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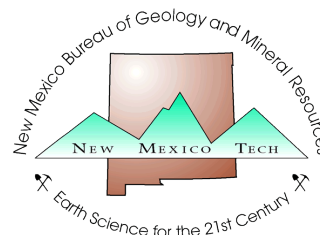
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Oil and gas activities in New Mexico in 1994

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 remained steady in 1994. A total of 1,296 wells were completed in 1994, an increase of 0.5% from the 1,289 wells completed in 1993. In the Permian Basin, southeast New Mexico, 793 wells were completed in 1994, down from 848 wells completed in 1993. In the San Juan Basin, northwest New Mexico, 503 wells were completed in 1994, up from the 441 wells completed during 1993.

During 1994, there was significant exploratory activity in the producing Permian and San Juan Basins. There was also significant exploratory activity in presently nonproductive areas such as the Tucumcari Basin, Española Basin, and on Chupadera Mesa of Socorro and Lincoln Counties. Rank wildcat wells were drilled in the Tucumcari and Española Basins, and exploratory activities will continue into 1995 in the Tucumcari Basin and on Chupadera Mesa. Plans were also made to drill an exploratory well in 1995 in the Albuquerque Basin.

The locations of significant wildcat wells completed in 1994 are shown in Fig. 1. Table 1 summarizes the significant wildcat discoveries, and Table 2 summarizes significant but unsuccessful wildcat wells. Table 3 lists significant wildcat wells that were being drilled, were not completed, were held "tight" at the end of 1994, or were planned to be drilled in 1995. 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 decreased in 1994 in the three geologic subdivisions of the Permian Basin: the Delaware Basin, the Central Basin platform, and the Northwest shelf; 793 wells were completed in this area in 1994, a decrease from the 848 wells completed during 1993; 552 of these wells were completed as oil producers and 139 were completed as gas producers while 101 were dry and abandoned, resulting in a success rate of 87%. 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 primary targets of development drilling in 1994. Approximately 150 wells were completed in these zones. Drilling was primarily for development in mature fields on the Central Basin plat-

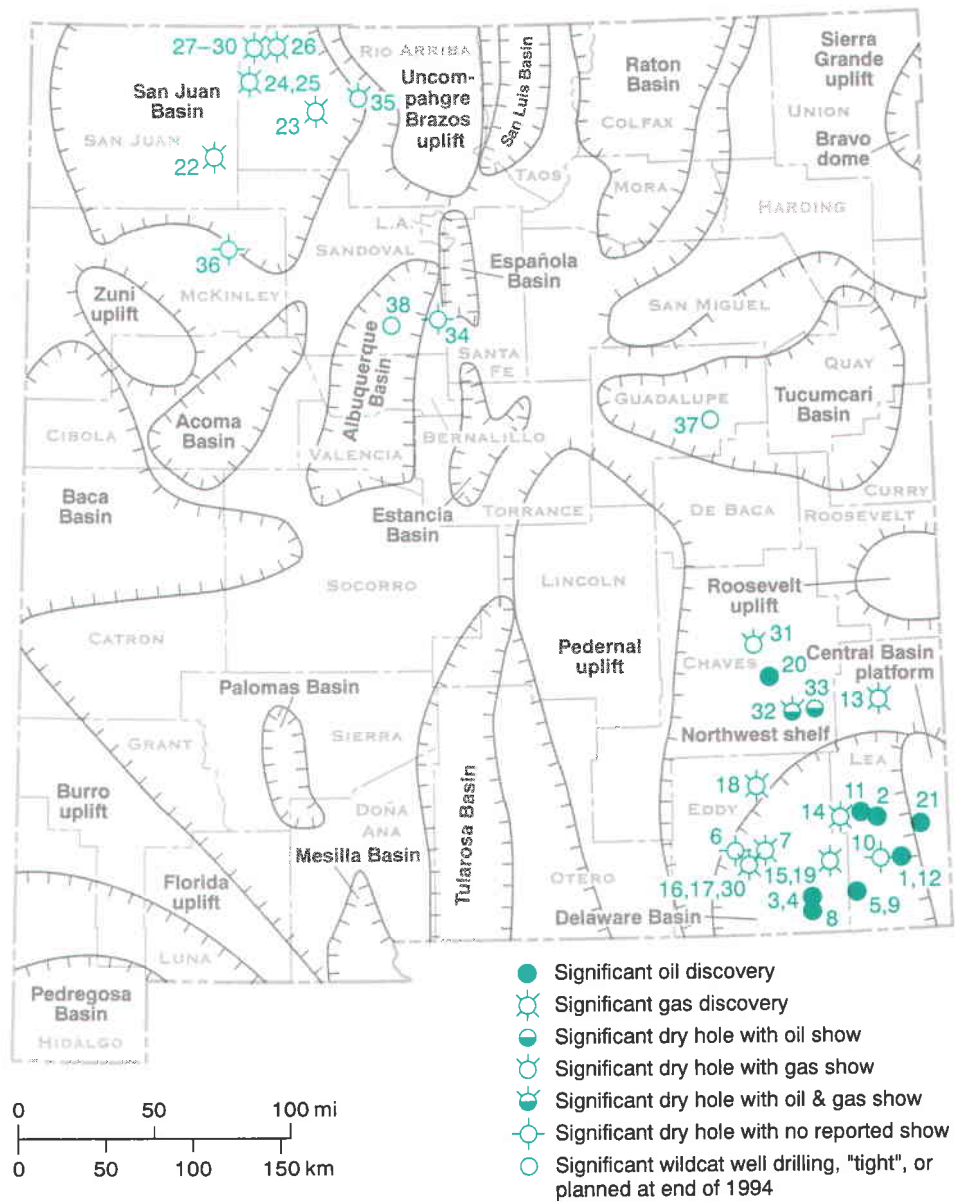


FIGURE 1—Significant oil and gas discoveries, dry holes, and frontier wildcat wells drilled in New Mexico in 1994. Major geologic features are from Broadhead and King (1988), Cather and Johnson (1984), Kelley (1978), Kottlowski and Stewart (1970), Meyer (1966), Molenaar (1977), Thompson and Jacka (1981), and Woodward et al. (1978).

form in Lea County. Activity was widespread, with significant numbers of development wells completed in Yates and Queen reservoirs in the Rhodes, Langlie–Mattix, and Eumont pools of Lea County and in the Queen Formation in the Shugart pool of Eddy County. Although exploration for hydrocarbons in Upper Guadalupian reservoirs was limited, one especially noteworthy discovery was made. Oil was discovered in the Stevens & Tull No. 2 New Mexico DW State well (1) in central Lea County and pushed Yates production westward on the Central Basin platform.

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 1994. Approximately 80 wells were completed in these zones. Drilling was primarily for development of mature fields on the southern part of the Northwest shelf in northern Eddy and west-central Lea Counties. Activity was widespread with wells drilled in 27 pools. Drilling was concentrated in the Grayburg–Jackson and Millman East pools of Eddy County and in the Maljamar pool

TABLE 1—Significant wildcat discoveries in New Mexico in 1994; the term formation is used in an informal sense. **BOPD**, bbls oil per day; **MCFD**, thousand ft³ gas per day; **BWPD**, bbls water per day; **IPP**, initial potential pumping; **IPF**, initial potential flowing; **NR**, not reported.

| 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 | 6-22S-35E, Lea | Stevens & Tull No. 2 New Mexico DW State | 5/94 | 3,944 | Seven Rivers (Permian) | Yates (Permian) | 3,700-3,829 | IPP 252 BOPD + 70 MCFD + 65 BWPD | 30 |
| 2 | 34-19S-34E, Lea | Mallon Oil No. 1 Mallon 34 Federal | 9/94 | 6,306 | Delaware (Permian) | Grayburg (Permian) | 5,094-5,138 | IPP 50 BOPD +100 BWPD | 35 |
| 3 | 16-24S-29E, Eddy | Pogo Producing No. 1 Buck H State | 6/94 | 7,850 | Bone Spring (Permian) | Delaware (Permian) | 5,122-7,690 | IPP 122 BOPD + 76 MCFD + 131 BWPD | |
| | | | 2/94 | | | Bone Spring (Permian) | 7,608-7,690 | IPF 55 BOPD + 201 MCFD + 30 BWPD | |
| 4 | 1-25S-28E, Eddy | Siete Oil & Gas No. 1 Seminole Federal | 1/94 | 6,429 | Bone Spring (Permian) | Delaware (Permian) | 4,902-5,002 | IPP 30 BOPD + 20 MCFD + 130 BWPD | 39 |
| 5 | 7-24S-32E, Lea | Enron Oil & Gas No. 1 Mesa Verde 7 Federal | 7/94 | 9,880 | Bone Spring (Permian) | Delaware (Permian) | 7,178-7,205 | IPP 188 BOPD + 145 BWPD | |
| 7 | 14-21S-26E, Eddy | Yates Petroleum Corp. No. 1 South Avalon MA Federal Com. | 12/94 | 11,400 | Mississippian | Bone Spring (Permian) | 5,944-6,127 | IPF 913 MCFD | |
| 8 | 9-25S-29E, Eddy | Maralo, Inc. No. 1 Pickett Draw Federal | 1/94 | 13,930 | Morrow (Pennsylvanian) | Bone Spring (Permian) | 8,573-8,641 | IPF 145 BOPD + 400 MCFD + 143 BWPD | 44 |
| 9 | 6-24S-32E, Lea | Santa Fe Energy No. 1 Zia 6 Federal | 7/94 | 9,930 | Bone Spring (Permian) | Bone Spring (Permian) | 9,690-9,706 | IPP 41 BOPD + 78 MCFD + 30 BWPD | 41 |
| 11 | 25-19S-33E, Lea | Union Oil Of California No. 1 Smith | 1/94 | 13,650 | Mississippian | Strawn (Pennsylvanian) | 12,175-12,187 | IPF 39 BOPD + 74 MCFD | 47 |
| 12 | 5-22S-35E, Lea | Mitchell Energy No. 2 San Simon 5 State | 11/94 | 13,250 | Morrow (Pennsylvanian) | Strawn (Pennsylvanian) | 11,696-11,742 | IPF 8 BOPD + 118 MCFD + 39 BWPD | 43 |
| 13 | 26-12S-34E, Lea | Phillips Petroleum No. 17 Ranger | 2/94 | 14,100 | Precambrian | Atoka (Pennsylvanian) | 11,675-11,694 | IPF 1,722 MCFD | |
| 14 | 33-19S-32E, Lea | Fina Oil & Chemical No. 1 Federal HH 33 | 8/94 | 12,850 | Morrow (Pennsylvanian) | Atoka (Pennsylvanian) | 12,040-12,049 | IPF 1,518 MCFD | |
| 15 | 24-22S-30E, Eddy | Mitchell Energy No. 1 Apache 24 Federal | 11/94 | 14,525 | Morrow (Pennsylvanian) | Atoka (Pennsylvanian) | 13,704-13,083 | IPF 1,983 MCFD | |
| 16 | 6-22S-26E, Eddy | Mewbourne Oil No. 1 Federal N | 2/94 | 11,500 | Mississippian | Atoka (Pennsylvanian) | 10,264-10,272 | IPF 199 MCFD | |
| 17 | 30-22S-26E, Eddy | Mitchell Energy No. 1 McKittrick 30 Federal | 12/94 | 11,660 | Morrow (Pennsylvanian) | Atoka (Pennsylvanian) | 10,540-10,594 | IPF 342 MCFD | |
| 18 | 31-17S-27E, Eddy | Yates Petroleum Corp. No. 1 Fasken Exxon AOF Federal | 3/94 | 9,465 | Mississippian | Morrow (Pennsylvanian) | 9,078-9,102 | IPF 2,600 MCFD | |
| 19 | 7-22S-31E, Eddy | Yates Petroleum Corp. No. 1 Llama ALL Federal | 12/94 | 14,300 | Morrow (Pennsylvanian) | Morrow (Pennsylvanian) | 12,853-12,856 | IPF 1,772 MCFD | |
| 20 | 33-10S-27E, Chaves | Hanagan Petroleum No. 1 Gray Wolf State | 12/94 | 6,522 | Devonian | Siluro-Devonian | 6,508-6,522 | IPP 81 BOPD + 15 MCFD | 35 |
| 21 | 36-20S-37E, Lea | Conoco, Inc. No. 1 Hardy 36 State | 4/94 | 10,625 | granite wash (Ordovician?) | McKee (Ordovician) | 9,940-10,285 | IPP 143 BOPD + 193 MCFD + 3 BWPD | 43 |

(Table 1 continues on page 56)

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) |
|------------------|--|--|-------------------------|------------------|----------------------------|------------------------------|-------------------------|----------------------|---------------------------|
| 22 | 33-24N-9W, San Juan | Dugan Production No. 1 Ohwada | 3/94 | 2,105 | Chacra (Cretaceous) | Chacra (Cretaceous) | 1,806-1,883 | NR (gas well) | |
| 23 | 26-27N-3W, Rio Arriba | Meridian Oil No. 11 Jicarilla 95 | 12/94 | 8,644 | Morrison (Jurassic) | Gallup (Cretaceous) | 7,320-7,594 | IPF 487 MCFD | |
| 24 | 16-29N-7W, Rio Arriba | Meridian Oil No. 92 San Juan 29-7 Unit | 1/94 | 5,609 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,135-3,285 | IPF 4,222 MCFD | |
| 25 | 14-30N-7W, Rio Arriba | Meridian Oil No. 66 San Juan 30-6 Unit | 4/94 | 5,490 | Point Lookout (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,004-3,024 | IPF 91 MCFD | |
| 26 | 31-31N-5W, Rio Arriba | Northwest Pipeline No. 137 Rosa Unit | 7/94 | 6,170 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,360-3,446 | IPF 1,650 MCFD | |
| 27 | 16-31N-6W, San Juan | Northwest Pipeline No. 145A Rosa Unit | 10/94 | 6,091 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,227-3,332 | IPF 1,374 MCFD | |
| 28 | 22-31N-6W, Rio Arriba | Northwest Pipeline No. 18A Rosa Unit | 8/94 | 5,955 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,139-3,225 | IPF 1901 MCFD | |
| 29 | 26-31N-6W, Rio Arriba | Northwest Pipeline No. 8A Rosa Unit | 8/94 | 5,955 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,113-3,208 | IPF 2774 MCFD | |
| 30 | 33-32N-5W, Rio Arriba | Schalk Development No. 3 Schalk 62 | 6/94 | 5,890 | Mancos (Cretaceous) | Pictured Cliffs (Cretaceous) | 3,088-3,133 | IPF 8 MCFD + 16 BWPD | |

TABLE 2—Significant wildcat dry holes in New Mexico in 1994; the term formation is used in an informal sense. **D&A**, dry and abandoned; **DST**, drill-stem test; **rec**, recovered; **GCM**, gas-cut mud; **HOGCM**, heavy oil- and gas-cut mud; **HOCM**, heavy oil-cut mud; **SGCW**, slight gas-cut water; **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 | Status | Comments |
|------------------|---|--|-------------------------|------------------|--------------------------|--------|---|
| 6 | 4-22-25E, Eddy | Enron Oil & Gas No. 1 Champaign 4 Federal | 5/94 | 4,240 | Bone Spring (Permian) | D&A | Perf 1,952-2,109 ft, 3,031-3,121 ft, no reported shows. |
| 10 | 14-22S-34E, Lea | BTA Oil Producers No. 1 Chiso 8711 JV-P (owwo) | 8/94 | 13,500 | Morrow (Pennsylvanian) | D&A | Perf 12,801-12,823 ft (Morrow), no reported show. Perf 10,746-10,790 ft (Bone Spring), no reported show. |
| 31 | 34-8S-26E, Chavez | Yates Petroleum Corp. No. 1 Martin ADW Federal | 7/94 | 6,525 | Precambrian | D&A | DST 5,996-6,090 ft (Ordovician), rec 60 ft mud; 2,350 cc mud & 0.03 ft ³ gas in sample chamber. |
| 32 | 6-13S-29E, Chaves | Thornton Operating No. 1 Seagull Federal | 4/94 | 9,250 | Siluro-Devonian | D&A | DST 8,276-8,332 ft (Morrow), rec 90 ft mud. DST 9,126-9,170 ft (Devonian), rec 6,374 GCM & tr oil. DST 9,142-9,172 ft (Devonian), rec 470 ft HO & GCM. DST 9,100-9,177 ft (Devonian), rec 403 ft HOCM. DST 9,187-9,234 ft (Devonian), rec 2,200 ft water. |
| 33 | 4-14S-29E, Chaves | Hanagan Petroleum No. 1 Leapin Lizzard | 11/94 | 9,830 | Devonian | D&A | DST 9,760-9,772 ft (Devonian), rec 1,700 ft oil. DST 9,786-9,796 ft (Devonian), rec 2,500 cc mud in sample chamber. DST 9,807-9,830 ft (Devonian), rec 1,625 ft water & 60 ft mud. |
| 34 | 34-14N-6E, Sandoval | Merrion Oil & Gas No. 2 Blackshare | 3/94 | 6,820 | Morrison (Jurassic) | D&A | Drilled in Espanola Basin to test Entrada Sandstone (Jurassic). |
| 35 | 28-27N-1E, Rio Arriba | Enre Corp. No. 1 Phoenix | 8/94 | 3,871 | Entrada (Jurassic) | D&A | Drilled to test Entrada Sandstone (Jurassic). DST 2,706-2,736 ft (Dakota), rec 1670 ft SGCW. DST 3,592-3,608 ft (Entrada), no details. DST 3,609-3,648 ft (Entrada), rec 1,800 ft water. |
| 36 | 18-18N-8W, McKinley | Merrion Oil & Gas No. 1 North Hospah 18 | 12/94 | 3,192 | Dakota (Cretaceous) | D&A | Drilled to test Dakota Group (Cretaceous). |

TABLE 3—Significant wildcat wells being drilled, held “tight,” or scheduled to be drilled.

| Number on Fig. 1 | Location (section-township-range, county) | Operator, Well number, and lease | Comments |
|------------------|---|----------------------------------|--|
| 37 | 32-7N-23E, Guadalupe | Labrador Oil No. 1 Jones State | Drilled to 10,500 ft in 1994. Re-entered in 4/95 and drilled to total depth of 18,500 ft. “Tight” hole. |
| 38 | 3-13N-3E, Sandoval | Vastar Resources No. 1 Tamara 3 | Scheduled to be drilled in Albuquerque Basin to total depth of 9,100 ft to test Dakota Sandstone (Upper Cretaceous). |

of Lea County. Although exploration along the mature San Andres and Grayburg trends was limited, one significant discovery was made. The Mallon Oil No. 1 Mallon 34 Federal well (2) established production from the Grayburg Formation in an area of west-central Lea County that is sparsely productive from the Grayburg.

Delaware Mountain Group sandstones

The most active play in New Mexico continued to be the basal sandstone reservoirs of the Delaware Mountain Group (Permian: Guadalupian). During 1994, 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 northern part of the Delaware Basin. Exploration was more subdued than in previous years, with only six exploratory wells drilled. Development was mostly by infill drilling and conservative stepouts from known production; the development success rate of Delaware reservoirs exceeded 99% in 1994. Development wells were drilled in 39 oil pools. The Red Tank West, Ingle Wells, Sand Dunes West, and Los Medanos pools were the most intensely developed Delaware reservoirs in 1994. As in the past few years, most of drilling was for oil in the Brushy Canyon Formation, the lowermost of the three sandstone-bearing formations that constitute the Delaware.

Three significant discoveries of oil in the Delaware were made during 1994. Oil was discovered in sandstones in the lower part of the Delaware in the Pogo Producing No. 1 Buck H State well (3) in southeast Eddy County; oil was also discovered in the Bone Spring Formation in the same well. Oil was discovered in the middle part of the Delaware Mountain Group in the Siete Oil & Gas No. 1 Seminole Federal well (4) in south-central Eddy County. On the eastern edge of the Delaware play in southwest Lea County, oil was discovered in the Delaware in the Enron Oil & Gas No. 1 Mesa Verde 7 Federal well (5). On the western edge of the Delaware play, the Enron No. 1 Champagne 4 Federal well (6) was drilled to a total depth of 4,240 ft before being abandoned; sandstones in the upper and middle parts of the Delaware were unsuccessfully tested.

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 1994. More than 70 wells were drilled for oil in these reservoirs. 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 27 oil pools in eastern Eddy and western Lea Counties. Drilling activity was most intense in the Red Hills pool of southernmost Lea County and in the Old Millman Ranch pool of east-central Lea County. Fifteen development oil wells were successfully completed in the Red Hills pool. Generally, oil pools in the southern part of Lea and Eddy Counties have been relatively small; most have only 1 to 3 wells. The establishment of Red Hills as a relatively large pool indicates that significant accumulations of hydrocarbons may exist within the Bone Spring in this area.

Exploration for hydrocarbons in Bone Spring reservoirs surged in 1994. Perhaps the most significant Bone Spring discovery was on the western edge of the Bone Spring play in the Yates Petroleum Corp. No. 1 South Avalon MA Federal Com. (7); in that well, gas was discovered in the upper Bone Spring. In the sparsely tested southern part of the Bone Spring play, oil was discovered in the middle part of the Bone Spring in the Maralo Inc. No. 1 Pickett Draw Federal well (8) and in the Santa Fe Energy No. 1 Zia 6 Federal well (9). An unsuccessful exploratory test was the BTA Oil Producers No. 1 Chiso 8711 JV-P well (10), drilled on the eastern edge of the Bone Spring play. This well was drilled to a total depth of 13,500 ft in search of gas in the Morrow Group (Lower Pennsylvanian); after an unsuccessful test of the Morrow, the shallower Bone Spring was tested without reported recovery of hydrocarbons.

Yeso shelf sediments

Shallow shelf carbonate reservoirs of the Yeso Formation (Permian: Leonardian) were actively drilled in 1994. Seventy-five

development wells were drilled in 15 pools on the Central Basin platform in southern Lea County and in the Vacuum field on the Northwest shelf in west-central Lea County. Production is obtained from all three members of the Yeso (descending): 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 1994 were the Blinebry pool on the Central Basin platform in southernmost Lea County and the Vacuum pool on the southeastern margin of the Northwest shelf.

There was limited exploration for hydrocarbons in Yeso reservoirs. Several wells were drilled successfully within one mile of established production.

Abo sandstone and carbonate reservoirs

Development of sandstone reservoirs in the Pecos Slope and Pecos Slope West gas pools continued in 1994 at a diminished pace from previous years. Fourteen gas wells were completed in these “tight” gas reservoirs. There was only limited development of Abo shelf-margin carbonate reservoirs on the southern edge of the Northwest shelf.

Upper Pennsylvanian carbonates

Moderately deep (7,000–10,000 ft) Cisco and Canyon (Upper Pennsylvanian) carbonate reservoirs continued to be developed in 1994. Forty-eight development wells were successfully completed in nine reservoirs. Activity was concentrated in the Dagger Draw North pool where 16 development oil wells were successfully completed and in the Dagger Draw South pool where 15 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 years. Upon realization that substantial oil resources remained unproduced in these reservoirs, drilling programs were instituted to tap into those resources. The result was an immediate increase in production (Fig. 2) and Dagger Draw North and Dagger Draw South quickly became two of the most productive oil pools in southeast New Mexico. In 1992, they provided approximately 10% of the state’s total oil production.

Strawn reservoirs

Development of moderately deep (10,000–12,000 ft) Strawn (Middle Pennsylvanian) reservoirs continued at a slow pace in 1994. Development of existing reservoirs was slow, with only 17 development wells completed in 13 fields. Exploration for oil and gas in Strawn reservoirs

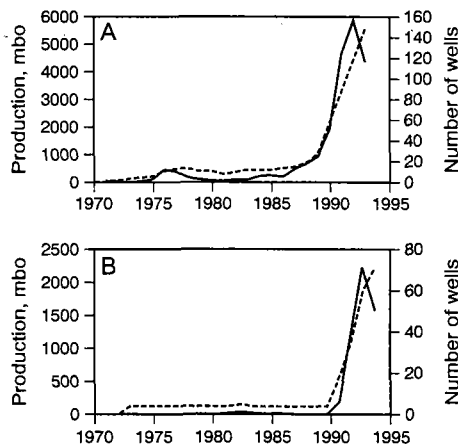


FIGURE 2—Historical annual oil production and number of producing wells in **A**, Dagger Draw North Upper Pennsylvanian pool, and **B**, Dagger Draw South Upper Pennsylvanian pool. Source of data: New Mexico Oil Conservation Division.

was vigorous, however. Oil was discovered in the Strawn in the Union Oil of California No. 1 Smith (11) and the Mitchell Energy No. 2 San Simon 5 State (12) wells in southern Lea County. Although there is some Strawn production in southern Lea County, these wells were drilled southeast of the main Strawn trend, which extends from Carlsbad to Lovington.

Atoka and Morrow "deep gas" reservoirs

The deep (10,000–14,000 ft) gas reservoirs in the Atoka and Morrow groups saw limited development with only 35 development gas wells completed in 32 pools in 1994. Exploratory drilling was fairly vigorous, however. Most exploration was for gas in the Atoka (wells 13, 14, 15, 16, 17) although two wells (18, 19) found Morrow gas in areas where shallower zones were already productive.

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 fault-bounded anticlinal closures. Nine dry exploratory tests were drilled on the Northwest shelf, and 4 were drilled on the Central Basin platform. Two successful wildcat wells were also drilled. On the Northwest shelf, oil was discovered in the Siluro-Devonian section in the Hanagan Petroleum No. 1 Gray Wolf State well (20). On the Central Basin platform, oil was discovered in the McKee Sandstone of the Simpson Group (Ordovician) in the Conoco No. 1 Hardy 36 State well (21). Exploration for structural traps in the Devonian, Silurian, and Ordovician sections is expected to remain strong through

1995 and 1996. Better definition of the relatively small structures that form traps in the lower Paleozoic has been made possible by new and affordable 3-D seismic techniques.

San Juan Basin, northwest New Mexico

Drilling activity increased during 1994 in the San Juan Basin. There were 503 completions during the year, an increase of 14% from the 441 completions in 1993. The success rate was 97%, with 455 wells completed as gas producers, 32 wells completed as oil producers, and 16 wells plugged and abandoned. Drilling concentrated on development of gas reservoirs in the Fruitland coals (Cretaceous), Mesaverde sandstones (Cretaceous), Pictured Cliffs Sandstone (Cretaceous), and Dakota sandstones (Cretaceous).

Fruitland coalbed methane reservoirs

Gas reservoirs of the Fruitland Formation (Upper Cretaceous) continued to be aggressively developed in 1994. More than 130 wells were completed in the Fruitland; most of these wells were drilled in coalbed methane reservoirs of the giant Basin pool in eastern San Juan and western Rio Arriba Counties. Twenty-nine wells were drilled to Fruitland sandstone reservoirs in the same area.

Pictured Cliffs Sandstone

Gas reservoirs in the Pictured Cliffs Sandstone (Upper Cretaceous) were major targets for exploratory and development drilling in 1994. Development drilling was concentrated in the Blanco pool of eastern San Juan and western Rio Arriba Counties and the Kutz West pool of eastern San Juan County. Exploration for gas in Pictured Cliffs sandstones was rejuvenated in 1994 with seven new pool discoveries drilled by Meridian Oil, Northwest Pipeline, and Schalk Development Company (24–30). These discoveries were drilled northeast of the main producing trend of the Pictured Cliffs (see Whitehead, 1993). Most of the wells were completed as development wells in Mesaverde gas reservoirs as well as in the Pictured Cliffs. They demonstrate significant potential remains in the Pictured Cliffs northeast of the main producing trend.

Mesaverde sandstones

Development of gas reservoirs in Mesaverde sandstones (Upper Cretaceous) remained strong during 1994. A total of 140 development gas wells were completed in Mesaverde sandstones. Almost all these wells were completed in the Blanco pool of northeast San Juan and northwest Rio Arriba Counties. Exploration for gas in the Mesaverde was minimal in 1994.

Gallup Sandstone

Oil reservoirs in the Gallup Sandstone (Upper Cretaceous) saw minimal development activity in 1994. Approximately 20 development wells were completed in nine reservoirs. Most wells were drilled in the Lybrook and Cha Cha pools. One significant wildcat discovery was also made; gas was discovered in the Gallup in the Meridian Oil No. 11 Jicarilla 95 well (23). This discovery is northeast of the Gallup oil-producing trend and is in an area where the Gallup produces mostly gas.

Dakota sandstones

Oil and gas reservoirs in sandstones of the Dakota Group (Upper Cretaceous) were aggressively developed in 1994. Twelve oil wells and 76 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 restricted to the Lindrith West pool of southeast Sandoval County. In many of these wells, production from the Dakota is commingled with production from Gallup and Graneros sandstones (Upper Cretaceous).

Entrada Sandstone

There was limited exploration for hydrocarbons in the Entrada Sandstone (Jurassic) in northwest New Mexico during 1994. In the San Juan Basin, the Enre Corp. No. 1 Phoenix well (35) was drilled along the eastern margin of the San Juan Basin; it was abandoned after unsuccessfully testing the Dakota Group (Cretaceous) and the Entrada. In the southern part of the Espanola Basin, the Merrion Oil & Gas No. 2 Blackshare well (34) was drilled to a total depth of 6,820 ft to test the Entrada. Unfortunately, extensive volcanic intrusives of probable Tertiary age were encountered unexpectedly at a depth of 5,275 ft, and production was not established.

Pennsylvanian carbonates

Exploration for hydrocarbons in Pennsylvanian carbonate reservoirs was minimal in 1994. Two development gas wells were successfully completed in the Ismay Member of the Paradox Formation in the Barker Creek field of northwest San Juan County. Although moderate production of oil and gas is obtained from Pennsylvanian reservoirs on the western 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.

Albuquerque Basin

Elsewhere in northwest New Mexico, Vastar Resources continued exploratory efforts in the Albuquerque Basin. These exploratory efforts have subsequently resulted in staking a location for a wildcat

well, the Vastar No. 1 Tamara 3 (38) in the northern part of the basin. The well is expected to be spudded in late 1995.

Exploratory interest in the Albuquerque Basin has been intermittent. The last exploration was in the early 1980s when 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) has summarized the history of petroleum exploration in the Albuquerque Basin.

Northeast New Mexico

Northeast New Mexico saw significant exploratory activity and plans for significant development in 1994. A petroleum exploration well was spudded in the Tukumcari Basin. Plans were made to further develop carbon dioxide resources on the Bravo dome. In addition, plans were considered to develop and produce coalbed methane in the Raton Basin.

In the Tukumcari Basin, the Labrador Oil Company No. 1 Jones State well (37) was spudded in September 1994 and drilled to a reported depth of 10,500 ft by November. A larger drilling rig was moved onto the location in April 1995, and the hole was deepened to a depth of 18,500 ft; the well was subsequently plugged and abandoned. Although details about the well are sketchy, it appears that abandonment was caused by problems with a caving hole; apparently, shows of oil and gas were encountered. During the June 1994 state lease sale, Labrador oil successfully bid on 12,831 acres of state trust land in northeast DeBaca and southeast Guadalupe Counties, continuing its lease play of previous years.

Commercial production of hydrocarbons has not been obtained from the Tukumcari Basin, but marginally commercial discoveries of both oil and gas were made in the early 1980s (Broadhead and King,

1988); these discoveries were never exploited. Primary objectives in the basin are Pennsylvanian sandstones and limestones and Lower Permian dolostones (Broadhead and King, 1988; Broadhead, 1990).

Pennzoil is still considering a program to develop and produce coalbed methane in the Vermejo Formation (Cretaceous) in the Raton Basin. From 1989 through 1991, Pennzoil drilled more than 30 wells as part of a pilot program to test and evaluate coalbed methane in the basin. Primary use of the gas, if developed and produced, will be for generation of electricity at a proposed power-generating plant in the city of Springer.

Elsewhere in northeast New Mexico, Amoco made plans to continue development of the Bravo dome carbon dioxide gas field. Amoco will drill 31 new wells and recomplete 13 existing wells to enhance production from this field to approximately 400 MMCFD. During the June 1994 state lease sale, Amerada Hess successfully bid on 1,080 acres of state trust land in southern Harding County on the western part of the Bravo dome field. This leasing activity indicates that Amerada Hess may attempt to further develop its part of the Bravo dome field. Almost all of the carbon dioxide produced from the Bravo dome field is transported through pipelines to the Permian Basin where it is used in enhanced oil recovery. A minor amount is converted to dry ice and bottled, liquid carbon dioxide at small processing facilities in Harding and Union Counties.

Southwest New Mexico

No petroleum exploration wells were drilled in southwest New Mexico in 1994. However, a large lease play continued to be developed in the Chupadera Mesa area of east Socorro and northwest Lincoln Counties with exploratory work done on land leased during 1993 by independent Ben Donegan.

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