STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

ASHMORE GAS AREA COLES COUNTY, ILLINOIS

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ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, *Chief*
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ASHMORE GAS AREA
COLES COUNTY, ILLINOIS

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ABSTRACT

The Ashmore gas area, of which the Ashmore South gas pool is a part, was discovered in 1948 and is near the northeastern boundary of the principal oil and gas-producing area of Illinois. Forty-three gas wells in an area of some 1500 acres had initial open-flow capacities ranging from 5000 to nearly 1,600,000 cubic feet per day from sandstone lenses in the Pennsylvanian System and from limestone, siltstone, and dolomite in the Mississippian System. The depth to the top of the gas-producing sandstone in the Ashmore South pool ranges from 350 to 446 feet; other wells in the area are as shallow as 180 feet. The shallower wells, which are located within the city of Ashmore, are for household use, whereas the deeper wells in the Ashmore South pool area are for gas storage.

INTRODUCTION

The Ashmore gas area is near the northeastern boundary of the principal oil- and gas-producing area of Illinois (fig. 1). It is in and is south of the city of Ashmore in Coles County, about 8 miles east of Charleston. It includes the south part of T. 13 N., R. 11 E.; the north one-half of T. 12 N., R. 11 E.; secs. 6, 7, and 18 of T. 12 N., R. 14 W.; and secs. 1, 12, and 13 of T. 12 N., R. 10 E.

The main producing zone in the area consists of lenses of sandstone at or near the base of the Pennsylvanian System and probably in the lower part of the Spoon Formation. A few wells produce gas from limestone and dolomite of the Salem Formation and from siltstone of the Borden Formation, both in the Valmeyeran Series of the Mississippian System.

The Central Illinois Public Service Company of Springfield, Illinois, is using the south area, known as the Ashmore South pool, for gas storage. Gas from this area is supplied to the cities of Charleston, Mattoon, and Paris (fig. 1)

through a pre-existing pipeline. Because of the reservoir's economic importance, the geology and production history of the area are briefly summarized.

DEVELOPMENT

The discovery gas well (fig. 2, arrow), the No. 1 Fred Miller in the $SE\frac{1}{4}$ $SE\frac{1}{4}$ $NE\frac{1}{4}$ sec. 18, T. 12 N., R. 11 E., was drilled by Earnest Zink in 1957 to a depth of 434 feet. The top of the gas-producing sandstone was encountered at 419 feet. The well had an open-flow gauge of 1,050,000 cubic feet of gas per day with a shut-in pressure of 100 psig (Bourdon pressure gauge). Since then, a total of 43 gas wells have been completed and, in addition, 15 oil wells have been drilled around the fringe of the gas-producing area. About half of the oil wells have been abandoned. The gas-producing area is divided in two parts that have different depths to the tops of the producing zones. The south area consists of 33 wells varying in depth from 350 to 446 feet. The north area, which is in the city of Ashmore, has wells with depths from 180 to 270 feet. The north area has 10 tested wells and other wells not tested. The wells were drilled for household gas use and are of much smaller volume. The south gas-producing area is somewhat rectangular in shape, about 2 miles long and 1 mile wide, and includes about 1300 acres.

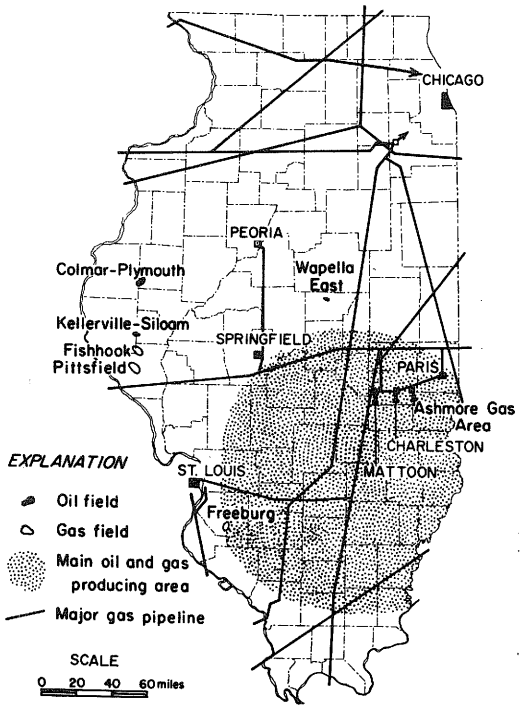


Figure 1 - Index map showing location of the Ashmore gas area with respect to nearby oil and gas pools, the main oil-producing area, and the major gas pipelines.

Open-flow capacities of the gas wells in the city area (table 1) range from 5000 cubic feet of gas per day up to 206,000 cubic feet per day. The average open-flow gauge is 58,000 cubic feet per day. Shut-in pressures initially ranged from 54 psig to 75 psig, and in the summer of 1964 three of these wells had similar pressures of 55 psig. Measured and projected open-flow capacities of the gas wells in the south producing area (tables 2 and 3), before gas injections, range from 9000 cubic feet per day up to 1,600,000 cubic feet per day. The average open flow is 444,000 cubic feet per day. Some of the better open flows are due to more permeable sand conditions, but most of the smaller volumes are due to the pressure drop through the 7 years of drilling activity. The original shut-in pressure on the discovery well was 100 psig, whereas the shut-in pressure on the later wells drilled in 1963 was 84.4 psid (dead-weight tester). Some of this pressure drop is due to the venting of gas during drilling processes and gas volume tests, but more is due to venting several of the oil-producing wells.

The removal of crude oil and associated brines from oil wells that are down dip on the structure (fig. 3) has caused some reservoir pressure decline. Total crude oil production up to 1964 has been about 26,000 barrels, and A.P.I. gravity

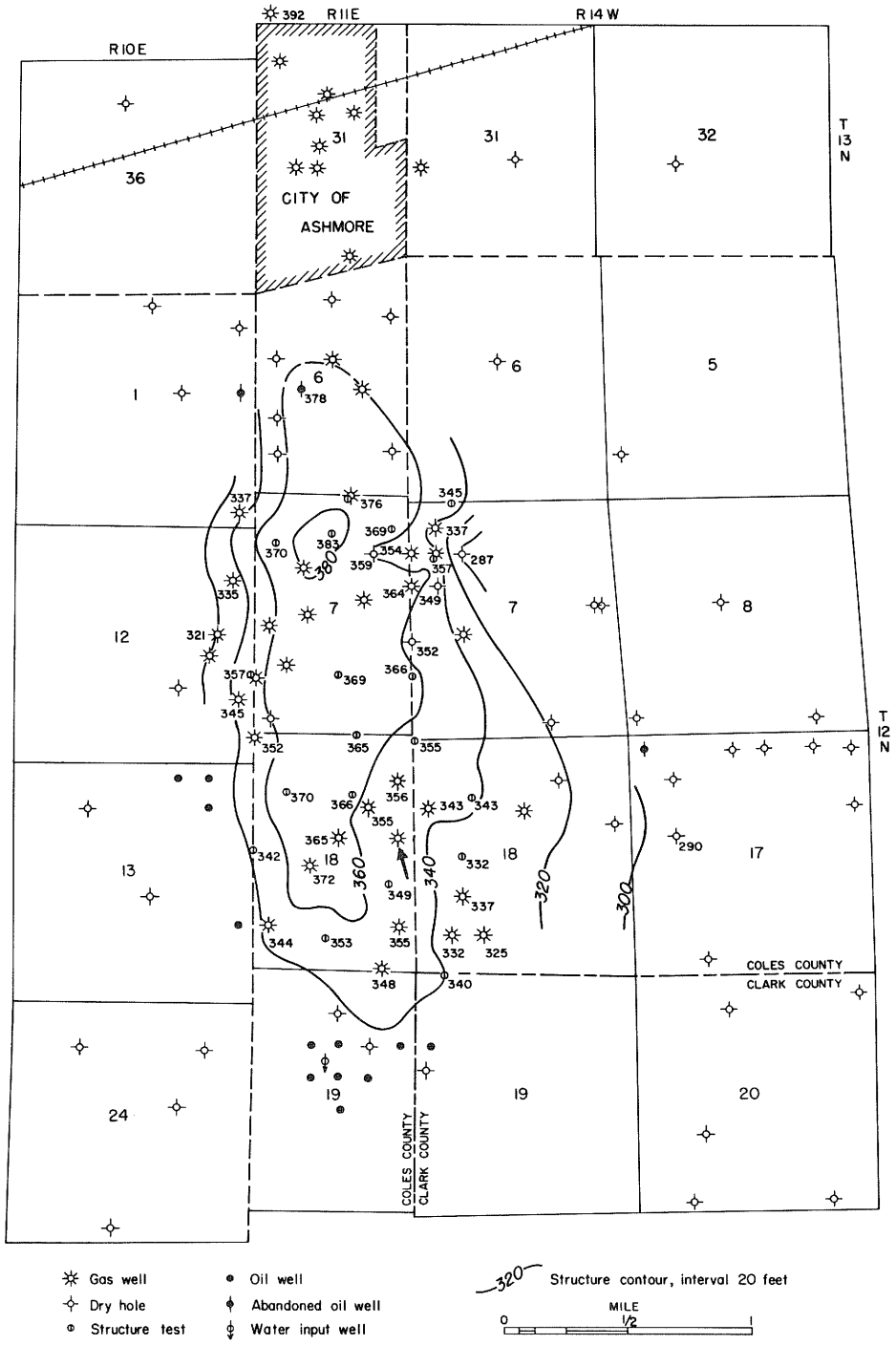


Figure 2 - Ashmore South gas pool showing structure contours on top of the Seeleyville (?) Coal. The discovery well is indicated by an arrow.

TABLE 1 - RESULTS OF OPEN-FLOW TESTS

Well owner	Location	Elev. (ft)	Gas sand depths	Total depth	Casing	Shut-in pressure psig	Open-flow volume Mcf per day 5 min	10 min	15 min	Longer (min)
R. M. Childress	280N 330E SWc 30-13N-11E	697	240-260	342	7" at 240	65.0	26	27		
Ashmore School	1900W 2700S NEc 31-13N-11E	693	180-210	210	7" at 175	64.0			206	
Mike Davis	2350W 2950S NEc 31-13N-11E	694	264-265	265	5½" at 238	67.0	17	16	15	
Dick Meese	500E 850S NWc 31-13N-11E	696	243-245	245	7" at 231	68.0			42	
L. V. See	1250W 2000S NEc 31-13N-11E	690	234-259	259	6" at 230	64.0	37	35	34	33 (25)
See Elevator Co.	1500S 1800W NEc 31-13N-11E	694	270-287	287	8" at 270	55.5	86	91	93	
Joe Shoots	5300S 1300W NEc 31-13N-11E	688	190-205	205	7" at 183	63.0			54	
W. C. Shoots Store	2000S 2000W NEc 31-13N-11E	695	259-260	260	5½" at 246	54.0	18	16	16-	15 (20)
John Wright	2000W 1900N SEc 31-13N-11E	691	245-247	247	5½" at 237	75.0			93	
J. Austin	SW NE SW 31-13N-14W	680	256-259	278	6½" at 250	63.0		5	5	

of this oil was measured at 24°. Associated brines produced were probably twice the volume of crude oil. The analysis of this brine showed the following in parts per million: 14,000 ppm sodium, 23,000 ppm chlorides, 40,000 ppm total solids, and additional minor constituents. Four wells have been drilled since gas injection was started in 1963 (table 2), and their shut-in pressures range from 97.9 psid to 99.2 psid, some 15 pounds higher than wells completed before gas injections. Gas volumes of these four wells also appear to be slightly higher, ranging from 960,000 cubic feet per day to 1,120,000 cubic feet per day. In April 1961, James A. Lewis Engineering, Inc., of Dallas, Texas, calculated the total gas volume of the Pennsylvanian and Mississippian gas sandstone reservoirs in the Ashmore South pool. At 89 psig, the Pennsylvanian reservoir was about 670,000 Mscf (thousand standard cubic feet) and the Mississippian reservoir was about 210,000 Mscf. This information was taken from the Illinois Commerce Commission, Docket No. 47,938, and was calculated from graphs in exhibits No. 7 and No. 8.

ACKNOWLEDGMENTS

I am indebted to Kenneth E. Clegg and Jack A. Simon of the Illinois State Geological Survey for identifying coals on electric logs in the area. Mr. Robert Oborn, gas storage consultant from Mattoon, Illinois, assisted in conducting most

ON WELLS IN THE CITY OF ASHMORE

Build-up pressure psig								Date tested	Remarks	Gas gravity
½ min	1 min	2 min	3 min	4 min	5 min	10 min	Longer (min)			
			14		22	36		4-48	Plugged back to 260, pressure July 1962=69, July 1963=65, July 1954=no gas	.60
24								7-52	Build-up pressure discontinued because of fresh casing cement	.60
	4	7	11	14	17	28	48 (30)	5-54		.60
	8	16	22	28		50		10-51		.61
	7	13	17	22	26	40	50 (15)	12-57	Pressures, 1958=62, 1959=59, 1960=55, 1961=52½, 1962=55, 1963=55	.58
6	11½	20	27	33	37½	47½	53½ (20)	8-62		
	16	26	35	43	49			7-52	July 1953 pressure=73, well drilled deeper to 245	.59
3	5	10	14	17	20	32		5-60	Pressure June 1962=53, May 1963=50	
	29	49	62	70	73			9-51		.61
					6	12	18 (15)			.55

of the earlier back-pressure volume tests, and Mr. Robert Rector, gas engineer with the Central Illinois Public Service Company, assisted in the more recent tests.

Mr. Earnest Zink of Paris, Illinois, who leased and developed most of the field, assisted in testing the original open flows and pressures. Mr. Ben H. Richards, Jr., geologist, of Mattoon, Illinois, furnished numerous well sample descriptions throughout the area, and I am indebted to him for descriptions of off-pool wells where drilling samples are not now available. Repeated volume and pressure tests were conducted on the Shoots Store and See Elevator wells in Ashmore, and I thank Mr. W. C. Shoots and Mr. L. V. See for their cooperation.

GAS TESTING PROCEDURE

The open-flow gas measurements listed (tables 1 and 3) were taken by the author through 2-inch connections at the well heads. The standard procedure was to install a 2-inch by 8-inch nipple that had a $\frac{1}{4}$-inch steel needle valve on a $\frac{1}{4}$-inch nipple welded half way from the ends. A 2-inch gate valve was placed on the output end of this 8-inch nipple, and a 2-inch by 2-foot flow nipple was inserted into the gate valve. Usually, volumes over 3/4 million were measured by a Pitot tube at the end of this flow nipple, and lesser volumes were measured by the 2-inch orifice well tester, which was attached to the output end of the flow nipple. The

TABLE 2 - RESULTS OF BACK-PRESSURE GAS

Farm and well	Location	Elev. (ft)	Gas sand depth	Borden† Siltstone depth	Total depth	Casing	Shut-in pressure psi*
D. Coyle #1	SE SE SE 1-12N-10E	682	394-409	409	419	5" at 410	85.6 D
L. O. Walton #1	1200S 450W NEc 12-12N-10E	702	407-439+		439	4½" at 405	86.6 D
L. O. Walton #2	2290S 750W NEc 12-12N-10E	693	416-453		453	4½" at 416	84.4 D
L. O. Walton #2							85.8 D
L. O. Walton #6	1425N 300W SEc 12-12N-10E	713	405-442+		442	4½" at 406	85.9 D
M. Dudley #1	NW NW SW 7-12N-11E	692	350-373		373	5" at 354	89.0 G
M. Dudley #1							85.7 D
M. Dudley #1					386		85.6 D
M. Dudley #2	1235N 20E SWc 7-12N-11E	698	386-413		413	4½" at 386	86.1 D
M. Dudley #3	1500N 700E SWc 7-12N-11E	702	366-393	393	393	4½" at 366	86.0 D
C. R. Miller #1	SW SE NE 7-12N-11E	700	377-391		391	5½" at 379	89.0 G
C. R. Miller #1							85.9 D
L. O. Walton #4	50S 2126W NEc SE 7-12N-11E	697	364-400		400	4½" at 364	86.5 G
M. Dudley #5	125S 20E NWc 18-12N-11E	720	411-423	423	435	4½" at 408	84.5 D
M. Dudley #5					422		84.4 D
Fred Miller #1	SE SE NE 18-12N-11E	743	419-434	441	443	8" at 112	88.0 G
Fred Miller #1							85.4 D
Fred Miller #2	990N 990W SEc NE 18-12N-11E	740	432-454	432	480	4½" at 476	98.1 D
Fred Miller #3	330N 1650W SEc NE 18-12N-11E	744	433-472	433	472	4½" at 435	97.9 D
Fred Miller #4	1637N 330W SEc NE 18-12N-11E	737	421-424 428-449	428	450	4½" at 419	99.2 D
M. P. Phipps #2	15N 700W SEc 18-12N-11E	727	424-448	452	457	4½" at 425	84.6 D
C. R. Miller #2	745N 20E SWc NW 7-12N-14W	693	368-400		400	4½" at 368	86.5 G
C. R. Miller #3	1405N 20E SWc NW 7-12N-14W	690	384-435		435	4½" at 379	86.1 D
C. R. Miller #5	1405N 580E SWc NW 7-12N-14W	691	383-409		409	4½" at 383	87.0 G
M. C. Ferguson #1	1700N 1100E SWc 18-12N-14W	728	425-451	451	465	4½" at 428	84.8 D
M. C. Ferguson #1							84.8 D
Everett Veach #1	1010N 330E SWc NW 18-12N-14W	749	466-479	463	500	4½" at 500	98.1 D

* D = Dead-weight tester. G = Pressure gauge.
** M = Measured.
† Salem Limestone in some wells.

VOLUME TESTS IN THE ASHMORE SOUTH GAS POOL

Three ten-minute back-pressure tests						Open flow projected Mcf**	Date tested	Remarks
psig	Volume Mcf	psig	Volume Mcf	psig	Volume Mcf			
71	48	50	144	37	202	312[M]	5-63	Plugged back to 403; casing perforated 395 to 403
70	113	50	225	36	275	365	1-63	
69	62	51	131	38	170	233	2-63	
		49	934	35	1190	1600	5-63	Shot with 30 qts.
70½	284	50½	555	38	685	915	1-63	
77	145			32	497	610	7-61	
70½	178	50	370	37	450	580	2-63	
70	342	50+	662	35	831	1100	5-63	Drilled deeper
68½	430	51	710	37	865	1100	12-62	
69	207	49	366	38	439	565	1-63	
60	206	38	303	21	333	375	7-61	
69½	135	50	253	38	307	412	2-63	
70½	247	51	500	36	659	880	12-62	
69	52	50	101	37	134	175	2-63	
70+	62	50-	139	34	188	256	5-63	Plugged back
70	199	57	307	36	461	606[M]	7-61	
70	185	49	400	34	512	655	2-63	
68½	515	51	812	33	900	1070	8-64	Casing perforated 435 to 443, 451 to 453
70-	515	51	710	35	812	960	8-64	
74	710	48½	930	35	Water spray	1120	8-64	
68½	54	51	99	35	134	168	2-63	
71	108	49	231	36½	279	380	12-62	
70	206	50½	417	35	540	710	12-62	Plugged back to 419
70	219	48	429	34	530	660	12-62	
69	147	49	294	35½	370	465	2-63	
69+	124	50	263	35	349	475	5-63	Plugged back to 450
68½	648	48	824	35	Water spray	1020	8-64	Casing perforated 466 to 479

TABLE 3 - RESULTS OF OPEN-FLOW TESTS

Operator*	Farm and well	Location	Elev. (ft)	Gas sand depth	Borden† Siltstone depth	Total depth	Casing	Shut-in pressure psi**
E. Zink	L. O. Walton #5	NW NE SE 12-12N-10E	696	417-462	462	463	5" at 449	84.3 D
E. Zink	L. O. Walton #1	NW NE NE 13-12N-10E	724	446-473	473	475	5½" at 442	78.0 G
E. Zink	M. Dudley #1	NW NW SW 7-12N-11E	692	350-373		373	5" at 354	90.0 G
E. Zink	C. R. Miller #1	SW SE NE 7-12N-11E	700	377-391		391	5½" at 379	94.0 D
C.I.P.S.	C. R. Miller #6	10S 1290W NEc 7-12N-11E	684	355-385	355	385	4½" at 355	87.2 D
E. Zink	L. O. Walton #3	990N 330E SWc NE 7-12N-11E	700	369-376	376	412	10" at 90	
E. Zink	W. Freeman #1	NW SW SW 18-12N-11E	729	430-440	440	495	5½" at 443	
E. Zink	W. Freeman #1							
E. Zink	Fred Miller #1	SE SE NE 18-12N-11E	743	428-441	441	443	8" at 112	
C.I.P.S.	Fred Miller #1					466	4½" at 443	83.1 D
E. Zink	Phipps-Ferguson #1	NE SE SE 18-12N-11E	731	412-425	425	555	7" at 412	96.0 G
E. Zink	E. Farris #1	NE NE SW 7-12N-14W	705	405-416	416	420	7" at 406	87.0 D
E. Zink								73.3 D
C.I.P.S.	M. C. Ferguson #2	800N 800E SWc 18-12N-14W	718	420-450	450	459	4½" at 420	83.2 D
C.I.P.S.	M. C. Ferguson #3	800N 1500E SWc 18-12N-14W	712	419-459	459	459	4½" at 421	83.2 D
C.I.P.S.						441		83.0 G
E. Zink	Reesie Robert #1	NW SW NE 18-12N-14W	722	430-448	448	484	5½" at 438	91.0 D

* C.I.P.S. = Central Illinois Public Service Company.
** D = Dead-weight tester. G = Pressure gauge.
† Salem Limestone in some wells.

flow nipple was used in all tests to avoid turbulence in the flow stream due to plug-type valves on many of the well heads and to avoid turbulence when taking back-pressure readings with partially opened gate valves.

Shut-in pressures were gauged with a standard Bourdon pressure gauge and were double checked with a dead weight tester on many wells. Gas samples were collected under well-head pressure in stainless steel (96 cubic inches) bottles and brought to the Survey's laboratories for analysis. Hydrogen sulphide content of the gas was measured with Tutweiler apparatus on three wells at the well head.

ON WELLS IN THE ASHMORE SOUTH GAS POOL

Open-flow volume (Mcf per day)				Build-up pressure psig									
5 min	10 min	15 min	Longer (min)	½ min	1 min	2 min	3 min	4 min	5 min	10 min	Date tested	Remarks	Gas gravity
452	429	418	418- (20)	34	50	66	73	76	79	83	7-63	H_2S odor	
630	560	503	280 (45)	30	39	48	52	55	57	64	5-60	Completed as oil well	
630	630			54	73	85	88	89	90		5-60		.58
440	440	440		40	65	86	91	93	94-		8-59		.58
100	93	88	87	13	24	40	50	58	63	74	12-62	Gas from Miss. sts.	.61
			136								6-60	Gauged while drilling, drilled deeper	
											3-61	Oil well vented through ½" valve, well not pumping	.65
											7-61	Same as above, well had been pumping day before	
			1050	35	47	57					10-57	Well had been flowing	.59
		231									5-63	Reworked, Miss. gas only	
620				26	44	65	75	79	81	87	6-59		.61
13	12	11	11 (20)		2	3	4	5	6	12	9-59		.61
18	16	15	12 (35)		2	3	4	5	6	11+			
90	90			14	24-	40	53	61-	67	77	2-63		
54	48			8	15	24	34	43	51	71	2-63		
34	31										5-63	Plugged back to 441	
88	53	44		4	9	16	20	25	28	40	5-60		.56

BACK-PRESSURE TESTING

Ten-minute isochronal back-pressure tests (figs. 4, 5, and 6) and the projected open-flow readings (table 2) were measured with the equipment and installation mentioned in this report. Three back-pressure tests were made whenever possible. On the first test, the shut-in pressure was partially released to about 70 psig; on the second test, the pressure was dropped from 70 to 50 psig; on the third test, the pressure was dropped to about 35 psig. On most tests, the back-

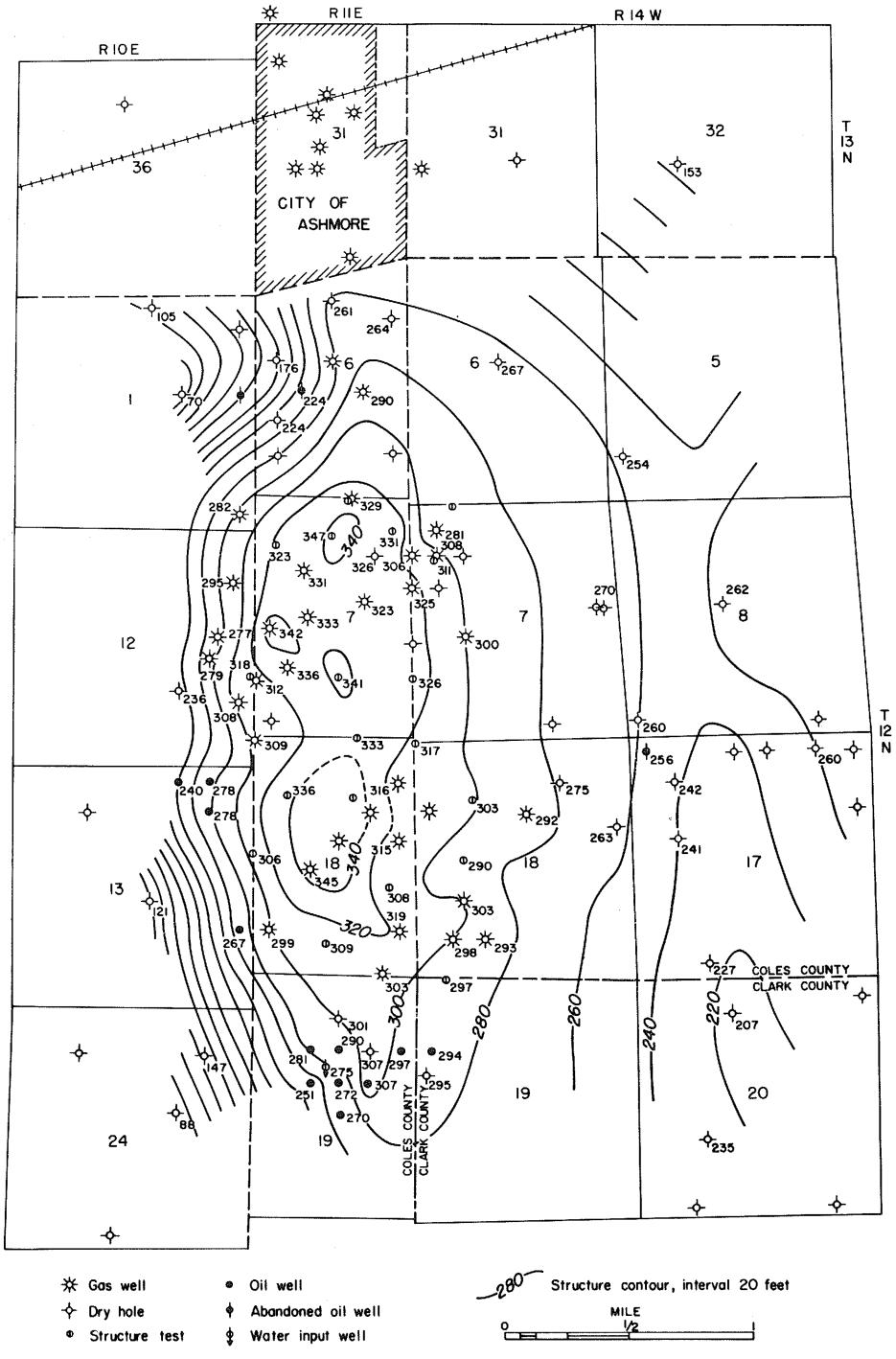


Figure 3 - Ashmore South gas pool showing structure contours on top of the gas sandstone in the Spoon Formation (Pennsylvanian).

pressure would stabilize within two or three minutes, but on several occasions, pressures kept declining slightly. These wells were producing from nonpermeable sandstone, or they contained drilling mud and, in a few cases, formation brine. The standard 2-inch Critical-Flow Prover was not used in this pool because of the small volumes and the low pressures encountered. Back-pressure tests were conducted to determine the ability of a well to deliver gas against different pipeline pressures.

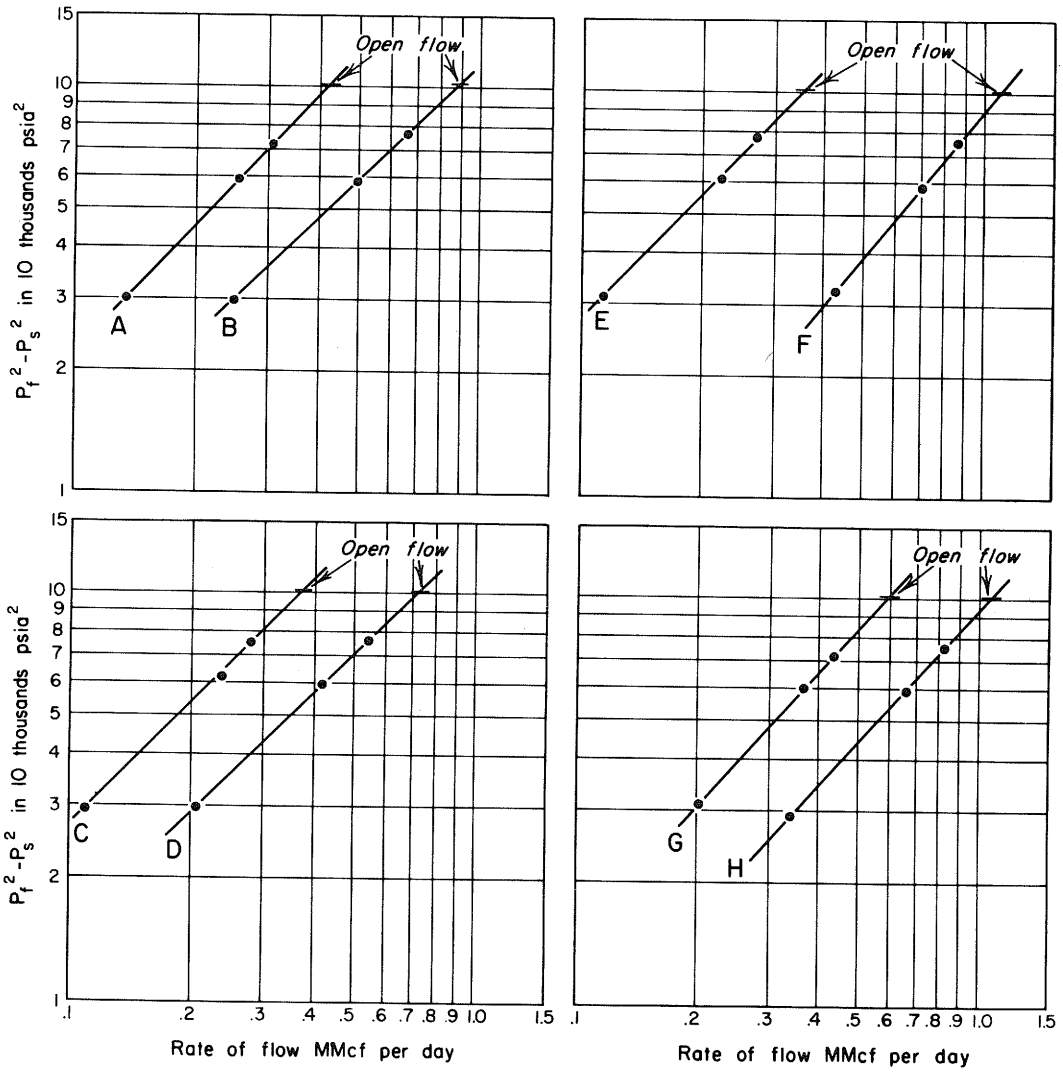
GAS ANALYSES

Gas gravities measured 0.58 to 0.61 (air is 1.00), indicating a dry gas. This is also verified by gas analyses (table 4). Gas samples from six wells were analyzed by the Orsat method in the Survey's laboratory. William Armon of the Survey staff conducted the laboratory tests and measured the hydrogen-sulphide content of gases on three wells at the well site with the Tutweiler apparatus. The H_2S content of the gases from three wells in sec. 12, T. 12 N., R. 10 E. was less than 2.0 grains per 100 cubic feet in L. O. Walton No. 5, 5.0 grains in L. O. Walton No. 2, and 35.0 grains in L. O. Walton No. 1. H_2S was not noticed at other wells in the field. Eleven gas samples have been analyzed by mass spectrometer at the Institute of Gas Technology in Chicago, Illinois. These analyses are similar to the Orsat analyses, except that they measure trace amounts of ethane, propane, butane, and helium. The carbon dioxide content of the gases from this area are higher than most gases from Illinois, based on several hundred analyses by the Survey. Freeman No. 1 and Phipps-Ferguson No. 1 gases measured 9.6 percent CO_2, and they both are located in the south part of the field. The analyses suggest that the city gas wells have less CO_2, which is probably due to their shallow depth.

CORE ANALYSES

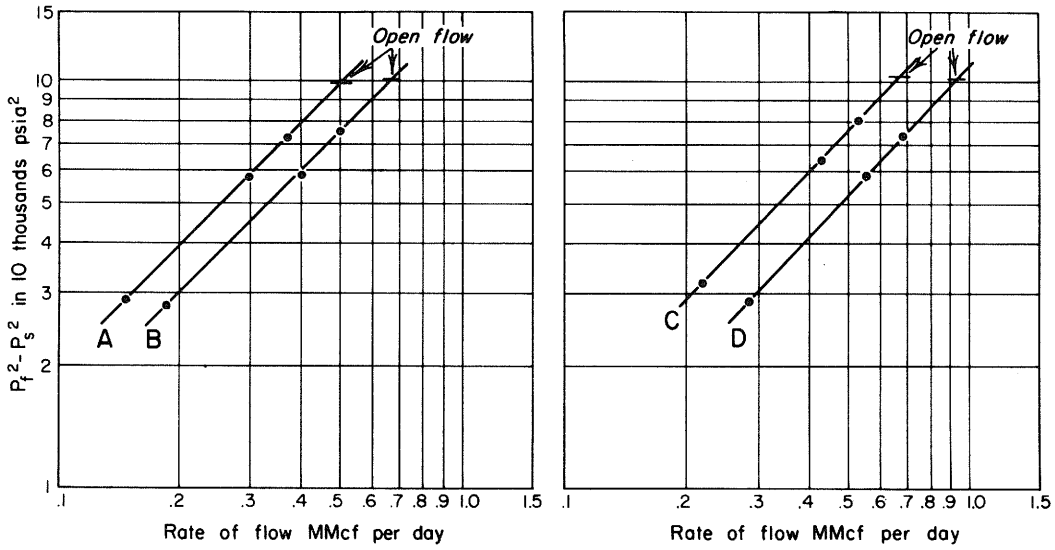
The core analyses listed in table 5 were furnished by the Central Illinois Public Service Company. Most of the structure test holes were cored and the cores were analyzed for permeability, porosity, oil saturation, and water saturation. Partial analyses have been listed for five wells through the Pennsylvanian gas-producing sandstone. The average permeability for this group is 144 millidarcys, and the average porosity is 16 percent. The sandstone is fine to coarse, angular to subrounded, and slightly micaceous. Many wells not listed in table 5 were cored in the Borden Siltstone, which consists of siltstone and dolomitic siltstone. The core analyses from these wells indicate very little permeability and only slight porosity.

Cores in the Salem Limestone from a few wells near the centers of the $NE\frac{1}{4}$ and $SE\frac{1}{4}$ sec. 18, T. 12 N., R. 11 E. and the center of the $NW\frac{1}{4}$ sec. 18, T. 12 N., R. 14 W. consisted of light gray, finely fossiliferous, partly oolitic limestone. The core analyses showed fair to good permeability up to 3000 millidarcys, but high water saturation.



A, C. R. Miller 1, SE-NE 7-12N-11E (1963)
B, L. O. Walton 4, NE-SE 7-12N-11E
C, C. R. Miller 2, SW-NW 7-12N-14W
D, C. R. Miller 3, SW-NW 7-12N-14W
E, L. O. Walton 1, NE-NE 12-12N-10E
F, M. Dudley 2, SE-SW 7-12N-11E
G, M. Dudley 3, NE-SW 7-12N-11E
H, M. Dudley 1, NW-SW 7-12N-11E (May 1963)

Figure 4 - Ten-minute back-pressure tests on eight Ashmore South gas pool wells.



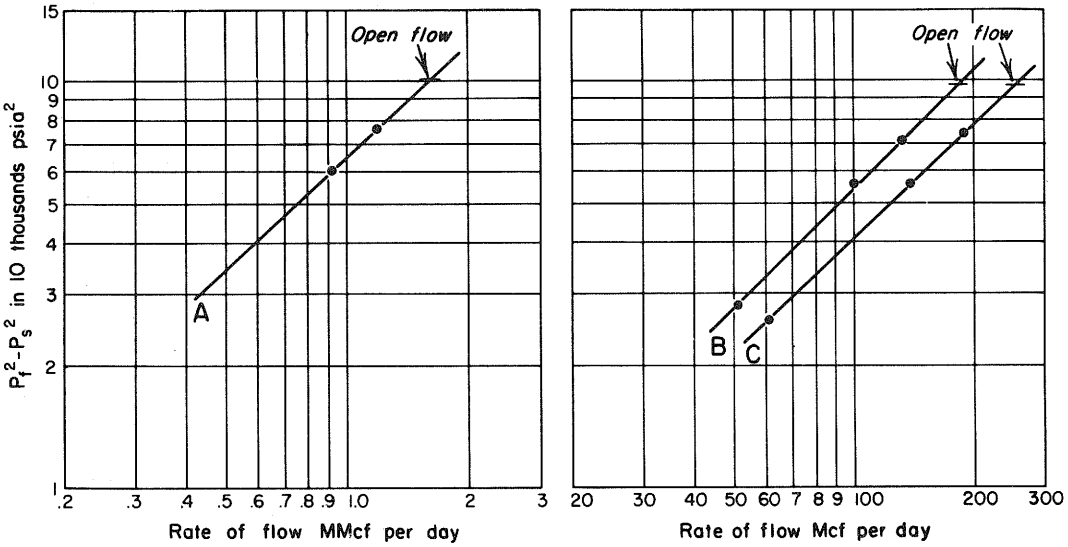
A, M. Ferguson 1, NE–SW 18–12N–14W (Feb. 1963)
B, Fred Miller 1, SE–NE 18–12N–11E (Feb. 1963)
C, C. R. Miller 5, NW–NW 7–12N–14W
D, L. O. Walton 6, NE–SE 12–12N–10E

Figure 5 - Ten-minute back-pressure tests on four Ashmore South gas pool wells.

STRUCTURE

The Ashmore South gas structure is an elongate oval dome, called the Ashmore Dome, on the western branch of the Oakland Anticline (fig. 7), which is the eastern half of the LaSalle Anticlinal Belt through this part of Illinois. The dome trends north-south and has a closure of about 25 feet on top of the Seeleyville (?) Coal (fig. 2), 87 feet on top of the Pennsylvanian gas sand (fig. 3), and 144 feet on top of the Borden Siltstone and the Salem Limestone (fig. 8). Electric log cross sections (figs. 9 and 10) show this configuration. The dome is about 4 miles long and about 2 miles wide. The structure map of the pre-Pennsylvanian erosional surface by Clegg (1959) indicates a regional dip to the west of 400 feet in $2\frac{1}{2}$ miles from the top of the Ashmore Dome. To the east, the dip is about half as much.

The Pennsylvanian sandstone gas reservoir in the Ashmore South pool varies from 4 feet to over 80 feet thick (fig. 11). On the flanks of the dome, where the top of the sand is about 50 feet lower, the sand is 40 feet or more thick, and crude oil saturation is usually encountered, especially on the west, southwest, and south. The sand appears to become very shaly along the north line of sec. 18, T. 12 N., R. 11 E., as indicated in electric logs. The author attempted to measure the open flow of two of three wells that were supposed to have been completed in the sand in sec. 6, T. 12 N., R. 11 E. Only a puff of gas was obtained in one well and about 21,000 cubic feet in the other.



A, L. O. Walton 2, SE-NE 12-12N-10E (May 1963)
B, M. Dudley 5, NW-NW 18-12N-11E (Feb. 1963)
C, M. Dudley 5, NW-NW 18-12N-11E (May 1963)

Figure 6 - Ten-minute back-pressure tests on three Ashmore South gas pool wells.

Another shaly area occurs in the SE$\frac{1}{4}$ sec. 7, T. 12 N., R. 11 E., the NE$\frac{1}{4}$ sec. 18, T. 12 N., R. 11 E., and the NW$\frac{1}{4}$ sec. 18, T. 12 N., R. 14 W.

Three wells have been completed in the Salem Limestone in the shaly area mentioned above, in the NE$\frac{1}{4}$ sec. 18, T. 12 N., R. 11 E., and one has been completed in the NW$\frac{1}{4}$ sec. 18, T. 12 N., R. 14 W. Two of these wells encountered water on back-pressure tests.

The Ashmore city gas wells are completed in shallow, thin, silty, sandy zones at different depths, and correlation between the zones was not practical.

A well in the southwest corner of sec. 30, T. 13 N., R. 11 E., just north of the city limits, was drilled to the Devonian System. The top of the Borden Siltstone was entered at an elevation of 330 feet above sea level. This shows a rise of 140 feet from the northernmost well of the Ashmore South structure and may indicate another dome farther north on the west branch of the Oakland Anticline. Additional drilling is needed to verify this.

STRATIGRAPHY

Glacial drift from 62 feet to 120 feet thick overlies the bedrock in most of the area. Pennsylvanian rocks underlie the drift and they include strata of the Modesto, Carbondale, and Spoon Formations. The Modesto Formation in this area is principally shale. The Carbondale Formation extends from the Danville (No. 7) Coal Member down to below the Colchester (No. 2) Coal Member (figs. 9 and 10).

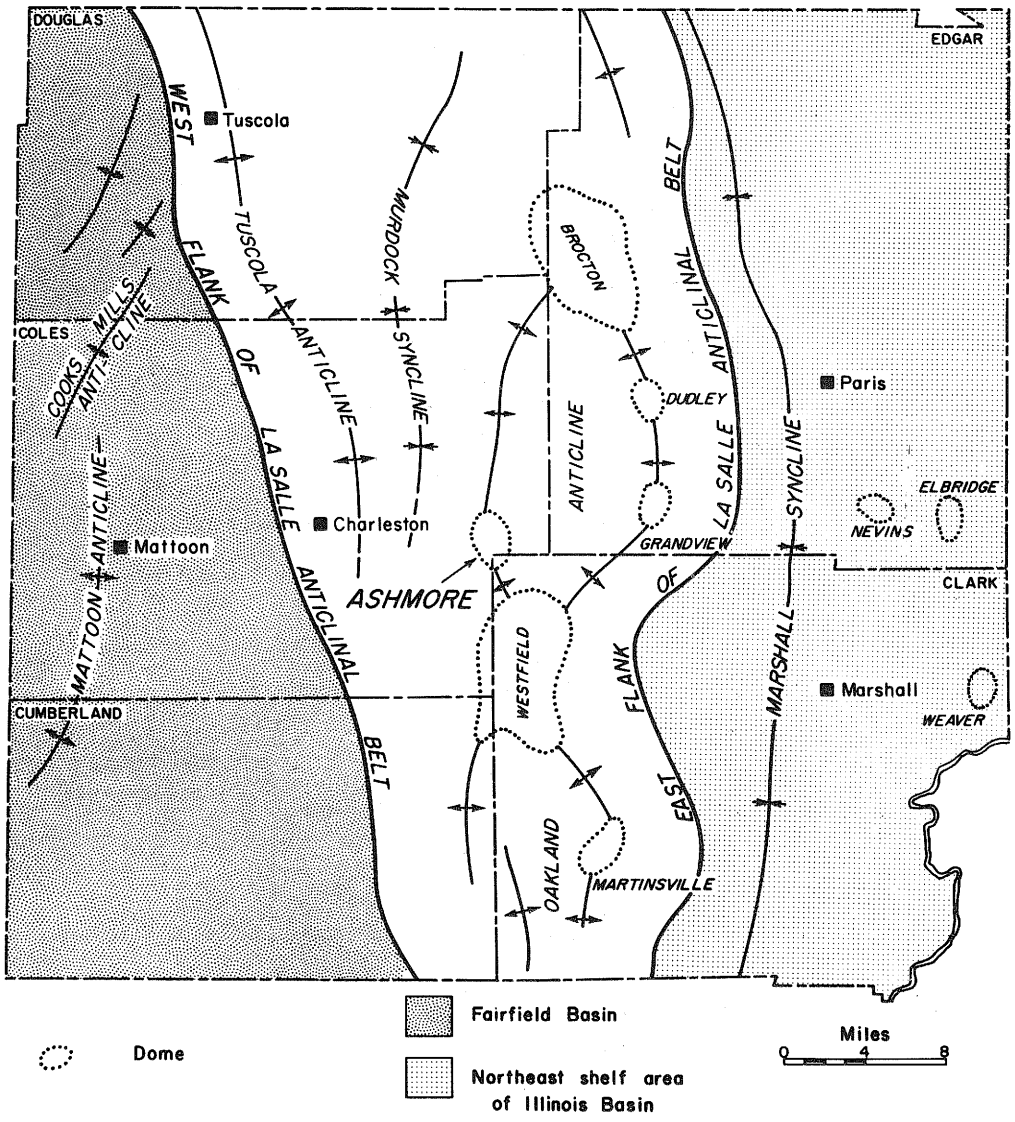


Figure 7 - Index map showing location of principal structural features in Douglas, Coles, Cumberland, Edgar, and Clark Counties (from Clegg, Illinois Geological Survey, Circular 380, in press).

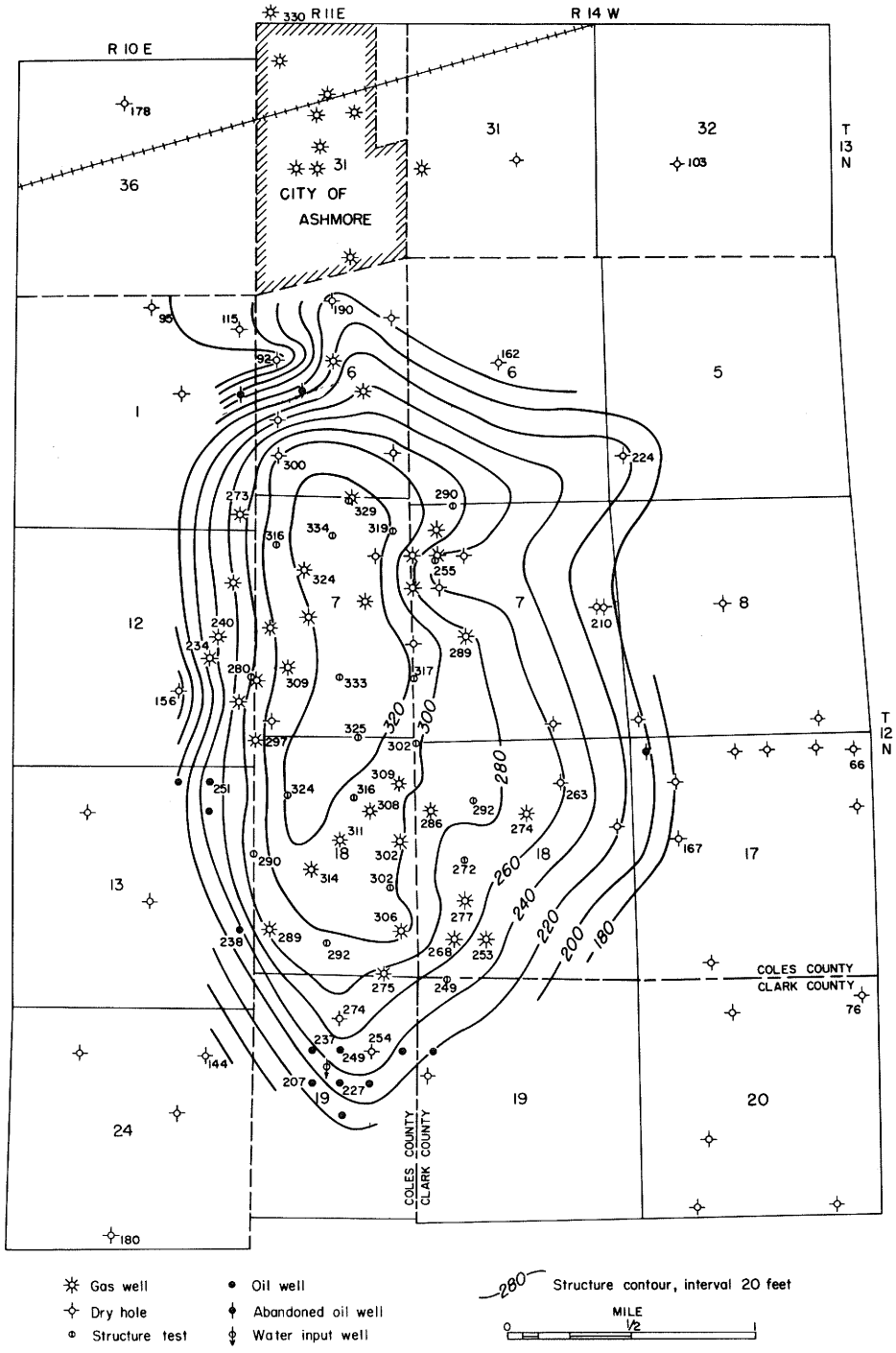


Figure 8 - Ashmore South gas pool showing structure contours on top of the Salem Limestone and the Borden Siltstone (Mississippian).

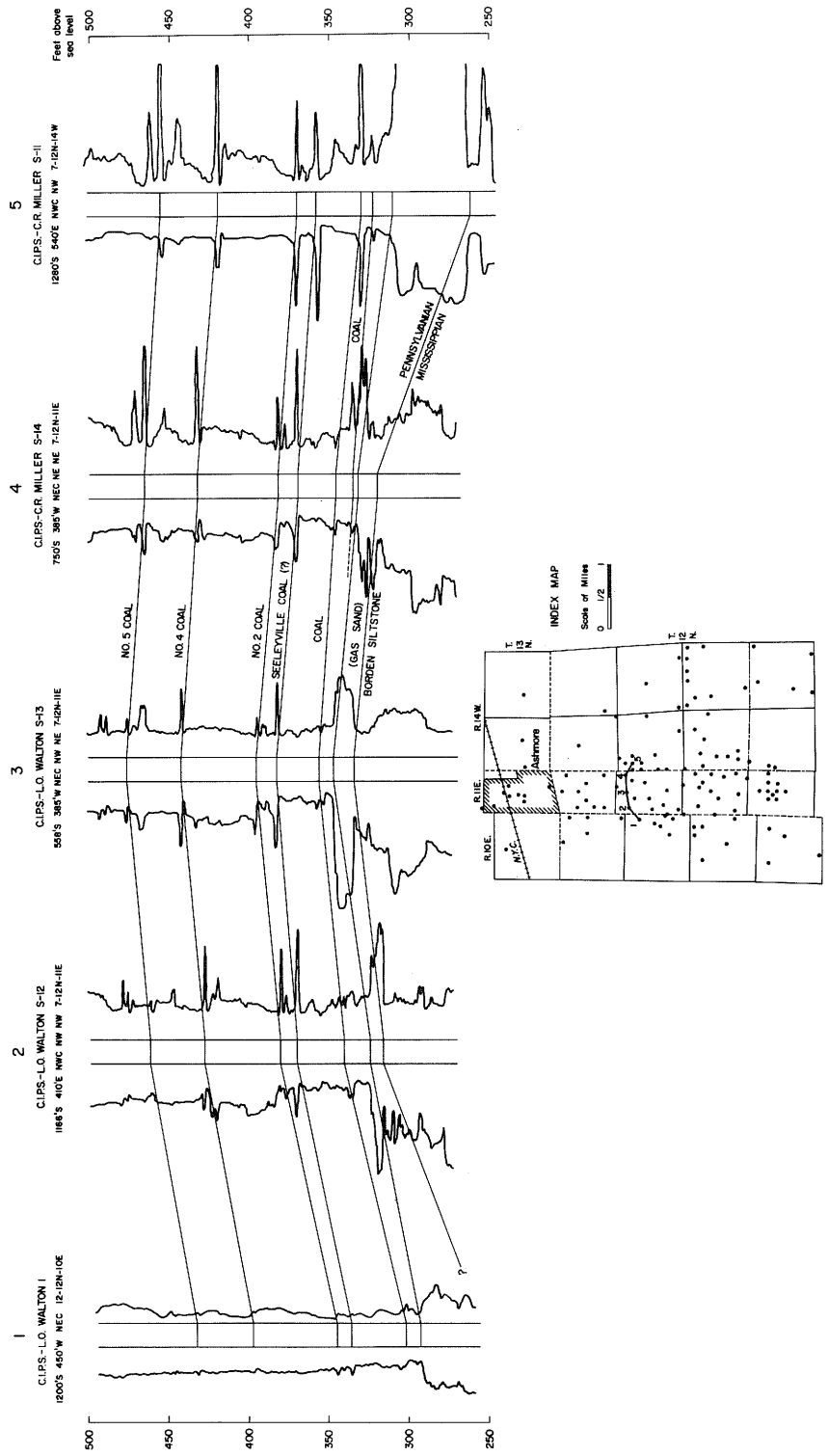


Figure 9 - East-west electric log cross section of the Ashmore South gas pool.

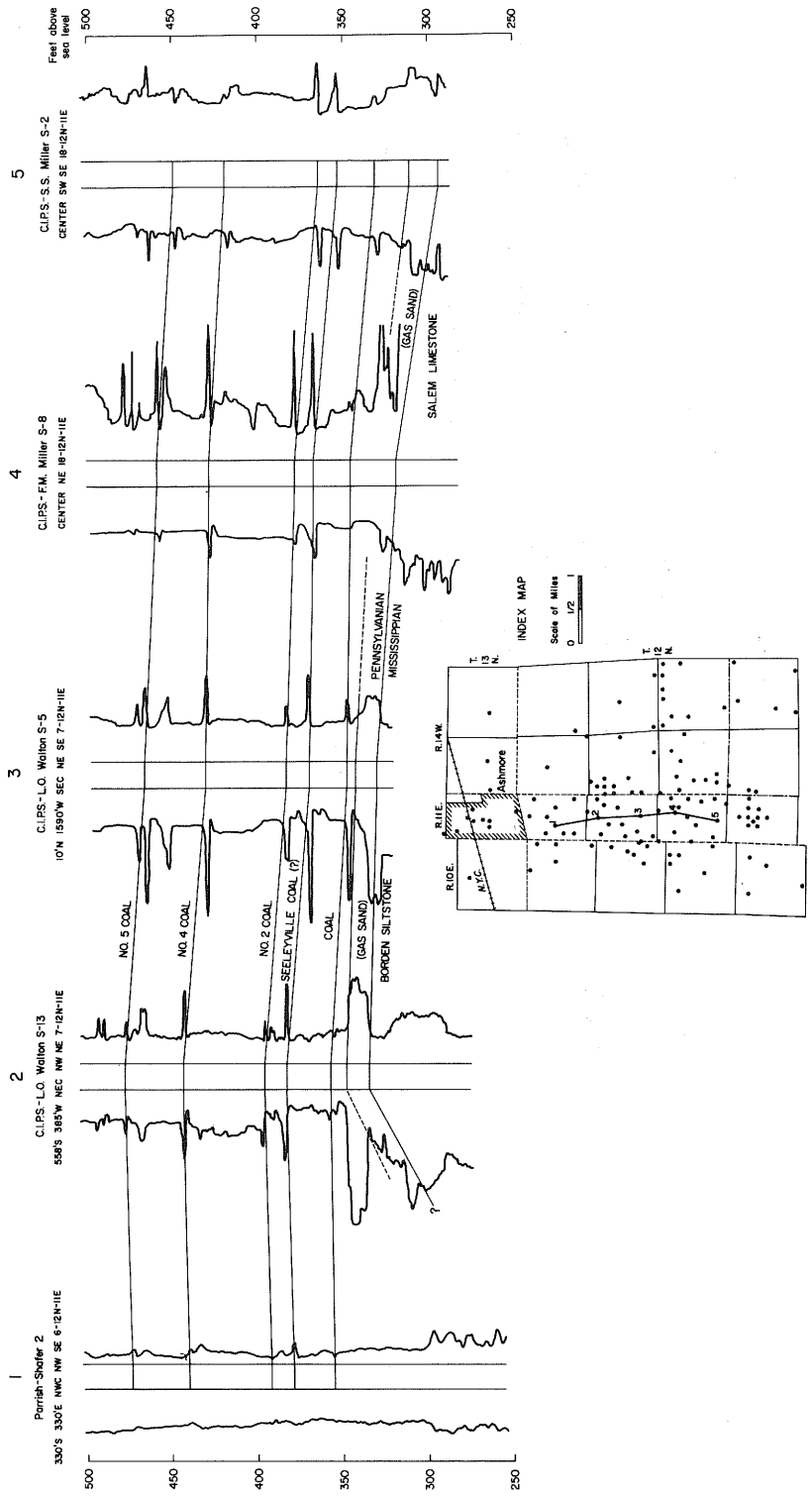


Figure 10 - North-south electric log cross section of the Ashmore South gas pool.

The Spoon Formation includes a coal tentatively correlated with the Seeleyville Coal (Coal III of Indiana). A lower, uncorrelated coal extends over the structure, and a second lower coal is present only on the east flank (fig. 9). The gas sand, where present at the base of the Pennsylvanian, is below these uncorrelated coals and is usually overlain by a shale. The Pennsylvanian strata extend to an estimated depth of 485 feet in the Parrish-Ensminger No. 2 Shafer oil test well in the NW¼ NW¼ SE¼ sec. 6, T. 12 N., R. 11 E. This well was a Trenton test, and formations below the Pennsylvanian System are as follows:

	Thickness (ft)	Depth (ft)
Mississippian System		
Valmeyeran Series		
Borden Siltstone	476	961
Kinderhookian Series		
New Albany Shale Group (in part Devonian)	96	1057
Devonian System		
Middle Devonian Series		
Lingle Limestone	72	1129
Grand Tower Limestone	103	1232
Lower Devonian Series		
Bailey Limestone	78	1310
Silurian System		
Niagaran Series	539	1849
Alexandrian Series	12	1861
Ordovician System		
Cincinnatian Series		
Maquoketa Shale Group	245	2106
Champlainian Series		
Galena (Trenton) Limestone Group	56	2162
Total Depth	=	2162

The Valmeyeran Series in this well consists entirely of siltstone and dolomitic siltstone of the Borden Siltstone Formation, but the feather edge of the truncated Salem Limestone is present above the Borden in wells about 1 mile to the south. The Salem has a thickness of 120 feet in the Phipps-Ferguson No. 1 well in the NE¼ SE¼ SE¼ sec. 18, T. 12 N., R. 11 E. The Salem Limestone and probably the St. Louis Limestone occur down dip 2 miles west of the No. 2 Shafer well in the Schrider Oil No. 1 Houghton well in sec. 2, T. 12 N., R. 10 E., and the pinch-out of the St. Louis is probably only 1 mile west of the Shafer well.

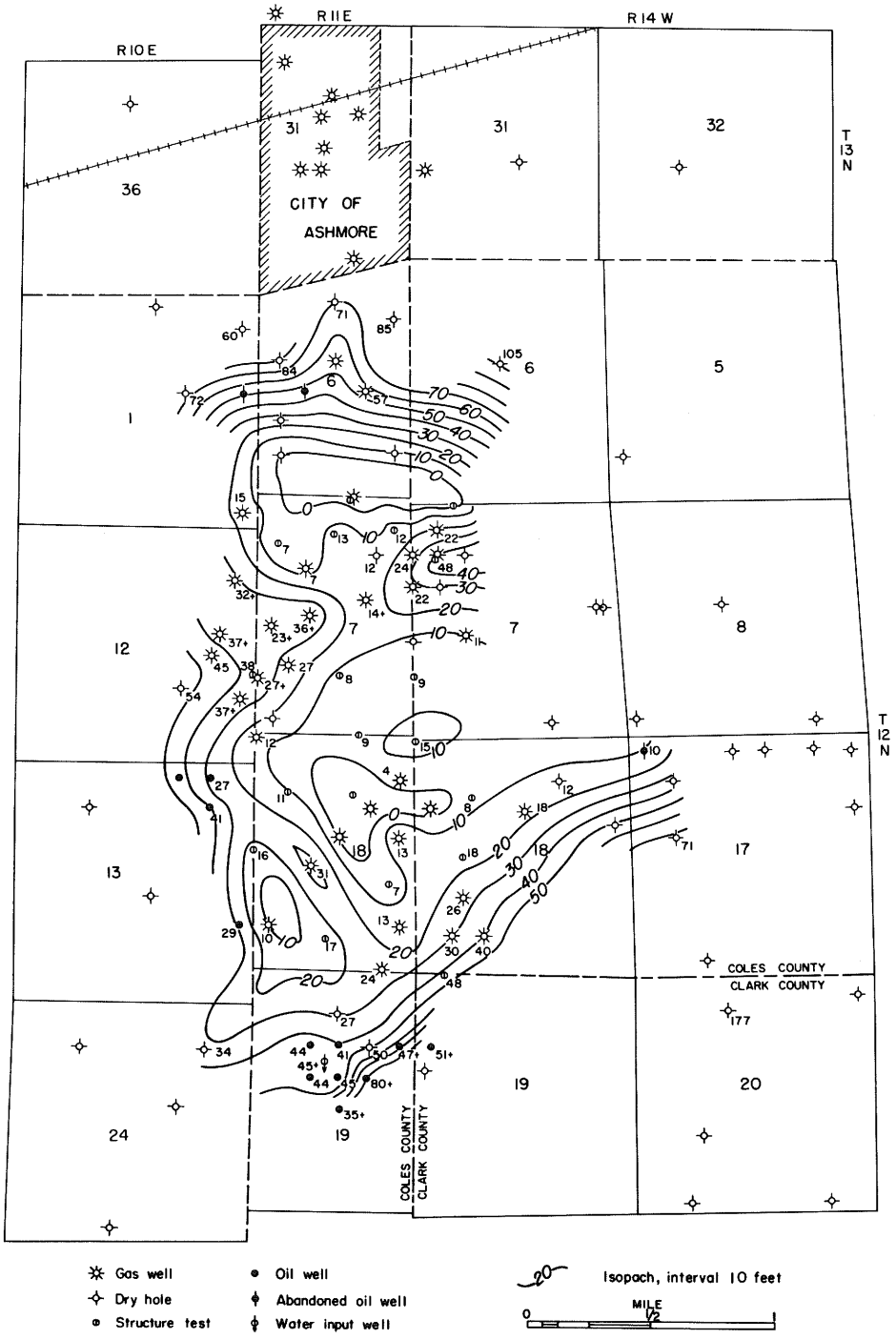


Figure 11 - Ashmore South gas pool showing thickness of the gas sandstone in the Spoon Formation (Pennsylvanian).

TABLE 4 - GAS ANALYSES FROM THE ASHMORE AREA

Farm and well, or well owner*		Location	Carbon dioxide CO_2	Oxygen O_2	Carbon monoxide CO	Hydrogen H_2	Helium He	Nitrogen N	Methane CH_4	Ethane C_2	Propane C_3	N-Butane C_4	Calculated Btu total	Specific gravity**
Coyle #1	a	1-12N-10E	5.0				0.02	1.6	93.2	0.11	0.03	0.00	932	.611[c]
Shoots #1	a	6-12N-11E	3.6				0.00	0.85	95.4	0.09	0.04	0.01	954	.594[c]
Shafer #3	a	6-12N-11E	6.3				0.03	1.3	92.2	0.10	0.05	0.00	922	.622[c]
M. Dudley #1	b	7-12N-11E	5.2		0.9				93.9				953	.58[d]
M. Dudley #1	a	7-12N-11E	7.1				0.03	1.0	91.7	0.10	0.11	0.00	918	.629[c]
C. R. Miller #1	b	7-12N-11E	5.4	0.1	0.8			2.2	91.5				929	.58[d] (.62[c])
C. R. Miller #1	a	7-12N-11E	6.9				0.02	0.91	92.0	0.13	0.05	0.01	921	.626[c]
C. R. Miller #6	a	7-12N-11E	5.1				0.05	1.3	93.4	0.12	0.06	0.00	933	.611[c]
L. O. Walton #4	a	7-12N-11E	7.1				0.04	0.84	91.8	0.15	0.08	0.00	920	.628[c]
Freeman #1	a	18-12N-11E	9.6				0.01	0.49	89.5	0.02	0.32	0.02	901	.654[c]
Fred Miller #1	b	18-12N-11E	6.1		0.7			1.6	91.6				929	.59[d] (.62[c])
Phipps-Ferguson #1	b	18-12N-11E	8.9	0.5	0.5	0.7		3.9	85.3				871	.61[d]† (.66[c])
Phipps-Ferguson #1 (Resampled)	b	18-12N-11E	9.6	0.1		0.5		0.9	88.9				901	.61[d] (.65[c])
Ashmore School	a	31-13N-11E	5.0				0.02	0.79	94.1	0.05	0.02	0.00	940	.606[c]
Ashmore Church	a	31-13N-11E	5.2				0.02	0.69	94.1	0.04	0.01	0.00	939	.608[c]
L. V. See	b	31-13N-11E	5.0	0.4	0.6	0.3		0.3	93.3				949	.58[d]‡ (.60[c])
Joe Shoots	a	31-13N-11E	3.6				0.00	0.85	95.4	0.09	0.04	0.01	954	.594[c]

* a = Institute of Gas Technology, Mass Spectrometer Analyses.
b = Illinois State Geological Survey, Orsat Analyses.
** c = Calculated from analysis.
d = Measured.
† = 0.2% illuminants.
‡ = 0.1% illuminants.

TABLE 5 - PARTIAL CORE ANALYSES FOR FIVE STRUCTURE TEST WELLS FROM THE PENNSYLVANIAN GAS SANDSTONE IN THE ASHMORE SOUTH GAS POOL

M. Dudley No. S-3 10'N, 800'W, SWc NW SE, 7-12N-11E		
Depth (ft)	Permeability (md)	Porosity (%)
382	8	9.2
383	115	11.8
384	125	12.2
385	26	9.7
386	56	17.2
387	21	18.0
388	13	13.3
389	21	15.3
390	25	14.8
391	68	17.2
392	22	14.2
393	128	20.6
394	52	18.5
395	66	12.2
396	102	17.5
397	48	15.5
398	3	16.3
399	61	15.1
400	40	14.8
401	11	13.2
402	0	15.8
407	2	14.2
408	230	18.5
409	206	19.0
410	97	18.0
411	133	19.0
412	19	18.4
413	5	14.5
414	8	13.9
415	235	14.4
L. O. Walton No. S-13 558'S, 385'W, NEc NW NE 7-12N-11E		
348	112	14.3
349	37	19.7
350	63	21.4
351	258	19.4
352	332	20.2
353	212	17.0
354	19	21.3
355	135	23.1
356	177	18.8
357	153	19.8
358	63	19.6
359	20	21.2
360	212	19.3

C. R. Miller No. S-11 1280'S, 540'E, NWc NW 7-12N-14W		
Depth (ft)	Permeability (md)	Porosity (%)
382	0	14.5
383	0	13.2
384	79	13.6
385	33	17.0
386	314	16.8
387	135	19.1
388	141	18.1
389	143	14.3
390	75	16.3
391	249	18.1
392	273	21.1
393	20	14.2
394	5	13.8
395	165	13.7
396	170	13.7
397	7	13.5
398	53	14.2
399	92	15.6
400	95	18.2
401	24	18.7
402	29	20.3
403	64	19.4
404	38	18.1
405	86	19.3
406	12	19.2
407	57	17.3
408	230	18.1
409	364	19.5
410	200	15.0
411	115	19.4
412	158	17.9
413	852	19.4
414	148	20.9
415	270	19.8
416	77	20.2
417	435	21.0
418	468	20.5
419	474	21.9
420	370	25.2
421	247	23.1
422	268	23.3
423	98	19.0
424	175	21.4
425	425	20.0
426	112	18.7

C. R. Miller No. S-14 750'S, 385'W, NEc NE NE 7-12N-11E		
Depth (ft)	Permeability (md)	Porosity (%)
359	0	
360	19	12.6
361	158	13.7
362	5	10.1
363	149	13.9
364	88	12.6
365	250	12.4
366	34	16.1
367	26	20.3
368	5	15.0
369	3	15.7
S. S. Miller No. S-2 Cen. SW SE 18-12N-11E		
400	1	10.5
401	1	14.6
402	0	10.8
403	0	14.9
404	0	13.7
405	0	10.3
406	0	6.5
407	464	21.2
408	640	20.7
409	574	20.2
410	227	17.5
411	108	20.2
412	27	18.0
413	62	22.9
414	4	16.3
415	274	25.0
416	117	19.4
417	152	17.8
418	2	18.7
419	8	17.2
420	408	10.5
421	256	22.7
422	70	19.3
423	34	20.4

SOME ILLINOIS STATE GEOLOGICAL SURVEY PUBLICATIONS PERTAINING TO NATURAL GAS

The Oil Fields of Crawford and Lawrence Counties: R. S. Blatchley. 1913. Bulletin 22 (out of print).

Oil Investigations in Illinois: F. H. Kay. 1915. Bulletin 31 (out of print).

Oil Investigations in Illinois: M. L. Nebel. 1919. Bulletin 40 (out of print).

A Restudy of the Staunton Gas Pool: L. A. Mylius. 1919. Bulletin 44A (out of print).

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Glacial-Drift Gas in Illinois: W. F. Meents. 1960. Circular 292.

Underground Storage of Natural Gas in Illinois: A. H. Bell. 1961. Circular 318.

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