was quiet compared to recent years. Additional wells were not drilled in the Bravo dome carbon dioxide gas field of Union and Harding Counties in 1997. Although no new wells were drilled, additional lands were leased in the Tucumcari Basin and in west-central and northeast Union County.

New state leases were acquired throughout the year in the Tucumcari Basin. In the January 1997 state-lease sale, Yates Petroleum Corp. acquired state leases on 3,200 acres in northeast Curry County while Circle Energy acquired 2,200 acres of state leases in northeast Guadalupe County and Rio Grande Resources acquired 3,200 acres of state leases in central Guadalupe and southern Quay Counties. In the March 1997 state lease sale, Rio Grande Resources and Eugenio Perez obtained an additional 9,100 acres of leases in central Guadalupe County. During May, IBIS Petroleum leased 2,900 acres of state lands in central Guadalupe County. Although commercial production of hydrocarbons has not been obtained from the Tucumcari Basin, marginally commercial discoveries of both oil and gas were made in the early 1980s (Broadhead and King, 1988). Primary objectives in the basin are Pennsylvanian sandstones and limestones and Lower Permian dolostones.

Elsewhere in northeast New Mexico, there has been extensive leasing of lands in northeast Union County near the Colorado border. Rio Grande Resources leased 7,600 acres during the January and March state-lease sales. Although the objectives of this lease play are not known, they may involve Morrow sandstones (Lower Pennsylvanian) that produce oil in southeast Colorado.

Leasing activity also took place in west-central Union County. IBIS Petroleum acquired 10,900 acres of state leases in this area during May and June 1997.

#### Southwest New Mexico

No petroleum exploration wells were drilled in southwest New Mexico during

1997. However, a 2-D seismic line was shot in the Carrizozo Basin of eastern Socorro and northwestern Lincoln Counties. This line was acquired as a followup to the two wells drilled by Manzano Oil during 1996; one of those wells encountered an excellent gas show in the Atoka (Lower Pennsylvanian) section.

Leasing activity was fairly heavy in the Pedregosa Basin of Hidalgo County. During the December 1997 state-lease sale, Daniel E. Gonzales, Doug J. Schutz, and R. R. Hinkle Co. acquired leases on 45,000 acres of state trust lands in the southeast part of Hidalgo County. Thompson (1981) and Thompson and Jacka (1981) have discussed the petroleum geology of the Pedregosa Basin.

Ridgeway Arizona Oil Company began drilling a series of seven CO<sub>2</sub> exploration wells (61–67) in western Catron County during late 1997. These wells are being drilled to delineate the east boundary of a CO<sub>2</sub> field that was discovered in the Holbrook Basin of eastern Arizona during 1994 (Heylman, 1997; Petzet, 1997). The CO<sub>2</sub> is trapped in sandstone reservoirs in the Yeso and Abo Formations (Permian). Although reserves will not be fully defined until all of the wells have been drilled and evaluated, preliminary calculations indicate several trillion ft<sup>3</sup> CO<sub>2</sub> may be present (Don Riggs, oral comm. 1997). Although no pipeline presently exists to transport the CO<sub>2</sub> to market, construction of a 600-mi pipeline to southern California is being considered (Petzet, 1997); CO<sub>2</sub>

transported to California would be used in enhanced oil recovery. Other options may include building a pipeline to transport the CO<sub>2</sub> to the Permian Basin where it could be used in enhanced oil recovery.

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