Update of Oil and Gas Reservoir Data Base, Permian and Fort Worth Basins, Texas

Final Report

by

Shirley P. Dutton, Helena H. Zirczy, Thomas A. Tremblay, and Andrew R. Scott

prepared for the U.S. Geological Survey under Order No. 99CRSA1102

Bureau of Economic Geology
S. W. Tinker, Director
The University of Texas at Austin
Austin, Texas 78713-8924

March 1, 2000

CONTENTS

Figure Captions

Tables

INTRODUCTION

This study updates previous work on oil and gas production in the Permian and Fort Worth Basins by Galloway and others (1983), Kosters and others (1989), and Holtz and others (1993). The original delineation of oil plays in Texas was published by Galloway and others (1983) in the *Atlas of Major Texas Oil Reservoirs*, which classified into plays all oil fields that had produced more than 10 MMbbl of oil through 1981. Gas reservoirs that had produced more than 10 Bcf of gas through 1986 were grouped into gas plays in the *Atlas of Major Texas Gas Reservoirs* (Kosters and others, 1989). In 1993, Holtz and others updated and expanded the data base from the two atlases. The *Update of Atlas of Major Texas Oil Reservoirs Data Base and Atlas of Major Texas Gas Reservoirs Data Base* (Holtz and others, 1993) updated cumulative production data through December 31, 1992, for reservoirs already in the data base and added smaller but significant-sized reservoirs (cumulative production >1 MMbbl of oil equivalent [boe]) to the data base. The addition of new reservoirs to the data base resulted in the modification of existing plays and the determination of several new oil plays. Play boundaries were also modified to accommodate the additional reservoirs.

The goals of this project were (1) to update cumulative production data through December 31, 1998, for all oil and gas reservoirs in the Permian and Fort Worth Basins, Texas, that were included in the data base of Holtz and others (1993) and (2) to add additional reservoirs now having cumulative production greater than 1 MMboe to the data base. (Reservoirs having production >1 MMboe are referred to as "significant" reservoirs in this report). Following the U.S. Geological Survey (1995), this report uses a value of 6,000 cf of gas to equal 1 boe; 6 Bcf is therefore the equivalent of 1 MMbbl of oil. The new reservoirs were assigned to plays, and play boundaries from Holtz and others (1993) were modified to include the additional reservoirs. Because one oil reservoir and one gas reservoir did not fall into existing plays, new plays were established for these reservoirs: the Mississippian Platform Carbonate (oil) play in the Permian

Basin and Barnett Shale (gas) play in the Fort Worth Basin. Information about the two new plays is provided in this report.

Oil and gas production data used to update cumulative production and to identify additional significant reservoirs to add to the data base were obtained from the Railroad Commission of Texas 1998 Oil & Gas Annual Report (Railroad Commission of Texas, 1999). Information used to assign new reservoirs to geologic plays was derived primarily from the hearing files of the Railroad Commission of Texas.

OIL-RESERVOIR PLAYS

The Holtz and others (1993) data base of oil reservoirs contains 873 reservoirs from the Permian Basin (fig. 1) and 91 reservoirs from the Fort Worth Basin (fig. 2). Cumulative production from those reservoirs was updated through the end of 1998 on the Excel™ worksheet "Oil_updated.xls" on the disk that accompanies this report. All other data shown in that data base are unchanged from the Holtz and others (1993) report.

Since the 1993 study was completed, an additional 176 reservoirs have produced more than 1 MMbbl of oil through 1998, including 166 reservoirs in the Permian Basin and 10 in the Fort Worth basin. Information about these reservoirs is summarized on the Excel™ worksheet "Oil_new.xls" on the accompanying disk.

The 176 additional significant reservoirs were assigned to plays (tables 1, 2). A complete listing of oil plays in the Permian and Fort Worth Basins appears in appendix A. The numbers assigned to the plays are those used by Holtz and others (1993), who defined 63 oil plays throughout Texas. Thirty of the plays defined by Holtz and others (1993) occur in the Permian or Fort Worth Basins. Only one of the new reservoirs did not fall into an existing play, leading to the definition of a new oil play: the Mississippian Platform Carbonate. In addition, four oil plays were renamed to more accurately reflect the geologic origin or age of the reservoirs within them: (1) Pennsylvanian Reef/Bank changed to Pennsylvanian and Lower Permian Reef/Bank,

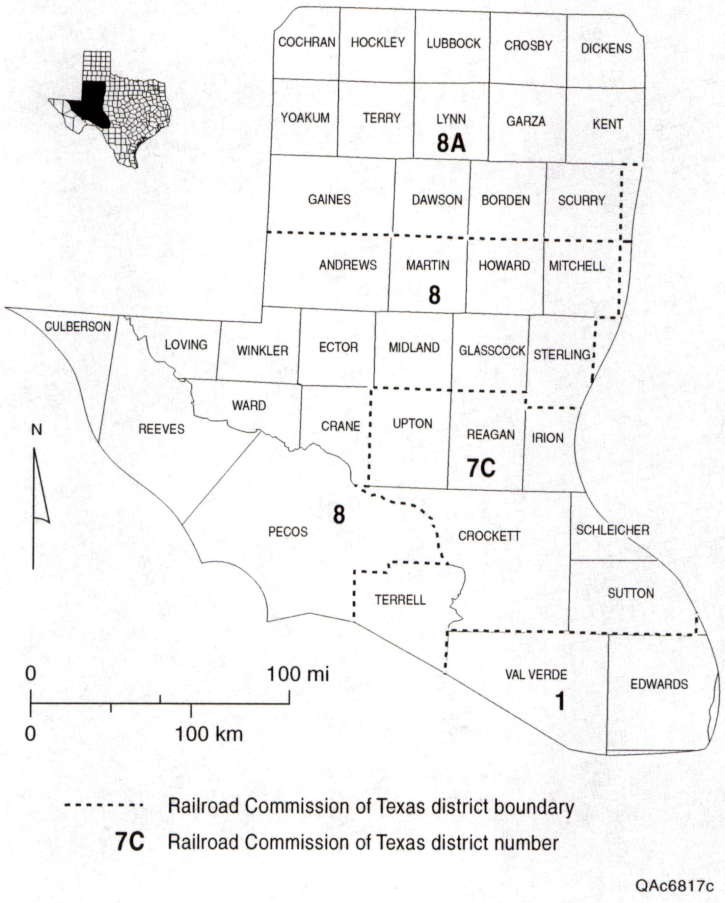

Figure 1. Counties in the Permian Basin geologic province (modified from Galloway and others, 1983).

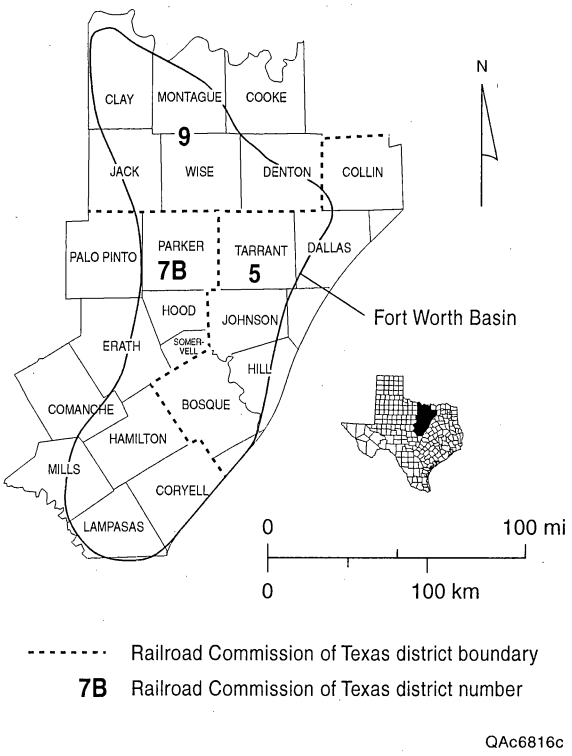

Figure 2. Counties in the Fort Worth Basin, which is part of the North-Central Texas geologic province (from Galloway and others, 1983). Fort Worth Basin outline from Flippen (1982).

Table 1. New oil reservoirs in the Fort Worth Basin having cumulative production greater than 1 MMbbl.

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
1860500	9	ALMA	STRAWN	MONTAGUE	10/26/57	3420	1,662,089	21
10870332	9	BOWERS	GRANITE WASH	MONTAGUE	7/16/39	3850	1,489,175	21
13128001	9	BUFFALO SPRINGS		CLAY	10/31/51	6502	1,090,391	52
26843500	9	DYEMOUND	BEND CONGLOMERATE	MONTAGUE	11/22/53	6652	1,013,178	22
38343666	9	HALSELL, WEST	VOGTSBERGER	CLAY	8/18/65	4762	1,472,576	21
45378600	9	JACKSBORO, S.	1975	JACK	11/7/77	1980	1,007,610	21
73705001	9	QUEENS PEAK		MONTAGUE	12/21/47	6335	2,329,957	22
86600700	9	STREET	STRAWN	JACK	3/21/80	2707	1,136,351	21
93503666	9	VERA	STRAWN 3600	CLAY	3/6/56	3571	1,051,676	21
95180666	9	WARD-MCCULLOUGH	STRAWN	JACK	6/9/51	3614	3,967,884	21

Table 2. New oil reservoirs in the Permian Basin having cumulative production greater than 1 MMbbl.

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
292058	8	ABELL	CLEAR FORK	PECOS	2/6/50	3555	1,023,177	40
292551	8	ABELL	PERMIAN 2200	PECOS	1949	2200	1,027,095	39
296500	8	ABELL, NORTHWEST	MCKEE SAND	PECOS	2/21/49	5432	1,435,103	30
450250	8A	ACKERLY, NORTH	CANYON REEF	DAWSON	8/3/58	9154	1,169,748	28
587498	7C	ADAMC	ELLENBURGER	UPTON	11/19/53	11575	1,118,803	51
702750	8A	ADCOCK	SPRABERRY	DAWSON	1/22/72	7556	1,214,421	29
1392500	7C	ALDWELL	SPRABERRY	REAGAN	6/16/51	6809	1,508,237	29
2220900	7C	AMACKER-TIPPET, SW	9100	UPTON	12/20/80	9344	4,420,317	59
2220700	7C	AMACKER-TIPPETT, SW	WOLFCAMP	UPTON	5/29/77	9218	12,181,198	59
2220710	7C	AMACKER-TIPPETT, SW.	WOLFCAMP A	UPTON	8/1/88	9069	4,104,769	59
2718400	7C	ANDREW A.	CANYON	IRION	10/29/79	7390	3,199,099	25
2711001	8A	ANDREW NOODLE CREEK		KENT	12/21/69	4010	1,063,283	25
2725760	8	ANDREWS	WOLFCAMP-PENN.	ANDREWS	10/1/95	9380	2,382,244	42
2728333	8	ANDREWS, NORTHEAST	DEVONIAN	ANDREWS	1952	12490	1,277,404	32
4184333	8	ATAPCO	DEVONIAN	CRANE	6/24/59	5520	1,265,706	31
4690300	8	B.C.	CANYON	HOWARD	12/3/85	9041	1,201,173	27
6385500	8	BAYVIEW, W.	GLORIETA	CRANE	4/29/65	3023	1,017,998	40
8740500	8	BLALOCK LAKE, SE	WOLFCAMP	GLASSCOCK	7/22/81	8245	9,499,505	27
9521500	7C	BLOCK 49	2450	REAGAN	11/15/55	2456	2,040,644	36
8958500	8	BLOCK A-34	SAN ANDRES	ANDREWS	3/16/79	4676	1,088,205	38
10406500	8A	BONANZA	SAN ANDRES	COCHRAN	11/21/80	4893	2,022,041	44
11082333	8	BOYDELL, S.	CLEAR FORK, LO.	ANDREWS	7/19/67	7089	2,055,967	40
11313300	8A	BRAHANEY, NORTHWEST	DEVONIAN	YOAKUM	2/1/82	11893	14,492,743	33
11314200	8A	BRAHANEY, W.	DEV	YOAKUM	10/13/81	11645	1,385,974	33
11334300	8A	BRALLEY	SILURIAN	YOAKUM	7/31/91	13108	1,555,998	33
11601500	8	BRAZOS	SAN ANDRES	MIDLAND	9/3/82	4433	1,809,102	37
12060500	8A	BRITT	SPRABERRY	DAWSON	7/24/57	7396	1,071,183	29
12244075	7C	BROOKS	CANYON K	IRION	9/9/73	6494	1,032,332	25
12978600	8	BUCKWHEAT	SILURO-DEVONIAN	HOWARD	9/7/89	10182	1,388,536	34
15724500	8A	CARM-ANN	SAN ANDRES	GAINES	11/18/79	4779	1,226,683	38
18790700	8A	CLAYTON RANCH, N.	SPRABERRY	BORDEN	3/14/85	5738	1,659,108	29
19235700	8	COBRA	WOLFCAMP	GLASSCOCK	6/20/84	7947	8,361,620	27
19347250	8A	COGDELL, EAST	CANYON	SCURRY	10/20/58	6813	5,703,671	28
19665200	8	COLLIE	DELAWARE	WARD	11/7/81	4725	3,242,157	45
20101500	7C	CONGER, SW	PENN	REAGAN	2/21/79	8134	2,629,900	26

Table 2. (cont.)

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
20844500	7C	CORVETTE	WOLFCAMP	UPTON	1/16/91	9388	4,569,692	59
21287250	8	COWDEN	CISCO	ECTOR	8/15/55	8846	6,138,200	43
21289180	8	COWDEN, NORTH	CANYON	ECTOR	1/20/73	9094	1,364,753	43
21577450	8	CRAWAR	GLORIETA	WARD	10/22/54	4040	1,178,893	40
21597250	8	CREDO	WOLFCAMP	STERLING	3/13/62	7334	3,927,497	27
23138500	8	DARMER, NE.	PENN	WINKLER	6/23/78	8256	1,032,965	43
24396100	8	DESPERADO	ATOKA	MIDLAND	11/24/84	10845	3,529,638	43
24488650	8	DEWEY LAKE	WOLFCAMP	GLASSCOCK	4/12/82	8449	1,373,780	27
24853400	8	DIMMITT	CHERRY CANYON	LOVING	8/23/80	6226	8,089,834	45
25957600	8A	DOVER	STRAWN	GARZA	2/15/85	8123	1,155,165	25
27451500	8A	ECHOLS	SPRABERRY	DAWSON	5/1/84	8277	1,332,714	29
28873500	8A	EMERALD	SILURIAN	YOAKUM	4/2/88	12372	1,279,889	33
28963500	8	EMPEROR, EAST	CLEAR FORK, LO.	WINKLER	7/12/62	6097	1,108,228	40
30398875	8	FASKEN, SOUTH	WOLFCAMP	ECTOR	10/3/60	8475	1,243,995	42
31222200	8A	FLANAGAN	CLEAR FORK	GAINES	7/15/49	7142	3,660,215	40
33232510	8	FULLERTON, NORTH	ELLENBURGER	ANDREWS	2/5/91	9872	1,047,521	51
34113425	8A	GARZA	SAN ANDRES, DEEP	GARZA	11/1/85	3465	3,385,312	27
34529200	8	GERALDINE	DELAWARE 3400	CULBERSON	4/1/82	3454	1,580,498	45
34742500	8A	GIEBEL	CLEARFORK, LOWER	GAINES	5/16/83	7045	1,219,503	40
35197380	8	GLASCO	ELLENBURGER	ANDREWS	5/16/85	13806	2,751,546	51
35659500	8	GOLDSMITH, W.	FUSSELMAN	ECTOR	12/22/55	8294	2,668,962	34
35741500	8A	GOOD, NORTHEAST	CANYON REEF	BORDEN	11/3/53	8066	3,366,227	28
35744333	8A	GOOD, SE.	CANYON REEF	BORDEN	9/1/59	8123	1,095,717	28
37821710	8	H. S. A.	PENNSYLVANIAN	WARD	12/28/60	8088	3,383,207	43
38455500	8A	HAMILTON	CLEARFORK	HOCKLEY	4/3/80	6459	1,098,043	44
38866600	8A	HAPPY	SPRABERRY LIME	GARZA	1/13/89	4970	5,354,345	27
39176690	8	HARPER	GLORIETA	ECTOR	9/24/88	5500	1,008,199	40
39717500	8A	HAVEMEYER	SAN ANDRES	GAINES	5/6/77	5488	1,074,330	38
40296500	7C	HELUMA, EAST	DEVONIAN	UPTON	10/1/73	8740	4,484,429	31
40300500	7C	HELUMA, SE	DEVONIAN	UPTON	9/25/79	9024	1,558,518	31
43106200	8	HUBBARD	CHERRY CANYON	LOVING	6/9/82	5286	1,054,577	45
45726550	8A	JANICE	WOLFCAMP	YOAKUM	6/2/81	8937	1,510,821	42
45991666	8A	JAYTON, WEST	STRAWN SAND	KENT	2/8/63	6466	1,921,249	26
46134500	8A	JENKINS, NORTH	CLEAR FORK	GAINES	1/1/54	7148	2,396,993	40
48549001	8A	KELLY		SCURRY	1948	6795	1,843,066	28

Table 2. (cont.)

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
49125500	8A	KEY WEST	SPRABERRY	DAWSON	11/23/82	7680	1,359,288	29
49138100	8	KEYSTONE, SW.	SAN ANDRES	WINKLER	6/9/81	4446	1,243,794	37
49411500	8	KING LAKE	ELLENBURGER	ECTOR	3/11/88	11082	1,983,246	51
53009500	8	LEHN-APCO, SOUTH	ELLEN	PECOS	1/26/77	4740	1,209,180	51
53411852	8A	LEVELLAND	WICHITA-ALBANY	HOCKLEY	11/24/65	7488	1,002,981	44
53759333	8A	LINKER	CLEAR FORK	HOCKLEY	4/6/61	7162	1,713,689	44
54590300	7C	LONE JOE DEEP	FUSSELMAN	IRION	6/26/87	9046	7,734,413	34
55975500	8A	LYN KAY	6150	KENT	1/7/75	6164	1,098,944	25
56159200	8	M.F.E.	GRAYBURG	ANDREWS	5/17/91	4936	3,185,743	37
56382200	8A	MABEN	CISCO	KENT	8/1/89	5664	1,247,337	26
57324650	8	MARALO	WOLFCAMP	PECOS	7/28/84	11055	1,176,163	59
57774083	8	MARTIN	CLEAR FORK	ANDREWS	8/14/53	5590	3,898,399	40
57774166	8	MARTIN	CLEAR FORK, LO	ANDREWS	1/31/69	6580	1,518,031	40
57774498	8	MARTIN	MCKEE	ANDREWS	1945	8300	6,759,541	30
57774581	8	MARTIN	SAN ANDRES	ANDREWS	1945	4300	2,916,514	38
57774664	8	MARTIN	TUBB	ANDREWS	11/24/55	6260	2,012,913	40
58027500	8A	MARY TWO	DEVONIAN	YOAKUM	6/25/81	13220	1,336,036	33
59560300	7C	MCKAY CREEK	CABALLOS	TERRELL	8/1/79	6238	1,143,321	31
60989200	8A	MICHELLE KAY	CISCO	KENT	12/23/83	5835	2,069,709	26
61046250	8	MIDDLETON	CANYON REEF	HOWARD	5/23/86	8536	1,154,534	28
61083500	8	MIDKIFF	SPRABERRY SAND	MIDLAND	1950	7304	1,688,256	29
61143400	8	MID-MAR, EAST	FUSSELMAN	MIDLAND	7/12/82	11711	2,741,476	34
61269500	7C	MIETHER	GRAYBURG	UPTON	5/14/56	3241	1,042,918	37
62415332	8	MONAHANS	ELLENBURGER	WARD	8/7/42	10550	5,340,224	51
62415415	8	MONAHANS	FUSSELMAN	WARD	2/7/54	8336	1,262,546	34
62415747	8	MONAHANS	QUEEN SAND	WARD	1/8/60	3269	6,078,222	39
62417450	8	MONAHANS, NORTH	FUSSELMAN	WINKLER	3/31/57	10026	1,857,656	34
62417630	8	MONAHANS, NORTH	MONTOYA	WINKLER	5/31/56	10080	1,028,092	34
62703200	8	MOONLIGHT	ELLENBERGER	MIDLAND	3/20/83	13325	1,014,717	51
62703400	8	MOONLIGHT	MISSISSIPPIAN	MIDLAND	9/23/84	11599	1,120,968	48
56432700	8A	MTS	SAN ANDRES	DAWSON	4/16/84	4922	2,859,713	44
65567300	8	NIX	CLEARFORK	ANDREWS	2/1/89	7036	2,125,119	40
65967410	8A	NORMAN	DEVONIAN	GAINES	7/8/61	12214	3,260,829	33
65973607	8A	NORMAN	ELLENBURGER	GAINES	1/19/70	13865	1,027,923	51
67604500	8	ORLA, SOUTH	DELAWARE SAND	REEVES	6/21/53	3562	1,044,747	45

Table 2. (cont.)

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
67905500	8A	OWNBY, WEST	SAN ANDRES	YOAKUM	2/6/53	5307	1,370,217	44
69233400	8	PARKS	FUSSELMAN-MONTOYA	MIDLAND	6/18/83	12405	1,095,214	34
70381001	7C	PEMBROOK		UPTON	1/22/50	7010	4,163,608	29
70383500	7C	PEMBROOK, NORTH	SPRABERRY	UPTON	1951	8160	5,867,690	29
72560500	8A	POST, WEST	STRAWN	GARZA	10/14/79	8482	1,099,581	25
72810500	8	POWELL	8300	GLASSCOCK	8/20/82	8552	2,154,881	27
73103666	8	PRICHARD	ELLENBURGER	ANDREWS	1/28/53	13475	1,034,605	51
74590075	8A	RAND-PAULSON	CANYON	HOCKLEY	12/29/95	9638	1,051,454	43
76043500	8A	REO	JO MILL, LOWER	BORDEN	11/11/80	7350	1,848,919	29
77622550	7C	ROCK PEN	CLEARFORK	IRION	5/1/88	3840	1,103,767	27
77953250	8	ROJO CABALLOS	DELAWARE	PECOS	7/2/62	5253	1,070,413	45
78279300	8	ROSE CREEK, N	WOLFCAMP	STERLING	1/23/82	5084	1,422,722	27
78525500	8A	ROUGH DRAW, N.	NOODLE CREEK	KENT	2/13/63	4140	1,613,739	25
78938500	8	RUNNING W, N.	HOLT	CRANE	2/7/64	4008	1,069,043	40
79131666	8	RUWE-COB	PENN REEF	HOWARD	11/26/67	7424	1,176,775	28
79659700	8	SAINT LAWRENCE	STRAWN	GLASSCOCK	8/10/83	9890	1,445,796	25
80474500	8	SAND HILLS, EAST	ELLENBURGER	CRANE	7/12/68	5703	2,140,694	51
81913750	8A	SEAGRAVES	STRAWN	GAINES	5/12/56	11243	1,037,909	43
81987400	8A	SEAN ANDREW	PENN.	DAWSON	10/2/94	8329	1,146,346	28
82228800	8A	SEMINOLE, NE.	SAN ANDRES	GAINES	3/1/86	5427	1,421,063	38
83703001	7C	SIMPSON		CROCKETT	1938	1985	1,075,079	36
84257333	8	SMITH	CLEAR FORK	ANDREWS	9/30/50	7340	1,110,435	40
84819850	7C	SOUTHWEST MESA	WOLFCAMP	CROCKETT	8/18/88	6268	1,414,287	59
85282001	8A	SPRABERRY, DEEP		DAWSON	1/8/49	6420	11,032,599	29
85282500	8A	SPRABERRY, DEEP	SPRABERRY, LO.	DAWSON	1/5/57	7592	12,942,511	29
85292450	8A	SPRABERRY, W.	DEEP, SPRABERRY	DAWSON	8/1/88	7018	1,357,903	29
85292150	8A	SPRABERRY, WEST	DEEP	DAWSON	10/1/53	6420	5,479,860	29
86252400	8A	STOCKYARD	CLEARFORK, UPPER	GAINES	8/8/91	6480	1,529,637	40
87015881	7C	SUGG RANCH	CANYON	STERLING	5/17/87	7860	7,256,288	26
87018550	8	SUGG RANCH	CANYON DIST 08	STERLING	5/17/87	7860	6,289,030	26
87145500	8	SUN VALLEY, N.	TUBB, LOWER	PECOS	6/30/69	3363	1,234,110	40
87640500	8A	SWENSON-BARRON	ELLEN.	GARZA	12/1/77	8000	5,846,592	52
88567700	8	TAYLOR LINK W.	SAN ANDRES	PECOS	4/1/84	1800	1,483,367	35
88611142	8A	TEAS	ELLENBURGER	GARZA	1/29/58	8396	1,090,118	52
88760100	8A	TEN GALLON	CANYON LIME	SCURRY	4/1/92	6760	1,023,897	28

Table 2. (cont.)

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
89134750	7C	TEXEL	PENNSYLVANIAN	UPTON	10/24/54	9143	1,611,576	43
89010700	8A	TEX-MEX, SE.	WICHITA ALBANY	GAINES	2/9/83	7498	4,904,657	40
89408205	8	THISTLE	CABALLOS NOVACULITE	PECOS	6/6/84	2679	1,274,294	31
89715400	8A	THREE-O-THREE	SAN ANDRES	GAINES	10/7/91	5538	1,040,343	38
88000500	8A	TLOC	SAN ANDRES	TERRY	3/10/80	4904	1,351,621	44
90315001	7C	TODD, DEEP		CROCKETT	1940	5691	3,679,628	25
90781200	8	TORO	DELAWARE	REEVES	2/7/61	5158	1,040,066	45
91424475	7C	TRIUMPH	WOLFCAMP	UPTON	5/23/92	8530	2,930,783	59
91621001	8A	TSTAR	ABO	HOCKLEY	1/6/96	8039	1,492,723	54
91670700	8A	TUFBOW	STRAWN	GARZA	8/10/79	7599	1,256,866	25
91784700	8A	TUMBLEWEED, NW.	TANNEHILL	DICKENS	4/10/86	4108	1,787,598	26
91803200	8	TUNIS CREEK	DEVONIAN	PECOS	12/18/82	6835	3,414,485	31
93485300	8	VENTEAM	ELLENBURGER	ECTOR	2/28/95	13250	1,407,062	51
93857500	8	VINCENT, S.	STRAWN	HOWARD	6/4/64	7839	1,156,677	28
93860500	8	VINCENT, WEST	PENN.	HOWARD	10/16/57	7454	1,067,283	28
93958525	8	VIREY	QUEEN	MIDLAND	8/27/88	4299	1,640,360	41
94114666	8A	VON ROEDER	WOLFCAMP	BORDEN	11/30/64	6063	1,006,344	28
94439400	8	W. T. FORD	ELLENBURGER	ECTOR	5/14/91	12260	1,071,434	51
94640500	8	WAGON WHEEL	PENN	WARD	3/1/79	8812	8,683,267	43
95122200	8	WAR-WINK	CHERRY CANYON	WARD	6/24/65	6037	2,222,608	45
95130900	8	WAR-WINK, W.	WOLFCAMP	WARD	2/7/76	11545	1,574,579	59
94215500	8A	WBD	SAN ANDRES	YOAKUM	1/21/69	5288	1,042,328	44
95869001	7C	WEGER, NORTH		CROCKETT	12/22/55	2318	1,130,511	36
95984500	7C	WEINER-FLOYD	SPRABERRY	UPTON	2/12/51	6705	5,873,161	29
99658500	7C	ZAN-ZAN	MID. CANYON	IRION	10/6/88	6014	1,124,129	26
99733500	8	ZEBULON		HOWARD	3/28/88	10324	1,311,612	27

(2) Upper Pennsylvanian Slope Sandstone changed to Upper Pennsylvanian and Lower Permian Slope and Basinal Sandstone, (3) Pennsylvanian Platform Carbonate changed to Pennsylvanian Reservoirs, and (4) Abo Reef changed to Abo Platform Margin Carbonate.

The oil plays having the greatest number of additional significant reservoirs since 1993 are the Leonardian Restricted Platform Carbonate (18 reservoirs), the Spraberry/Dean Submarine-Fan Sandstone (15), the Horseshoe Atoll (12), and the Ellenburger Karst-Modified Restricted Ramp Carbonate (12). The outline of many oil plays remained the same, but boundaries of plays 25, 26, 27, 35, 37, 42, 43, 44, 52, 54, and 59 (app. A) were modified to accommodate the additional reservoirs added during this study. The largest change was to play 52, which expanded from the Permian Basin to include an area in the Fort Worth Basin. The outlines of all oil plays in the Permian and Fort Worth Basins, shown in figures 3 through 6, are contained in digital format on the accompanying data disk.

DESCRIPTION OF NEW OIL PLAY

The Mississippian Platform Carbonate play in the Permian Basin includes one new reservoir, Moonlight (Mississippian) in Midland County, and one reservoir that was misclassified in the 1993 data base, Lamesa, West (Mississippian), in Dawson County. Several smaller reservoirs having less than 1 MMbbl of cumulative production also produce from the Mississippian. Little information is available about this play. The reservoirs are composed of shallow-water limestones of Mississippian age (Ruppel, personal communication, 2000). Frenzel and others (1988) noted that Osage and Meramec carbonate strata in West Texas are not dolomitic like most of the pre-Mississippian carbonates but generally consist of "finely crystalline, nonporous limestones" (p. 275). The play is divided into two parts (fig. 4) because the Mississippian was removed by erosion from an elongate area that extends from western Andrews County southeast to Crane County (Frenzel and others, 1988).

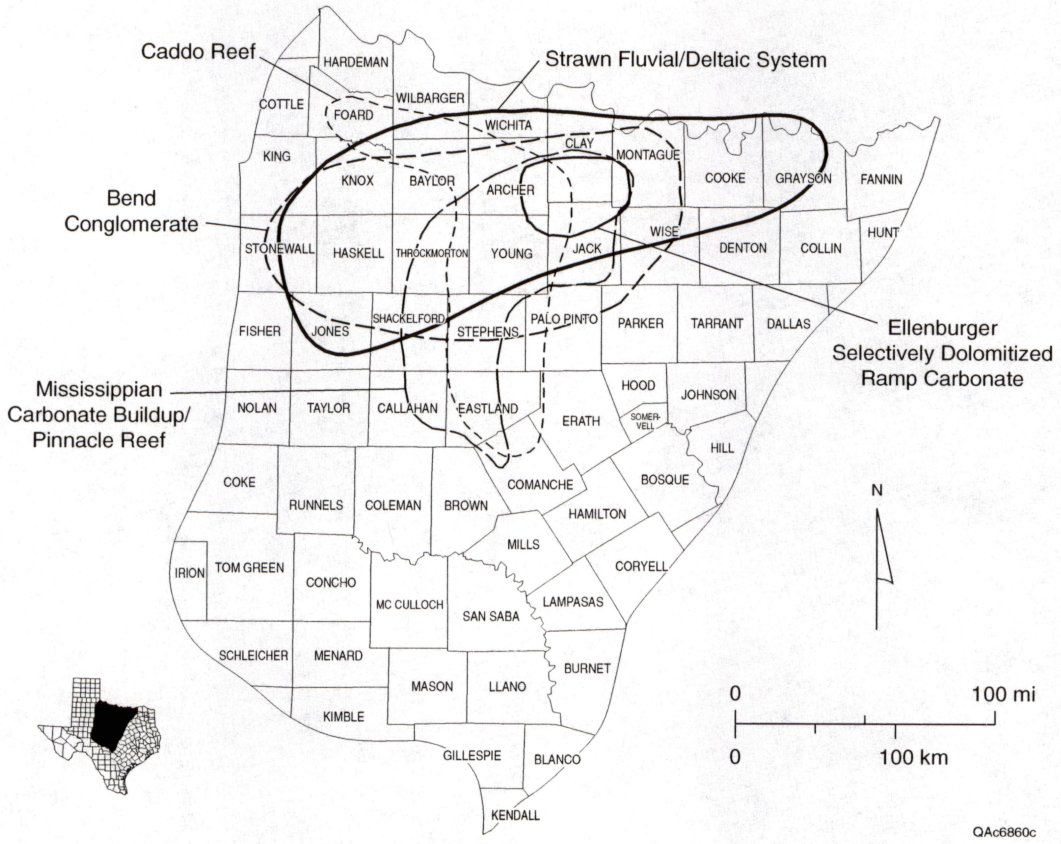

Figure 3. Oil plays in the Fort Worth Basin.

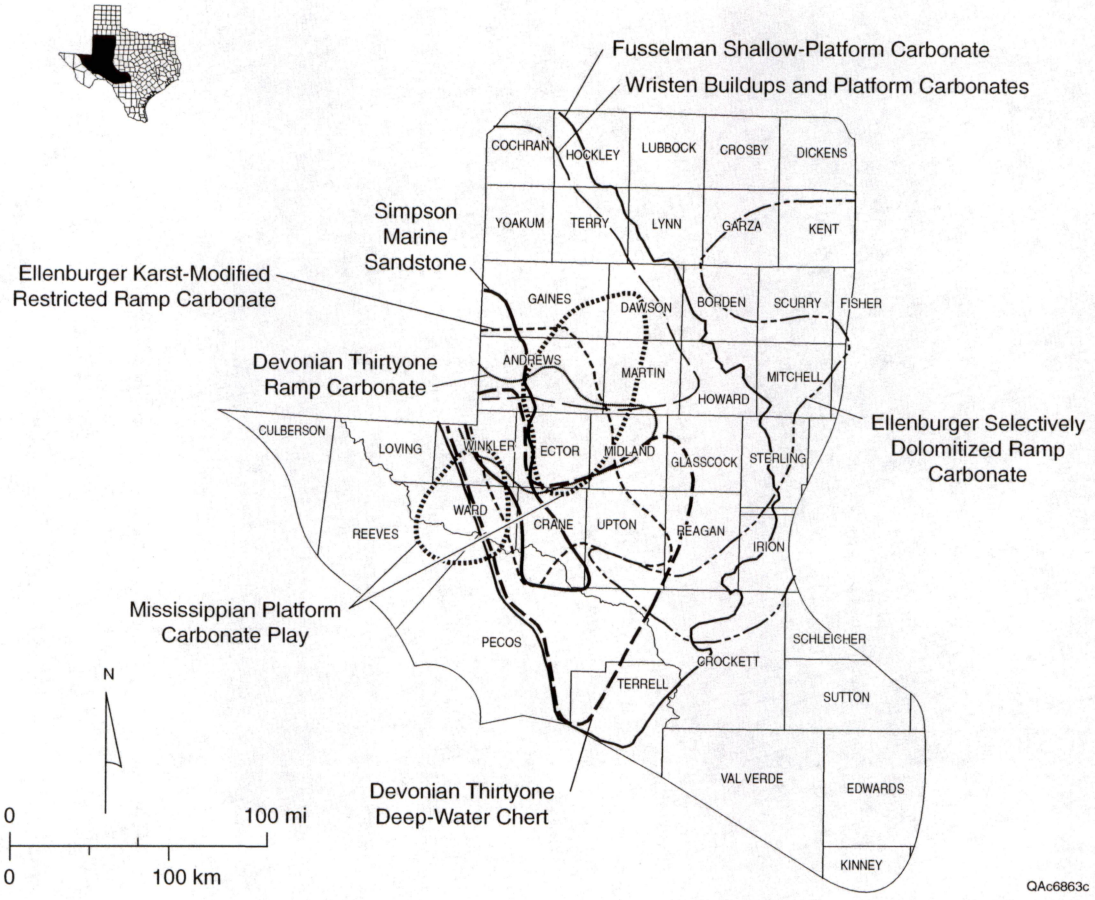

Figure 4. Pre-Pennsylvanian oil plays in the Permian Basin.

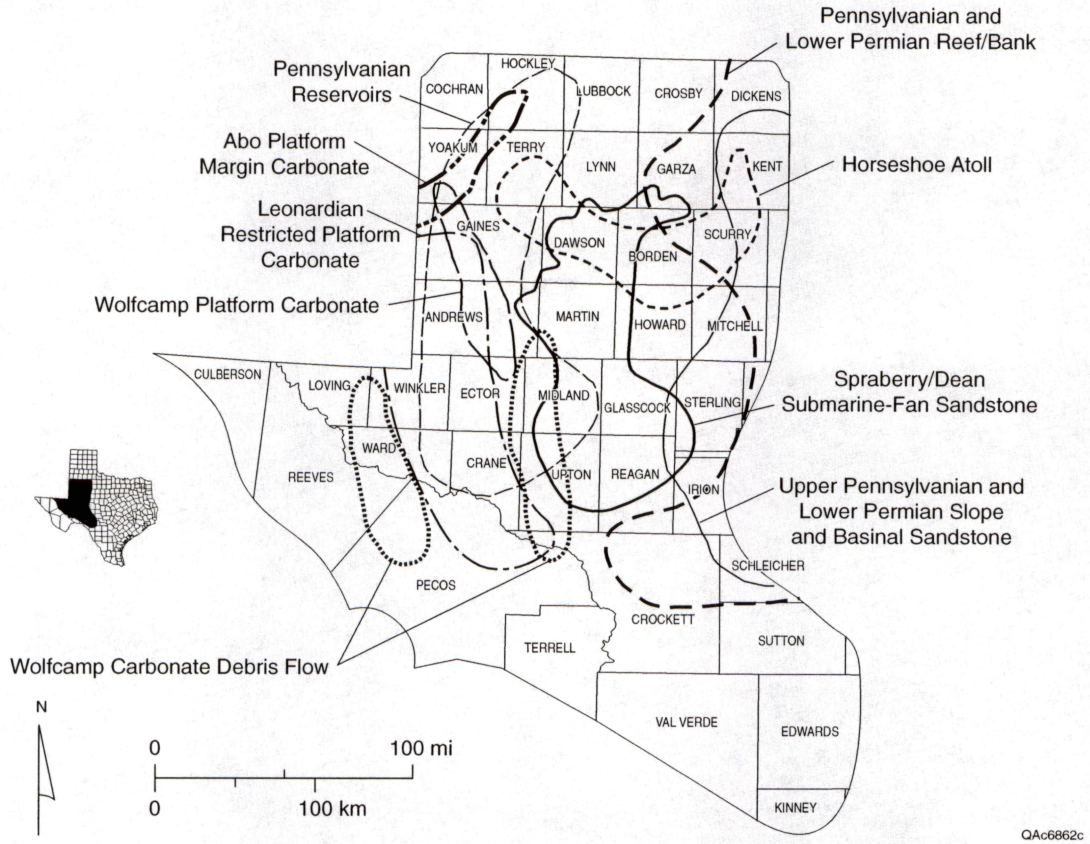

Figure 5. Pennsylvanian and Lower Permian oil plays in the Permian Basin.

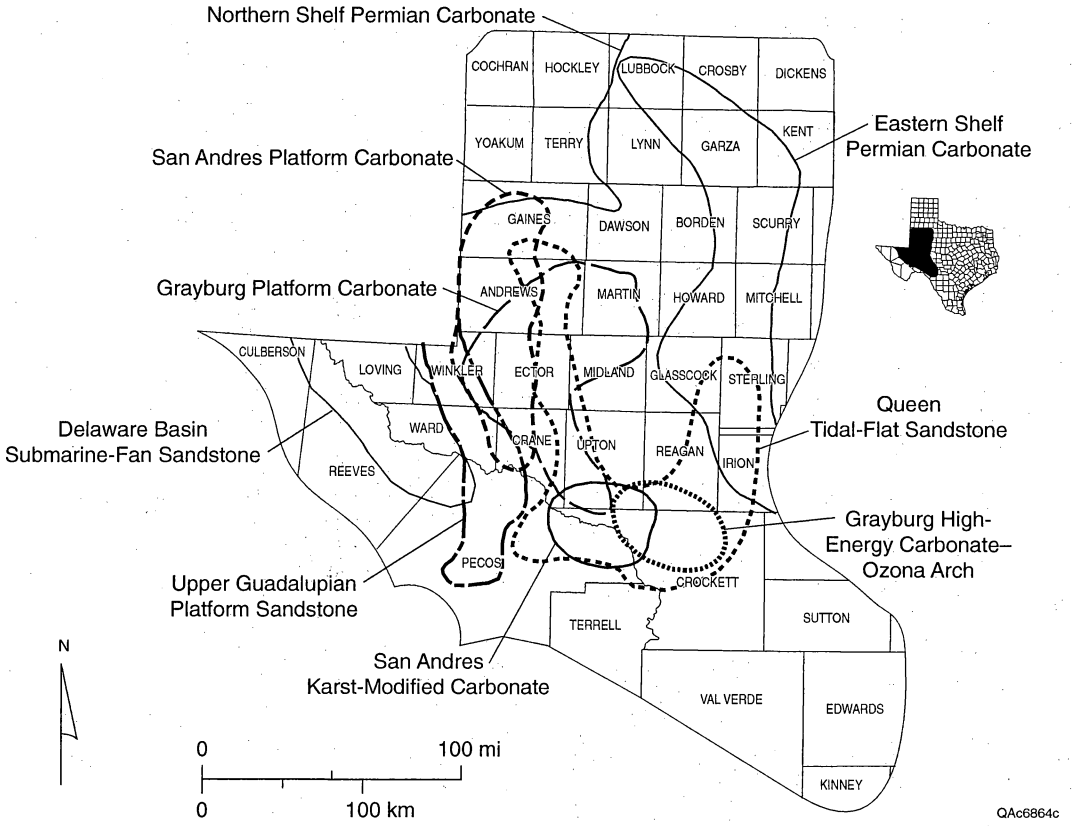

Figure 6. Upper Permian oil plays in the Permian Basin.

The source of oil in this play is unknown but might be the organic-rich Upper Devonian Woodford Shale. The Woodford is more than 500 ft thick in parts of Loving, Ward, and Winkler Counties, and total organic carbon measured in core samples ranges from 2.2 to 9.0 weight percent (Comer, 1991). The Woodford Formation is in the oil window in the Midland Basin, Central Basin Platform, and Eastern and Northwestern Shelves and in the gas window in the Delaware and Val Verde Basins (Comer, 1991).

GAS-RESERVOIR PLAYS

The Holtz and others (1993) data base of gas reservoirs contains 287 reservoirs from the Permian Basin (fig. 1) and 32 reservoirs from the Fort Worth Basin (fig. 2). The values for cumulative production in the 1993 data base represented production since reservoir discovery, even for fields discovered before 1970. Holtz and others (1993) used Dwight's Energy data to obtain the cumulative production information because the Railroad Commission of Texas provides only cumulative gas production starting in 1970. For old fields discovered before 1970, there can have been significant pre-1970 production.

Cumulative production values for the reservoirs in the 1993 data base are updated through the end of 1998 on the Excel™ worksheet "Gas_updated.xls" on the data disk that accompanies this report. The update was made by our adding the production from 1993 through 1998 to the value in the Holtz and others (1993) data base, which represents all production from reservoir discovery through 1992. All other data shown in that table are unchanged from the Holtz and others (1993) report.

According to the records of the Railroad Commission of Texas, since 1993, 72 additional reservoirs in the Permian Basin and 17 reservoirs in the Fort Worth Basin have now produced more than 6 Bcf of gas. Cumulative production data for these reservoirs are listed on the Excel worksheet "Gas_new.xls" on the data disk. Data were unavailable from Dwight's Energy for the current project. Because data from the Railroad Commission provide only cumulative production

since January 1, 1970, there may be older gas reservoirs that have now produced more than 6 Bcf that were not identified. Of the 89 reservoirs added in this update, because 61 were discovered after 1970, no production is missing from the records of the Railroad Commission for them. The 28 reservoirs that were discovered before 1970, however, have actually produced more gas than is listed.

Production data in the new and updated data bases include both nonassociated gas and associated gas-well gas. Nonassociated gas is produced from reservoirs in which gas is the primary resource and little, if any, liquid hydrocarbon is produced (Kosters and others, 1989). Associated gas is produced from oil reservoirs and occurs as a gas cap in the reservoir (associated gas-well gas) or in solution in the oil (associated casinghead gas). Only associated gas-well gas is included in the data bases, not associated casinghead gas.

Because cycling of produced gas (reinjection of gas into the reservoir for pressure maintenance) occurs in some oil reservoirs, cumulative production figures may be imprecise. No adjustments for gas cycling were attempted in this project or the projects of Kosters and others (1989) or Holtz and others (1993).

The 89 new reservoirs having 6 Bcf of cumulative gas production were assigned to plays and subplays (tables 3, 4). A complete listing of gas plays and subplays in the Permian and Fort Worth Basins appears in appendix B. The letters and numbers assigned to the plays are those used by Kosters and others (1989), which defined 73 gas plays throughout Texas. No new gas plays were added by Holtz and others (1993). Twenty-one of the plays defined by Kosters and others (1989) occur in the Permian or Fort Worth Basins. Only one of the new reservoirs did not fall into an existing play, leading to the definition of a new gas play in the Fort Worth Basin: MS-3 Barnett Shale.

The gas plays with the greatest number of additional significant reservoirs since 1993 are Upper Pennsylvanian and Lower Permian Slope and Basinal Sandstone (22 reservoirs), Lower and Middle Pennsylvanian Fan-Delta Sandstone and Conglomerate (16), and Midland and Val Verde Basin Limestone (7). The outline of many of the gas plays remained the same, but the

Table 3. New gas reservoirs in the Fort Worth Basin having cumulative production greater than 6 Bcf.

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
2148083	9	ALVORD, SOUTH	ATOKA	WISE	1/3/58	6140	13,196	PN-7
8050200	7B	BIG SUNDAY CREEK	BIG SALINE	ERATH	11/29/84	3883	36,634	PN-7
10574720	9	BOONSVILLE	CADDO LIME	WISE	1/29/57	4548	8,224	PN-7
10574780	9	BOONSVILLE	CONSOLIDATED CONGL.	WISE	7/1/74	5780	7,631	PN-7
19280700	7B	COCKRELL	STRAWN	PARKER	2/24/82	2564	12,015	PN-7
21456600	9	CRAFTON, WEST	CONGLOMERATE	JACK	7/30/58	5612	7,183	PN-7
23159500	9	DARNER-HAMMON	BEND CONGL.	JACK	4/8/56	4208	6,805	PN-7
24282300	7B	DENNIS, WEST	STRAWN	PARKER	4/3/82	1784	6,523	PN-7
24618250	7B	DICEY	CONGLOMERATE	PARKER	8/1/77	5364	11,377	PN-7
47726800	9	JUPITER	CONGLOMERATE 3RD	JACK	9/15/79	5283	6,358	PN-7
50252500	9	KRAMBERGER	ATOKA CONGL.	JACK	11/28/72	5243	16,683	PN-7
53505500	7B	LIBERTY OAK	BIG SALINE	ERATH	10/4/78	3505	6,405	PN-7
53826500	7B	LIPAN	STRAWN	HOOD	12/18/73	2912	6,169	PN-7
60123200	9	MEANDER, WEST	BEND CONGL.	WISE	6/1/55	5550	9,294	PN-7
62970700	9	MORRIS	CONSOLIDATED CONGL.	WISE	7/1/74	5883	12,957	PN-7
65280200	9	NEWARK, EAST	BARNETT SHALE	WISE	10/15/81	7216	158,047	MS-03
69175500	9	PARK SPRINGS	CONGL.	WISE	6/1/50	5733	9,661	PN-7

Table 4. New gas reservoirs in the Permian Basin having cumulative production greater than 6 Bcf.

RRC_RESN	RRC	FLDNAME	RESNAME	COUNTY	DISCYR	DPTHTOP	CUMPROD	BEG_PLAYCO
24462600	8	ABELL	PERMIAN-GENERAL	PECOS	6/19/75	3120	9,603	PM-3
29210200	7C	ADAMC	DEVONIAN	UPTON	1/24/53	10490	45,337	SD-3
32519500	7C	ALLISON	DETRITAL	TERRELL	7/10/73	9394	6,697	PN-2A
32519510	7C	BAKER RANCH	CANYON	IRION	3/22/76	6970	20,026	PN-5
48523100	8	BARSTOW	WOLFCAMP	REEVES	12/10/73	14852	7,617	PM-1A
58112500	7C	BENEDUM	FUSSELMAN	UPTON	8/30/48	10850	10,696	SD-3
56267250	7C	BENEDUM, NE.	BEND LIME	REAGAN	2/27/75	10474	6,822	PN-2B
77755500	8	BITTERWEED		PECOS	8/19/88	4980	22,016	SD-1
83704300	8	BRADFORD RANCH	ATOKA	MIDLAND	5/4/90	11338	19,254	PN-1B
93875365	7C	BROOKS, SOUTH	CISCO 5600	IRION	2/9/77	6430	6,837	PN-5
587332	7C	BROWN-BASSETT	WOLFCAMP	TERRELL	5/2/61	6221	12,637	PN-5
1789300	8A	BUCKSHOT	4950	COCHRAN	8/17/56	5010	11,338	PM-4A
5143300	8	CONGER	CANYON	STERLING	12/18/73	7179	11,491	PN-5
7109500	8	CRAWAR	DEVONIAN, NORTH	CRANE	9/1/76	6496	7,540	SD-2
7114300	8	CRITTENDON	SILURIAN	WINKLER	2/24/84	18984	6,120	SD-1
12249500	7C	DAVIDSON RANCH	CANYON 6200	CROCKETT	12/22/64	6201	9,234	PN-5
12390750	7C	DEER CANYON	PENN	TERRELL	3/3/95	10818	44,842	PN-5
23365250	7C	DEER CANYON	STRAWN	TERRELL	4/7/95	11368	7,567	PN-2A
23932325	1	DEVILS RIVER	STRAWN	VAL VERDE	4/13/75	10223	14,538	PN-2B
23932375	8	DIXIELAND	ATOKA, U.	REEVES	8/2/82	16465	26,399	PN-1A
25930568	7C	DOVE CREEK	CISCO	IRION	7/10/65	5980	9,262	PN-5
26319500	7C	DUDLEY, EAST	DEVONIAN	CROCKETT	2/16/80	9225	7,599	SD-3
36953500	8	DUNE		CRANE	1/1/38	3270	9,274	PM-4B
42985500	8	EL CINCO	LEONARD, LOWER	PECOS	9/15/69	4685	7,914	PM-3
43675700	1	EPPERSON	CANYON SAND	EDWARDS	4/10/82	4494	11,050	PN-5
43679700	1	FRANCES HILL	PENN	EDWARDS	4/26/72	6201	51,539	PN-5
44634333	1	FRANCES HILL	PENN, LOWER	EDWARDS	7/20/79	6594	9,646	PN-5
45637500	8	GOLDSMITH	CLEAR FORK	ECTOR	3/11/46	6300	11,979	PM-3
54137500	8	GOMEZ, N.	DEVONIAN	PECOS	4/22/78	18900	6,806	SD-1
58840250	7C	GRIERSON SPRING	STRAWN	REAGAN	10/2/85	8774	17,421	PN-2B
67998600	8	HEINER, S.	WICHITA-ALBANY	PECOS	12/9/80	4654	6,890	PM-3
67998075	7C	HOWARDS CREEK	CANYON	CROCKETT	1900	N/A	14,025	PN-5
68460800	8	HOWE	ATOKA	WARD	9/8/80	10799	6,751	PN-1A
81267691	7C	HUNT-BAGGETT	STRAWN, NORTH	CROCKETT	8/29/88	N/A	7,877	PN-2B

Table 4. (cont.)

84715400	7C	HUNT-BAGGETT, W.	STRAWN	CROCKETT	1/28/91	N/A	26,483	PN-2B
84715500	7C	INTERSTATE	CANYON	SUTTON	11/22/71	4301	6,048	PN-5
87018551	7C	JAN-JERRYE	CANYON REEF	SCHLEICHER	4/2/77	5768	15,501	PN-4C
93410426	1	KELLEY	ELLENBURGER	EDWARDS	9/8/90	6660	8,674	OR-1
93416200	8	KERMIT	MCKEE	WINKLER	2/11/60	9946	8,293	OR-3
97834003	8	KEYSTONE	ELLENBURGER	WINKLER	6/6/43	9567	67,865	OR-2
292599	8	KEYSTONE	HOLT	WINKLER	9/8/43	4800	7,043	PM-4B
5889710	7C	LIVE OAK DRAW	STRAWN	CROCKETT	1/23/75	9187	6,462	PN-1B
8469001	1	M. M. W.	CANYON	EDWARDS	5/1/86	N/A	14,060	PN-5
11240500	1	MASSIE	STRAWN	VAL VERDE	4/30/80	11100	85,175	PN-2B
20097500	7C	MCCAMEY	DEVONIAN	UPTON	1/25/68	8022	9,587	SD-3
21577180	8	MI VIDA	PERMO-PENN	WARD	9/8/76	14618	6,438	PM-1A
21752875	7C	OZONA, N. E.	ELLENBURGER	CROCKETT	6/9/75	8667	12,193	OR-1
25020250	7C	OZONA, NE.	CANYON SAND	CROCKETT	10/3/95	6168	60,390	PN-5
26538001	7C	PAKENHAM	WOLFCAMP	TERRELL	8/1/75	7463	64,130	PN-5
27945498	8	PENWELL	QUEEN	ECTOR	7/12/93	3100	8,879	PM-6
35652062	8	PINON	CABALLOS	PECOS	1/15/83	4839	16,446	SD-1
35710400	8	QUITO, EAST	CHERRY CANYON	WARD	12/17/81	6106	21,283	PM-5
40172400	8	RIO CABALLOS	CABALLOS	PECOS	9/30/92	6210	6,030	SD-1
43013300	1	ROCKSPRINGS, W.	CANYON	EDWARDS	12/5/76	3875	8,123	PN-5
49038426	8	RUNNING W	WICHITA-ALBANY	CRANE	3/12/60	5090	8,496	PM-3
49129330	8	SAND HILLS	JUDKINS	CRANE	9/1/60	3000	796,325	PM-4B
49129396	8	SAND HILLS	MCKNIGHT	CRANE	1944	3420	140,167	PM-4B
60950900	8	SAND HILLS	TUBB	CRANE	1930	4500	25,304	PM-3
70537597	7C	SAWYER	STRAWN, NORTH	SUTTON	3/1/74	8491	20,558	PN-2B
71659400	1	SIMPSON-MANN	CANYON	VAL VERDE	9/1/84	4217	8,249	PN-5
73927345	7C	SOUTH BRANCH	STRAWN	TERRELL	11/10/94	10994	23,049	PN-2A
76823125	7C	SOUTH BRANCH	WOLFCAMP	TERRELL	2/1/96	11379	6,798	PN-5
78936900	8	SPRABERRY	TREND AREA CL. FK.	MIDLAND	11/1/55	7000	9,264	PM-2
80473248	7C	SUGG RANCH	CANYON	IRION	8/12/91	7696	6,311	PN-5
80473310	8	SUGG RANCH	CANYON DIST 08	STERLING	11/12/87	7467	21,983	PN-5
80473682	8	THIGPIN	DEVONIAN	PECOS	12/18/79	7708	12,882	SD-3
85279400	7C	VELREX	CISCO 6260	SCHLEICHER	12/29/61	6364	6,480	PN-5
87018550	7C	VELREX, SW.	CANYON	SCHLEICHER	3/11/65	6577	6,055	PN-5
89366200	1	VINEGARONE, E.	PENN. SAND	EDWARDS	4/30/97	8876	9,052	PN-5
98817750	7C	WILSHIRE	CONSOLIDATED	UPTON	2/28/95	10426	24,225	SD-3
99583400	8	WORSHAM	DELAWARE	REEVES	1/5/57	5081	48,607	PM-5
12961500	8	YUCCA BUTTE, W.	ELLEN	PECOS	4/4/75	10624	12,450	OR-1

boundaries of plays OR-1, OR-3, PM-1A, PM-3, PM-6, PN-5, PN-7, SD-1, and SD-3 were modified to accommodate the additional reservoirs added during this study. The outlines of all gas plays in the Permian and Fort Worth Basins, shown in figures 7 through 10, are contained in digital format on the accompanying data disk.

DESCRIPTION OF NEW GAS PLAY

One new gas play was delineated in this project, MS-3, the Mississippian Barnett Shale in the Fort Worth Basin (fig. 7). The play contains one reservoir that has produced more than 6 Bcf, the Newark, East (Barnett Shale), in Wise County. This reservoir was discovered in 1981, the year of the first recorded completion in the Barnett Shale (Lancaster and others, 1993). By late 1999, more than 428 wells were producing from the Barnett Shale (Petzet, 1999), with production concentrated in southeast Wise and southwest Denton Counties (fig. 7).

The reservoir in this unconventional gas play is the low-permeability Barnett Shale, which is composed of organic-rich shales deposited in a low-energy, shallow-marine shelf environment during the Mississippian (Henry, 1982). The Barnett Shale has an average total organic carbon content of 4.5 percent (Lancaster and others, 1993) and is its own source rock. In the main producing area of Wise and Denton Counties, the Barnett is divided into upper and lower shales by a limestone (Lancaster and others, 1993). The lower Barnett Shale is the main producer, but wells have also been recently completed in the upper Barnett Shale (Petzet, 1999).

The low-permeability Barnett Shale is a naturally fractured reservoir; hydraulic fracture stimulation is used to produce gas at economic rates. Natural fractures in the formation strike 100° to 120°, whereas drilling-induced fractures generally strike from 45° to 80° (Hill, 1992). The difference in orientation indicates that the current stress regime differs from that which existed when the natural fractures formed (Hill, 1992). Good Barnett Shale wells have predicted recovery of about 1 to 1.3 Bcf (Lancaster and others, 1993; Petzet, 1999).

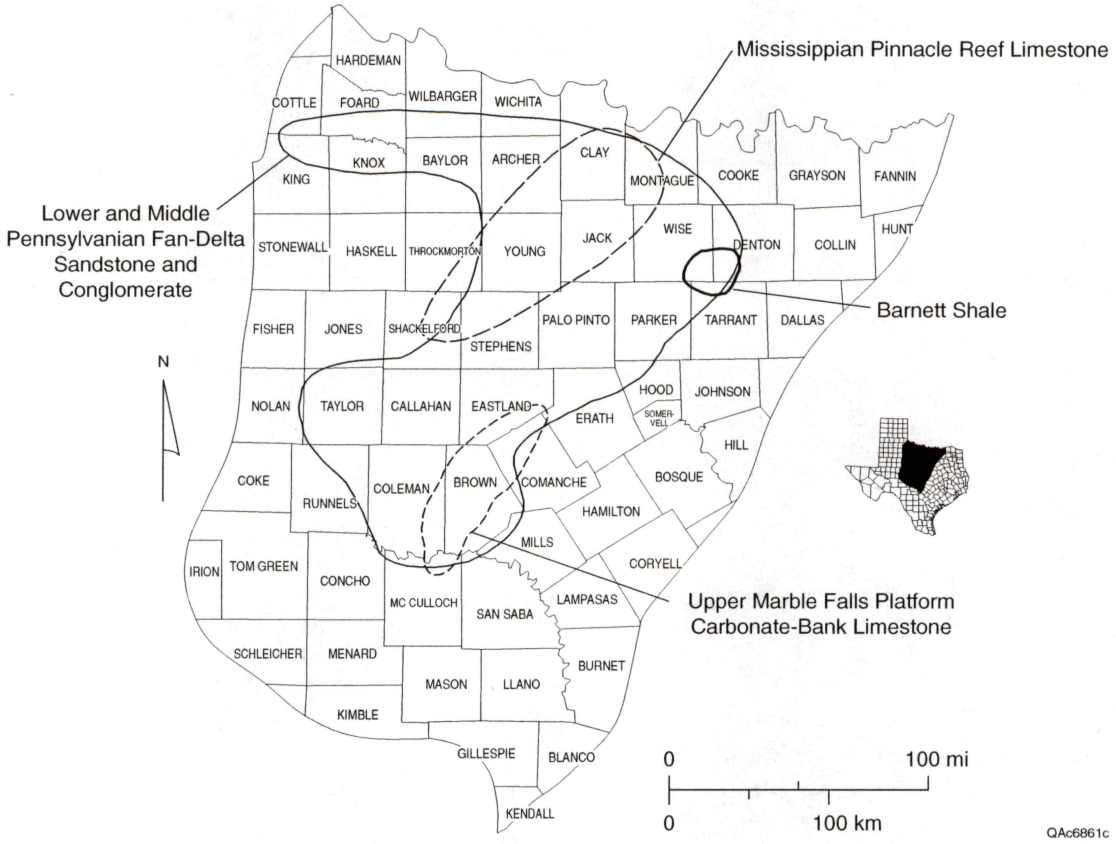

Figure 7. Gas plays in the Fort Worth Basin.

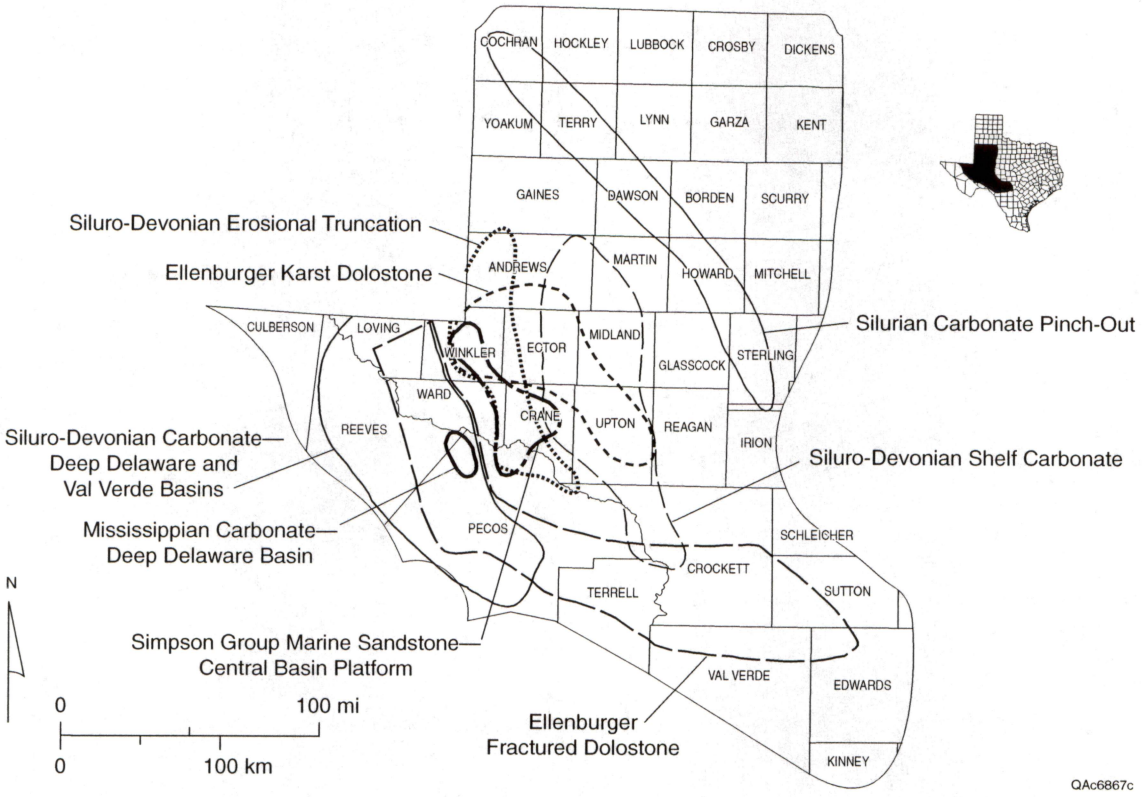

Figure 8. Pre-Pennsylvanian gas plays in the Permian Basin.

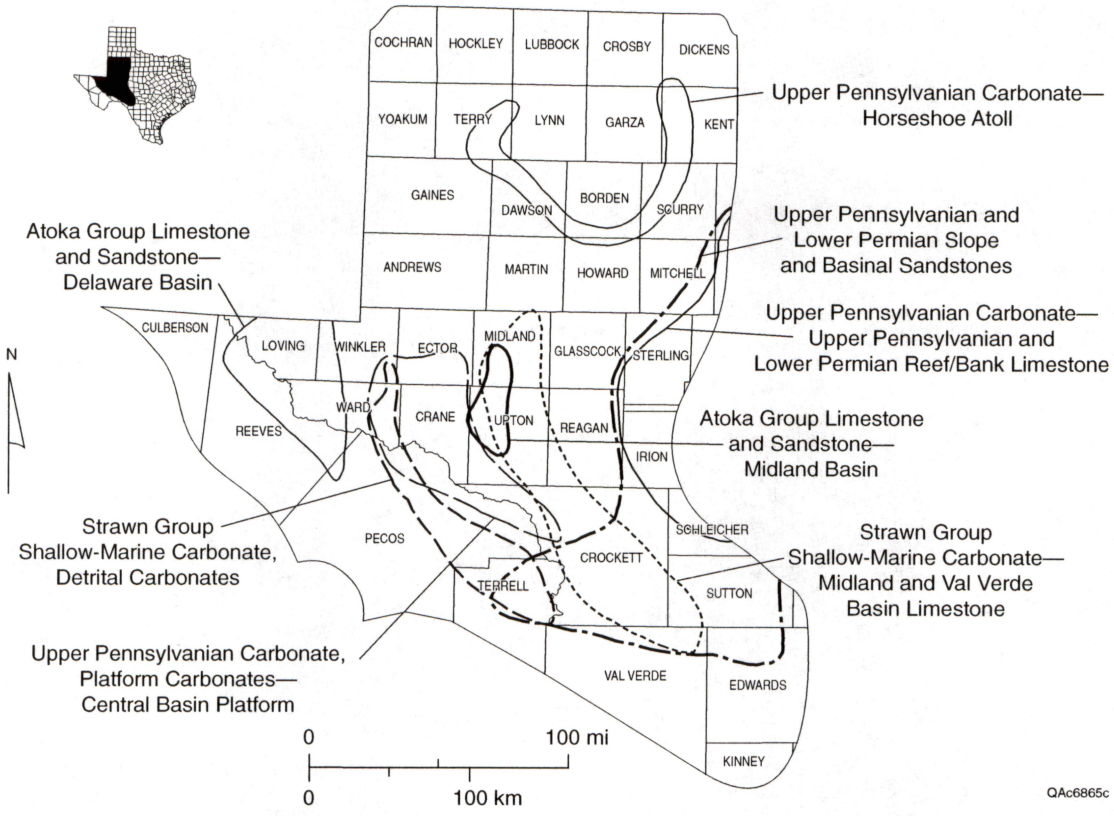

Figure 9. Pennsylvanian gas plays in the Permian Basin.

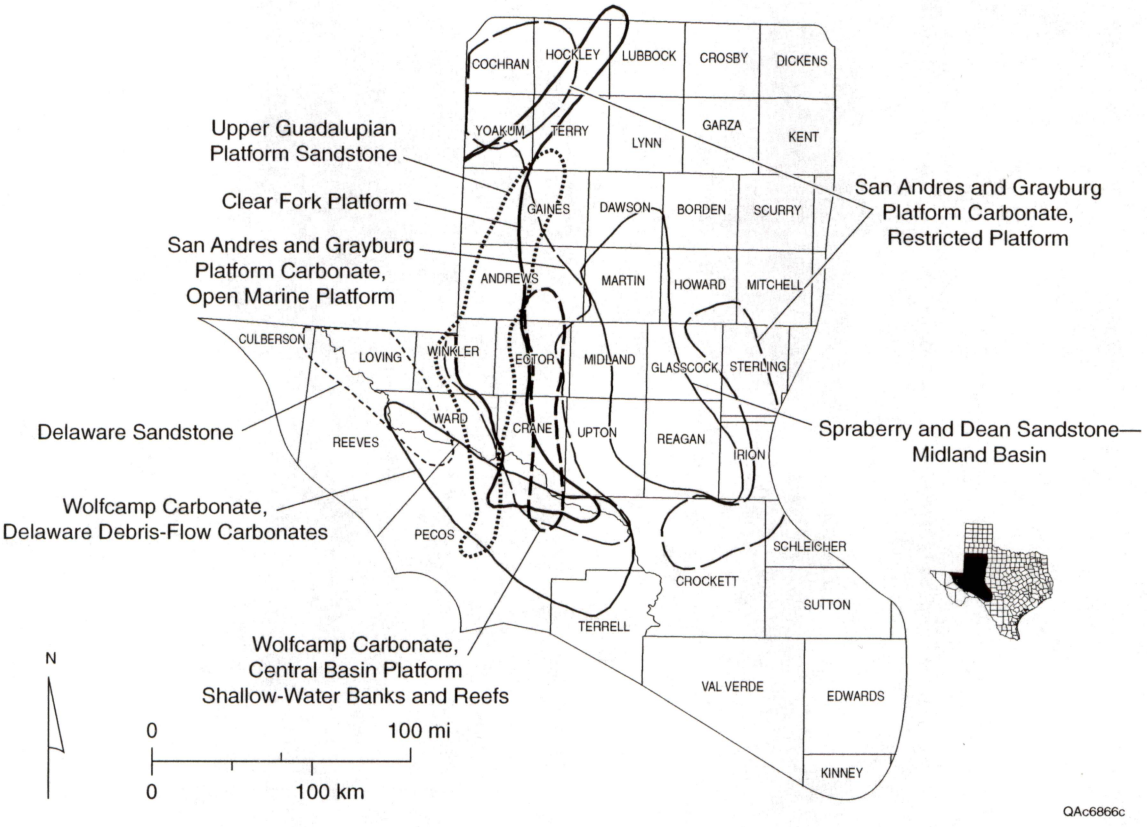

Figure 10. Permian gas plays in the Permian Basin.

DATA-DISK FORMAT

The data disk included with this report contains reservoir-production data bases, play outlines in digital format, and the text of this report. Reservoir-production data are in four Excel™ files, "Oil_updated.xls," "Gas_updated.xls," "Oil_new.xls," and "Gas_new.xls" inside the Production Data folder.

The updated oil and gas files contain all reservoirs from the Holtz and others (1993) report that are located in the Permian and Fort Worth Basins. These reservoirs are listed in alphabetical order by field and reservoir on the sheet "All"; reservoirs are also grouped by Railroad Commission district on separate sheets. The cumulative production values have been updated through December 31, 1998, but no other information in the tables has been changed. The following information is listed in the updated files: Railroad Commission reservoir number (RRC_RESN), Railroad Commission district (RRC), field name (FLDNAME), reservoir name (RESNAME), county, discovery year (DISCYR), latitude (LAT_DEG), longitude (LONG_DEG), depth in feet to top of reservoir (DPTHTOP), cumulative production through December 31, 1998 (CUMPROD), and Bureau of Economic Geology play code (BEG_PLAYCO). Cumulative oil production is shown in barrels and gas production in MMcf.

The new oil and gas files contain reservoirs in the Fort Worth and Permian Basins that (1) had produced more than 1 MMbbl of oil or 6 Bcf of gas by December 31, 1998, and (2) were not listed in the Holtz and others (1993) data base. A few of the new gas reservoirs appeared in the *Atlas of Major Texas Gas Reservoirs* but for some reason were not included in the updated data base of Holtz and others (1993). The files are on a multipage Excel™ worksheet in which reservoirs are listed on separate pages by Railroad Commission district and in alphabetical order. A concatenated list of reservoirs from all districts is called "All"; the reservoirs on this page are sorted by play code then listed alphabetically by field and reservoir. Separate sheets list reservoirs in the Fort Worth and Permian Basins in alphabetical order by field and reservoir. Gas reservoirs that were

discovered before 1970 are shown in red to emphasize that the cumulative production value does not include pre-1970 production. The new files contain the same information, under the same headings, as the updated files except that they do not include latitude and longitude.

The disk also contains the play boundaries for all the oil and gas plays in ARC/INFO format and Albers projection. Many of the play boundaries were modified to accommodate the additional reservoirs added during this study, but the remainder of the play boundaries are unchanged from the Holtz and others (1993) report. The play outlines are in four folders on the disk: oil plays with changed boundaries (newoil.shp), oil plays with unchanged boundaries (oldoil.shp), gas plays with new boundaries (newgas.shp), and gas plays with unchanged boundaries (oldgas.shp) in the Play Boundaries folder.

ACKNOWLEDGMENTS

This research was funded by the U.S. Geological Survey under Order No. 99CRSA1102. Stephen C. Ruppel, Charles Kerans, and F. Jerry Lucia provided their expertise on Permian Basin geology and hydrocarbon production, and Eugene M. Kim elucidated oil and gas production data bases. Their gracious assistance is gratefully acknowledged. S. C. Ruppel established the play outline for oil Play 56 because no play boundary was found in the digital files from Holtz and others (1993). Drafting was by the Graphics staff of the Bureau of Economic Geology under the direction of Joel L. Lardon. Others contributing to this report were Susan Lloyd, word processing, and Lana Dieterich, editing.

REFERENCES

Comer, J. B., 1991, Stratigraphic analysis of the Upper Devonian Woodford Formation, Permian Basin, West Texas and southeastern New Mexico: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 201, 63 p.

Flippen, J. W., 1982, The stratigraphy, structure, and economic aspects of the Paleozoic strata in Erath County, North-Central Texas, *in* Martin, C. A., ed., Petroleum Geology of the Fort Worth Basin and Bend Arch area: Dallas, Texas, Dallas Geological Society, p. 129–155.

Frenzel, H. N., Bloomer, R. R., Cline, R. B., Cys, J. M., Galley, J. E., Gibson, W. R., Hills, J. M., King, W. E., Seager, W. R., Kottlowski, F. E., Thompson, S., III, Luff, G. C., Pearson, B. T., and Van Siclen, D. C., 1988, The Permian Basin region, *in* Sloss, L. L., ed., Sedimentary cover—North American Craton: U.S.: Boulder, Colorado, Geological Society of America, The Geology of North America, v. D-2, p. 261–306.

Galloway, W. E., Ewing, T. E., Garrett, C. M., Jr., Tyler, Noel, and Bebout, D. G., 1983, Atlas of major Texas oil reservoirs: The University of Texas at Austin, Bureau of Economic Geology Special Publication, 139 p.

Henry, J. D., 1982, Stratigraphy of the Barnett Shale (Mississippian) and associated reefs in the northern Fort Worth Basin, *in* Martin, C. A., ed., Petroleum geology of the Fort Worth Basin and Bend Arch area: Dallas, Texas, Dallas Geological Society, p. 157–177.

Hill, R. E., 1992, Analysis of natural and induced fractures in the Barnett Shale, Mitchell Energy Corporation, T. P. Sims No. 2, Wise County, Texas: CER Corporation, topical report prepared for the Gas Research Institute, report no. GRI–92/0094, 51 p.

Holtz, M. H., Garrett, C. M., Jr., and Tremblay, T. A., 1993, Update of atlas of major texas oil reservoirs data base and atlas of major texas gas reservoirs data base: The University of Texas at Austin, Bureau of Economic Geology, contract report prepared for the U.S. Geological Survey under contract no. 1434-93-C-40079, 14 p. plus data tape.

Kosters, E. C., Bebout, D. G., Seni, S. J., Garrett, C. M., Jr., Brown, L. F., Jr., Hamlin, H. S., Dutton, S. P., Ruppel, S. C., Finley, R. J., and Tyler, Noel, 1989, Atlas of major

Texas gas reservoirs: The University of Texas at Austin, Bureau of Economic Geology Special Publication, 161 p.

Lancaster, D. E., McKetta, S., and Lowry, P. H., 1993, Research findings help characterize Fort Worth basin's Barnett shale: Oil & Gas Journal, v. 91, no. 10, p. 59–64.

Petzet, G. A., 1999, Mitchell hikes Barnett shale reserves, Fort Worth basin output in N. Texas (abs.): Oil & Gas Journal, v. 97, no. 39, p. 89.

Railroad Commission of Texas, 1999, 1998 Oil and gas annual report, volumes I and II: Austin, Texas, Railroad Commission of Texas Oil and Gas Division, 410 p. (v. I) and 513 p. (v. II).

U.S. Geological Survey, 1995, National assessment of United States oil and gas resources: U.S. Geological Survey Circular 1118, 20 p.

APPENDIX A. TEXAS GEOLOGIC OIL PLAYS

PLAY CODE	GEOLOGIC PLAY
	Fort Worth Basin Plays
21	Strawn Fluvial/Deltaic Sandstone
22	Bend Conglomerate
23	Caddo Reef
52	Ellenburger Karst-Modified Ramp Carbonate
56	Mississippian Carbonate Buildup/Pinnacle Reef
	Permian Basin Plays
25	Pennsylvanian and Lower Permian Reef/Bank
26	Upper Pennsylvanian and Lower Permian Slope and Basinal Sandstone
27	Eastern Shelf Permian Carbonate
28	Horseshoe Atoll
29	Spraberry/Dean Submarine-Fan Sandstone
30	Simpson Marine Sandstone
31	Devonian Thirtyone Deep-Water Chert
32	Devonian Thirtyone Ramp Carbonate
33	Wristen Buildups and Platform Carbonates
34	Fusselman Shallow-Platform Carbonate
35	San Andres Karst-Modified Carbonate
36	Grayburg High Energy Carbonate—Ozona Arch
37	Grayburg Platform Carbonate
38	San Andres Platform Carbonate
39	Upper Guadalupian Platform Sandstone
40	Leonardian Restricted Platform Carbonate
41	Queen Tidal Flat Sandstone
42	Wolfcamp Platform Sandstone
43	Pennsylvanian Reservoirs
44	Northern Shelf Permian Carbonate
45	Delaware Basin Submarine-Fan Sandstone
48	Miscellaneous
51	Ellenburger Karst-Modified Restricted Ramp Carbonate
52	Ellenburger Selectively Dolomitized Ramp Carbonate
54	Abo Platform Margin Carbonate
59	Wolfcamp Carbonate Debris-Flow
64	Mississippian Platform Carbonate
69	Reservoirs designated by Play Code 69 in the file "Oil_updated.xls" have been transferred into, or combined with, other reservoirs. Cumulative production listed for these reservoirs represents only production prior to the transfer date. No geologic play is assigned to these reservoirs.

APPENDIX B. TEXAS GEOLOGIC GAS PLAYS

PLAY CODE	GEOLOGIC PLAY
	Fort Worth Basin Plays
MS-2	Mississippian Pinnacle Reef Limestone
MS-3	Barnett Shale
PN-6	Upper Marble Falls Platform Carbonate-Bank Limestone
PN-7	Lower and Middle Pennsylvanian Fan-Delta Sandstone and Conglomerate
	Permian Basin Plays and Subplays
MS-1	Mississippian Carbonate, Deep Delaware Basin
OR-1	Ellenburger Fractured Dolostone
OR-2	Ellenburger Karst Dolostone
OR-3	Simpson Group Marine Sandstone, Central Basin Platform
PM-1	Wolfcamp Carbonate
1A	Delaware Basin Debris-Flow Carbonates
1B	Central Basin Platform Shallow-Water Banks and Reefs
PM-2	Spraberry and Dean Sandstone, Midland Basin
PM-3	Clear Fork Platform Carbonate
PM-4	San Andres and Grayburg Platform Carbonate
4A	Restricted Platform
4B	Open-Marine Platform
PM-5	Delaware Sandstone
PM-6	Upper Guadalupian Platform Sandstone
PN-1	Atoka Group Limestone and Sandstone
1A	Delaware Basin
1B	Midland Basin
PN-2	Strawn Group Shallow-Marine Carbonate
2A	Detrital Carbonates
2B	Midland and Val Verde Basin Limestone
PN-4	Upper Pennsylvanian Carbonate
4A	Platform Carbonates, Central Basin Platform
4B	Horseshoe Atoll
4C	Upper Pennsylvanian and Lower Permian Reef/Bank Limestone
PN-5	Upper Pennsylvanian and Lower Permian Slope and Basinal Sandstone
SD-1	Siluro-Devonian Carbonate—Deep Delaware and Val Verde Basins
SD-2	Siluro-Devonian Erosional Truncation
SD-3	Siluro-Devonian Shelf Carbonate
SD-4	Silurian Carbonate Pinch Out