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The history of petroleum exploration in southwestern New Mexico

William M. Sandeen
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Permian

The Permian of central New Mexico consists of the shaly Bursum formation, the red sandstones, largely continental, of the Abo formation, the gypsiferous Yeso formation, and the massive San Andres limestone. The Abo is considered Wolfcamp in age, the Yeso and San Andres together as equivalent to the Leonard. But the formational boundaries are not clear time lines. The Bursum has been found to interfinger with the lower Abo in the Sacramento Mountains. Read has reported a flora from the upper Abo indicative that in some places, at least, the Abo deposition continued on into Leonard time. Lateral gradation of part of the Glorieta sandstone into beds of Yeso lithology has been demonstrated.

The problem becomes more complex in southern New Mexico, where Bursum and Abo beds grade laterally into lower Permian limestones, and become the Hueco limestones in Texas. The little known Gym limestone of southern New Mexico is apparently of lower Permian age, and its fauna indicates that it is the equivalent, at least in part, of the Hueco limestone. In the Hatchet Mountains a thick Permian section is found, clearly extending farther up in the section than any beds known in the south-central region, and more closely allied to the higher Permian beds of Arizona, than to anything in the southeast region of New Mexico.

THE HISTORY OF PETROLEUM EXPLORATION IN SOUTHWESTERN NEW MEXICO

by
William M. Sandeen*

Introduction

The southwestern one quarter of New Mexico includes Catron, Dona Ana, Grant, Hidalgo, Luna, Sierra, and Socorro counties.

This region may be divided into three separate physiographic divisions. The Mogollon Plateau comprises the northwestern portion of the region. The Basin and Range province includes the southern portion of the area, the eastern portion of which is the southern Rio Grande Valley. This area between the Black Range and the Sacramento Mountains, extends into portions of Lincoln and Otero counties.

The Mogollon Plateau is almost exclusively covered by Tertiary intrusives and extrusives. The Basin and Range section consists of a series of tilted fault-block mountains separated from one another by the flat-floored desert valleys called bolsons.

The pre-Mississippian sedimentary beds thin depositionally and erosionally northward to the Mogollon Plateau on the west and to the approximate location of San Antonio (Socorro County) on the east. Epeirogenic downwarping took place to the south during lower Paleozoic time. Mississippian sediments appear to overlap onto the margins of the erosional surface but were subsequently eroded in central New Mexico. This late Mississippian-early Pennsylvanian erosion was followed by the invasion of widespread Pennsylvanian seas. The Wolfcamp, basal Permian, seems to follow the sedimentation pattern originated in Pennsylvanian time, with the Abo representing a regressive facies. A prolonged period of erosion followed the deposition of the San Andres formation.

The Permian-Cretaceous unconformity is overlain in some regions by thick conglomerates. Cretaceous seas appear to have advanced over an irregularly developed land-mass of which local islands remained during at least a portion of Mesaverde time.

History of petroleum exploration

The search for oil and gas in southwestern New Mexico began more than thirty years ago. Although more than a hundred wells have been drilled in this region, the Laing No. 1 Sanchez, Socorro County, approximately eight miles southwest of Scholle, is the only one that encountered significant shows of oil or gas. This test, which was completed in January of 1952, recovered 200 MCFGPD from the Pennsylvanian at a depth of 836 feet. The offset to this test, the No. 2 Sanchez, reportedly shut down due to financial difficulties.

Although shows of oil and gas have been reported in the twenty-seven wells listed in the accompanying table, there is a reasonable doubt as to the validity of many of the shows.

Approximately 35% of the wells drilled in the area were started in the twenties. The year 1926 was a

* Standard Oil Company of Texas, El Paso, Texas

banner one in which more tests were commenced than in any one year before or since.

One of the few early tests located on geological information was the Mitchell No. 1 Red Lake, drilled on the Red Lake anticline 22 miles north of Datil in Socorro County. This well encountered Pennsylvanian rocks overlying an eroded granite, and held the depth record for southwestern New Mexico (4,012 feet) until the completion of the Angelus No. 3 State, 17 miles north-northwest of Deming, which was drilled in 1934.

The Lockhart No. 1 Stackhouse*, located about 24 miles east of Socorro, was also drilled on surface structure. This well, completed in 1930, was drilled to a depth of 2,772 feet, and bottomed in Pennsylvanian red beds and limestone (top of Pennsylvanian 2,515 feet). A second test, the Lockhart No. 1 Lockhart Federal, is currently being drilled on this structure to test the basal Pennsylvanian rocks. This test is expected to encounter granite at approximately 3,900 feet, and in August 1953 was drilling at a depth of 1,025 feet.

Activity remained relatively high in southwestern New Mexico during the early days of the Depression, but practically ceased between 1934 and 1937. As drilling activity began to pick up in 1937, geological and geophysical methods of exploration were increasingly utilized.

Post-War Development

Although sporadic exploration parties operated in southwestern New Mexico as early as the twenties, little interest was evidenced in the area until after World War II. The advent of high lease costs and the unavailability of open acreage in the Permian Basin of West Texas and New Mexico fostered a westward movement of petroleum exploration personnel as early as 1948. The impetus of competition forced oil companies to seek additional petroleum reserves in regions where the geologic relationships were still uncertain.

Skelly Oil Company was the first major oil company to re-enter this area following World War II, and in 1948 they drilled the No. 1 Federal Goddard on the Prairie Springs anticline, about 18 miles east of Socorro. No pre-Pennsylvanian sediments were found in this test, which reached granite at 3,384 feet.

*Known variously as the Lockhart No. 2 Powell Stackhouse and Rio Grande No. 1 Stackhouse.

The Garner Gartland No. 1 Federal, 10 miles north of Truth or Consequences, set a new depth record of 6,524 feet in 1951. This test was reported to have encountered bolson deposits overlying granite. Such an interpretation does not seem plausible because the Gartland No. 1 Drew and Mathews, approximately six miles to the east, bottomed at a total depth of 7,126 feet in Pennsylvanian beds. This test found about 1,580 feet of bolson material overlying 1,060 feet of Cretaceous rocks. The Drew and Mathews well would probably have had to reach a depth of 9,500 feet before encountering Precambrian granite.

Standard of Texas completed its No. 1 Heard, 12 miles northwest of Carrizozo on the Carrizozo anticline in May of 1951. This test was drilled to a depth of 8,050 feet, and bottomed in diorite and gneiss.

During 1952 Sun Oil Company completed two tests in the Jornada del Muerto about 18 miles northeast of Engle. It is understood that these wells were drilled on seismic information. Attempts to correlate information obtained from core tests were reported to have been unsuccessful. These two wells are believed to be the first seismograph prospects in this area. Both tests encountered a Pennsylvanian limestone section.

The Humble No. 1 Santa Fe Pacific, approximately 12 miles west-southwest of Los Lunas, in Valencia County, has encountered occasional shows of gas, and in August 1953 was drilling below 10,800 feet. The geologic information from this well will contribute much valuable data to the petroleum industry.

To adequately evaluate petroleum prospects in southwestern New Mexico is a difficult problem. Cities Service, Sun, Continental, and Humble, have approached the exploration problem by using the seismograph. Magnolia has used such tools as the magnetometer and gravity meter in the Jornada del Muerto. Skelly has attempted to verify seismograph work in the northwestern portion of Catron County by using core tests. Surface work has been done in southwestern New Mexico by Standard of Texas, Shell, Sun, Humble, and Stanolind.

Land situation

Although little leasing has been done on Federal Lands, nearly all available state acreage has been taken. The Armendariz and the Sevilleta Grants are about the only large tracts of fee acreage in the area.

CHRONOLOGICAL LIST OF WELLS REPORTING OIL AND GAS SHOWS IN SOUTHWESTERN NEW MEXICO

(The writer wishes to emphasize that the following is the information appearing on the completion cards in the files of the El Paso District Office of the Standard Oil Company of Texas, and the existence of shows in many of these wells is questionable. It is probable that many of the so-called "shows" reported from these wells would not have been reported in other sections of the country.)

WELL NAME	COUNTY	LOCATION	COMPLETION DATE	DEPTH OF SHOW	FORMATION FROM WHICH SHOW WAS ENCOUNTERED AND REMARKS
Red Feather Oil Co. #2	Catron	Sec. 30, T4N, R9W	5-1-26	(1)950-1000', (2)SO 1345-1348'	(1) Dakota, (2) Triasic (?).
Bowser-McCall Drilling Co.	Sierra	Sec. 19, T14S,R2W	9-?-27	(1) SG 534', (2)SO 1115-1120', (3) SO 1740',(4)SG 2285', (5) SOG2335',(6)SO 2545'	(1-3) Cretaceous (4-6) Probably Permian.
Arnold #1 Apache	Sierra	Sec. 13, T6S, R1W	12-9-27	SO 1690'	Probably Cretaceous.
McCall #2 Park Bowser	Sierra	Sec. 32, T14S,R2W	3-20-28	SO 415'	Cretaceous.
Arnold #2 Apache	Socorro	Sec. 13, T6S, R1W	12-9-29	SG 1955-73'	Permian.
Owens & Bouton #1 (State-Owens)	Hidalgo	Sec. 14, T22S,R20W	9-25-30	(1) SOG790-1340', (2) SG 1540' (3) SO 165-80', 405-28,1330-40'	(1, 2 & 3) Bolson deposits.
Viking Oil & Development #1 Cox	Dona Ana	Sec. 26,T23S,R5E	3-?-31	(1) SO 1057', (2)SO 3110' 3224'.	(1) Bolson Deposits, (2) Probably Permian.
Angelus Oil & Mining #3 State	Luna	Sec. 20,T21S,R10W	3-?-34	(1) SOG2300', (2)SOG4,200' (3) SOG 4503', (4)SO 4150-95' (5) SOG 5600'.	Log undecipherable. Shows questionable.
Cent.New Mexico Oil Co. #1 Brown-Livingston (Also known as Brown #1 Belen Grant)	Socorro	Sec. 16,T3N, R1E	11-28-39	SOG 1860'	Probably Bolson deposits.
Berry #1 Federal (Also known as Berry #1 Berry)	Luna	Sec. 33, T22S,R10W	12-?-39	(1) SG 520-550', (2)SG 700-770', (3) SOG 940', (4) SO1055-1077'	Probably bolson deposits.
Barney Iorio #1	Sierra	Sec. 25, T14S,R5W	4-29-41	(1) Show of asphalt at 935'	Warm mineral waters were encountered in this test.
Joiner Oil Corp.-Livingston (Belen Grant) #2 (?)	Socorro	Sec.16, T3N, R1E	10-6-41	(1) SO 845	Unknown, probably same as Cent. New Mexico Oil Co. #2 Livingston.
Wofford et al #1 (Graham-State)	Sierra	Sec. 8, T14S, R2W	12-?-41	(1) SG at 300', (2) SO at 458'	(1 & 2) Probably Cretaceous.
Parker #1 Simmons Federal (Formerly Slack & Mahres #1 Simmons)	Dona Ana	Sec. 35,T22S, R5E	3-?-42	(1) SG3040 (2) SO3028-34	(1 & 2) Possibly Permian.
Picacho Oil & Gas Syn. (Slack & Mahres) #1 Armstrong.	Dona Ana	Sec. 15,T23S,R1W	5-15-41	SG 2435 & 2620	Unknown.
Long & Beck #1 State	Hidalgo	Sec. 14,T22S,R20W	6-?-42	SO 790-848'	Unknown.

CHRONOLOGICAL LIST OF WELLS REPORTING OIL AND GAS SHOWS IN SOUTHWESTERN NEW MEXICO

WELL NAME	COUNTY	LOCATION	COMPLETION DATE	DEPTH OF SHOW	FORMATION FROM WHICH SHOW WAS ENCOUNTERED AND REMARKS
Winslow & Wofford et al #1	Sierra	Sec. 8(?)T14S,R2W	11-13-43	SG 543'	Cretaceous.
Al Parker #1 State	Dona Ana	Sec. 15, T23S, R5E	10-20-44	SO 3002'	Unknown.
Wininger Bros. & R.D. Berry & R.H. Mike #1 State	Grant	Sec. 16, T27S,R16W	10-16-47	(1) SG 950, (2) SOG 1495-1500'	(1) Prob. Montoya, (2) Prob. El Paso, pos. Bliss
Colgrove & Brinker #1 State (Colusa Remedy Co.)	Grant	Sec. 3, T20S, R11W	3-27-47	SO 1757-59	Cretaceous (?).
F.B. Umbarger #1 State (formerly Long & Gossom)	Hidalgo	Sec. 14, T22S,R20W	5-1-59	SOG (No depth given).	Unknown.
Snowden & Clary Interests #1 State (formerly Clary & Ruther)	Dona Ana	Sec. 36, T23S, R2E	9-30-49	(1) S dead oil 526, (2) SOG 553-73, (3) SO 703, 1025-35, (4) SO 1245, (5) SOG 1492-1518, (6) SOG 2540-60.	All shows except (6) in the Pennsylvanian; (6) Mississippian.
Bruton #1 Guame (Fed.)	Socorro	Sec. 21, T16S,R2E	8-7-50	(1) SG602-4, (2) SO 715-25, (3) SG 1057	All shows from Cretaceous.
Blackstone & Spaugh #1 Truth or Consequences-Min.	Sierra	Sec. 2, T13S,R4W	10-3-51	SO1820-1935, 2005, 2090'	Probably Cretaceous.
Richard B. Liang #1 Sanchez	Socorro	Sec. 23, T2N, R4E	4-30-52	(1) SG 836' est. 200, MCFGPD (2) SG 1090'	Pennsylvanian.
Western Prod. & Tobe Foster #2 Bruton (Formerly Bruton #2 Guame)	Socorro	Sec. 21, T16S, R2E	Prep.P&A 6-16-53	(1) SG 1800, (2) SG 1875-95'	Yeso.

Note: A show of oil and gas was reported in the A. R. Fenner #1 Failey, 670' Catron County test. No information is available as to when this well was drilled.

Abbreviations:

SO Indicates a show of oil.

SG Indicates a show of gas.

SOG Indicates a show of oil and gas.

The numbers in parenthesis in the "Depth of Show" column are used for convenience as a reference point for the "Formation from which show was encountered" column.

Sun is reported to have quit-claimed the portions of the Armendariz Grant which they leased from the Victorio Land and Cattle Company prior to the drilling of their two wildcat oil tests.

Future outlook

Geological information which will enable the industry to make more adequate evaluations of the potentialities of southwestern New Mexico is just beginning to become available. The New Mexico Bureau of Mines, under the direction of Dr. Eugene Callaghan, has made tremendous strides in the past few years in making additional geological information available to the public. Reports such as those now being compiled by Dr. Frank Kottlowski on the Las Cruces area, and Robert A. Zeller, Jr. on the Big Hatchet Mountains, together with other reports in progress, will be invaluable in assisting the petroleum industry to interpret the geology of this region.

BASIN AND RANGE STRUCTURE IN SOUTHWESTERN NEW MEXICO

by
Eugene Callaghan

A glance at the Tectonic Map of the United States will show that southwestern New Mexico is within the zone of Basin and Range structure at the southeastern point of the Colorado Plateau. A second look will show that the Basin and Range structural elements which trend northwesterly south of the international border split in New Mexico into those following a northerly course in the Rio Grande and Tularosa valleys and those trending northwesterly along the south side of the Colorado Plateau through Arizona. Long ago it was pointed out that base and precious metal mining districts are distributed through the Basin and Range area outside of the Colorado Plateau.

Folds and faults together with the variable erosional and depositional history of different blocks provide for the present appearance of this region. In Basin and Range areas, certain blocks are elevated and others are depressed. Adjustments between adjoining blocks may be accomplished by folding or warping, but commonly the relative movements cause breaks or faults of varying pattern, length, and displacement. The pattern is controlled by regional horizontal pressures; the vertical movements are caused by vertical pressures of varying intensity acting from below and in line with the force of gravity.

The various blocks do not necessarily move simultaneously. Seemingly, a few blocks in a large area are particularly active and will rise rapidly to produce very abrupt slopes that are in marked contrast to their surroundings. At the same time other positive blocks will remain at about the same position and may be reduced to a mature erosion surface. Thus a block such as the Big Hatchet Mountains will stand out distinctly in contrast to its subdued neighbors. Doubtless, some blocks that tend to remain low for long periods later rise as positive blocks.

As a consequence of their varying structural and erosional history, the various positive blocks will differ in their formational content. For example, the Big Hatchet Mountains are characterized by Paleozoic formations in contrast to Mesozoic formations in the Little Hatchet Mountains and Mesozoic and Tertiary formations in the Animas Range. Long ranges such as the Peloncillo Mountains may reveal cross warps so that older formations are exposed where relative elevation has been greatest and younger formations where upward movement has been less.

The internal structure of both positive and negative blocks may be complex, in part from internal adjustments during Basin and Range faulting, and in part from older structural disturbances. During Paleozoic time positive and negative movements of relatively slight differential amounts caused changes in thickness and lithologics of the various formations, as well as accounting for non-deposition in certain areas. Of Mesozoic rocks, only the Lower Cretaceous is thick and extensive. The occurrence of conglomerates and volcanic rocks in Lower Cretaceous beds suggests that some movements had taken place or were taking place at this time. Subsequent to the deposition of Cretaceous rocks a compressional epoch, generally called Laramide, produced extensive thrust faulting which was probably followed by some normal faulting.

The Tertiary record is obscure, particularly of the earlier Tertiary history. Presumably structural disturbances and some volcanic and intrusive igneous activity and mineral deposition as well as erosion took place in the early Tertiary. Middle and later Tertiary time saw the accumulation of a great blanket of volcanic rocks, dominated by rhyolite,