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OIL AND GAS IN THE ADAMS-BROWN-SCHUYLER COUNTY AREA, ILLINOIS

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ABSTRACT

The discovery of the Kellerville and Siloam oil pools in western Illinois in 1959, the first in the area since 1914, prompted a geologic study of the nature of the pay zone and the conditions of entrapment.

The oil is trapped at a depth of 600 to 675 feet in vuggy dolomite zones in Silurian limestone on a terrace on the northeast flank of the Fishhook Anticline. The thickness and lateral extent of the pay zone are unpredictable; it is absent in much of the area. Its maximum known thickness is 7.5 feet.

The areas southwest of the Plymouth pool, southeast of the Siloam pool, and southeast of the Fishhook pool are recommended for further prospecting.

INTRODUCTION

The discovery in late 1959 of commercial quantities of oil approximately 8 miles north of the Fishhook gas pool in western Illinois prompted investigation of its geologic occurrence. The area studied is bounded on the north by the Colmar-Plymouth oil field and on the south by the Fishhook gas pool, and includes all of Brown and parts of Schuyler, Pike, Adams, Hancock, and McDonough Counties. It is approximately 48 miles long from north to south, 33 miles wide from east to west, and its western edge is 12 miles east of Quincy, Illinois (fig. 1).

Physiographically the area is in the southern part of the Galesburg Plain of the Till Plains Section of the Central Lowlands Province. Except for the western and southern fringes that drain westward to the Mississippi River, the area drains eastward to the Illinois River via McKee Creek and the La Moine River. Topographic elevations in the area range from more than 880 feet above sea level at the village of Baylis in Pike County to below 430 feet above sea level in the Illinois River bottom. Local relief is generally 60 to 100 feet.

GEOLOGY

General Setting and Geologic Position

The area discussed is high on the northwest flank of the Illinois Basin (fig. 2) and only a few miles east of the crest of the Mississippi River Arch, which separates the Illinois and Forest City Basins (USGS and AAPG, in press). Rock strata dip gently eastward at an average rate of about 8 feet per mile toward the deep part of the Illinois Basin. Pleistocene glaciation of the entire area left deposits of till, loess, sand, and gravel, as much as 200 feet of which remains in some places. Pennsylvanian and Mississippian rocks, however, crop out in many places. Records of deep water wells and oil tests reveal the sequence and character of these and deeper strata. A generalized columnar section appears in figure 3.

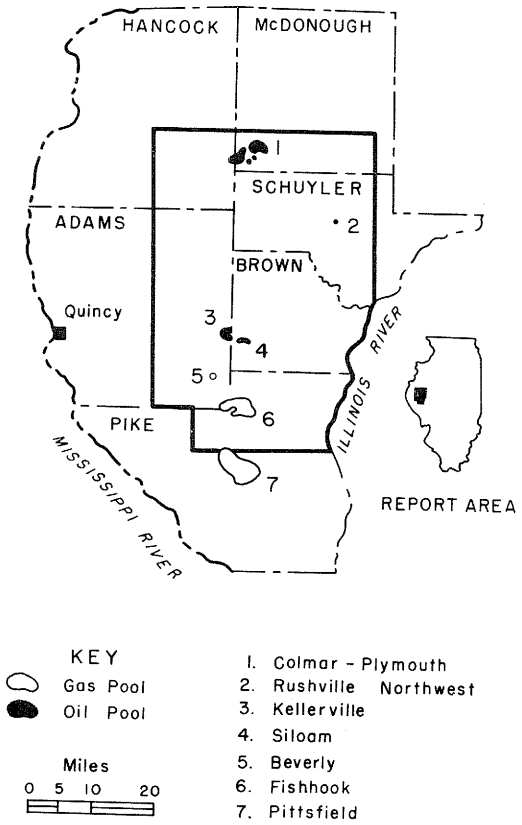


Fig. 1 - Occurrences of oil and gas in the area of this report.

Stratigraphy

Pleistocene Series

Accumulations of Recent alluvium, Wisconsinan loess, and glacial till of Illinoian and Kansan age vary in thickness from a few feet to about 200 feet in the region studied. The average thickness throughout the area is 50 to 75 feet.

Pennsylvanian System

Pennsylvanian strata rest unconformably on Mississippian rocks. They consist of interbedded shales, sandstones, coals, and limestones and vary in thickness from 150 feet on the west to over 300 feet in the eastern part of the area. The Pennsylvanian System has been completely eroded in the major stream valleys. Structure maps of the Colchester (No. 2) Coal, drawn by Nebel (1919), Morse and Kay (1915a), and Hinds (1914) have proved useful in locating deeper structures.

Mississippian System

St. Louis Limestone. - The St. Louis Limestone is the youngest of the Mississippian formations in the area. It is a light gray, cherty, dense, fossiliferous limestone averaging 15 to 30 feet thick throughout the area. It is separated from overlying Pennsylvanian strata by a major erosional unconformity.

Salem Limestone. - The Salem Limestone is browner, sandier, and more dolomitic than the St. Louis and varies in thickness from 10 to 40 feet.

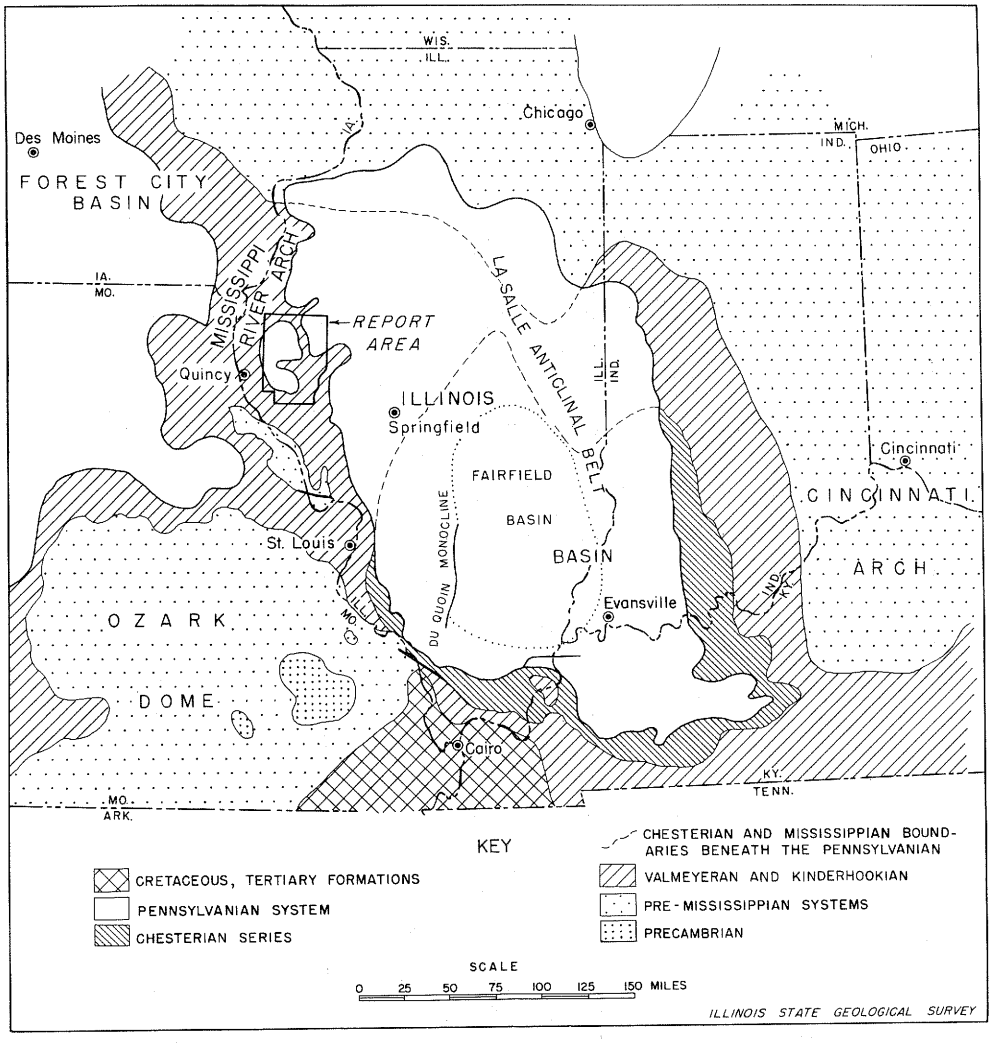


Fig. 2 - Geologic setting of report area.

Warsaw Formation. - The lithology of the Warsaw Formation varies laterally from light greenish gray, dolomitic or calcareous shale containing geodes to limestone, dolomite, or siltstone. Its thickness varies from 60 to 80 feet in the area.

Burlington-Keokuk Limestone. - The Keokuk Limestone and the underlying Burlington Limestone generally are not differentiated in well records. The unit is cherty, dolomitic limestone, light gray to dark gray in the upper part and white to light gray in the lower part. Thickness of the Burlington-Keokuk ranges from 180 to 240 feet.

"Kinderhook" Shale. - In oil field parlance "Kinderhook" means the 170 to 260 feet of shale below the Burlington-Keokuk Limestone and above the Devonian or Silurian carbonates. The Hannibal-Saverton Shale, which unconformably underlies the Burlington-Keokuk Limestone, is green to greenish gray in the upper portion

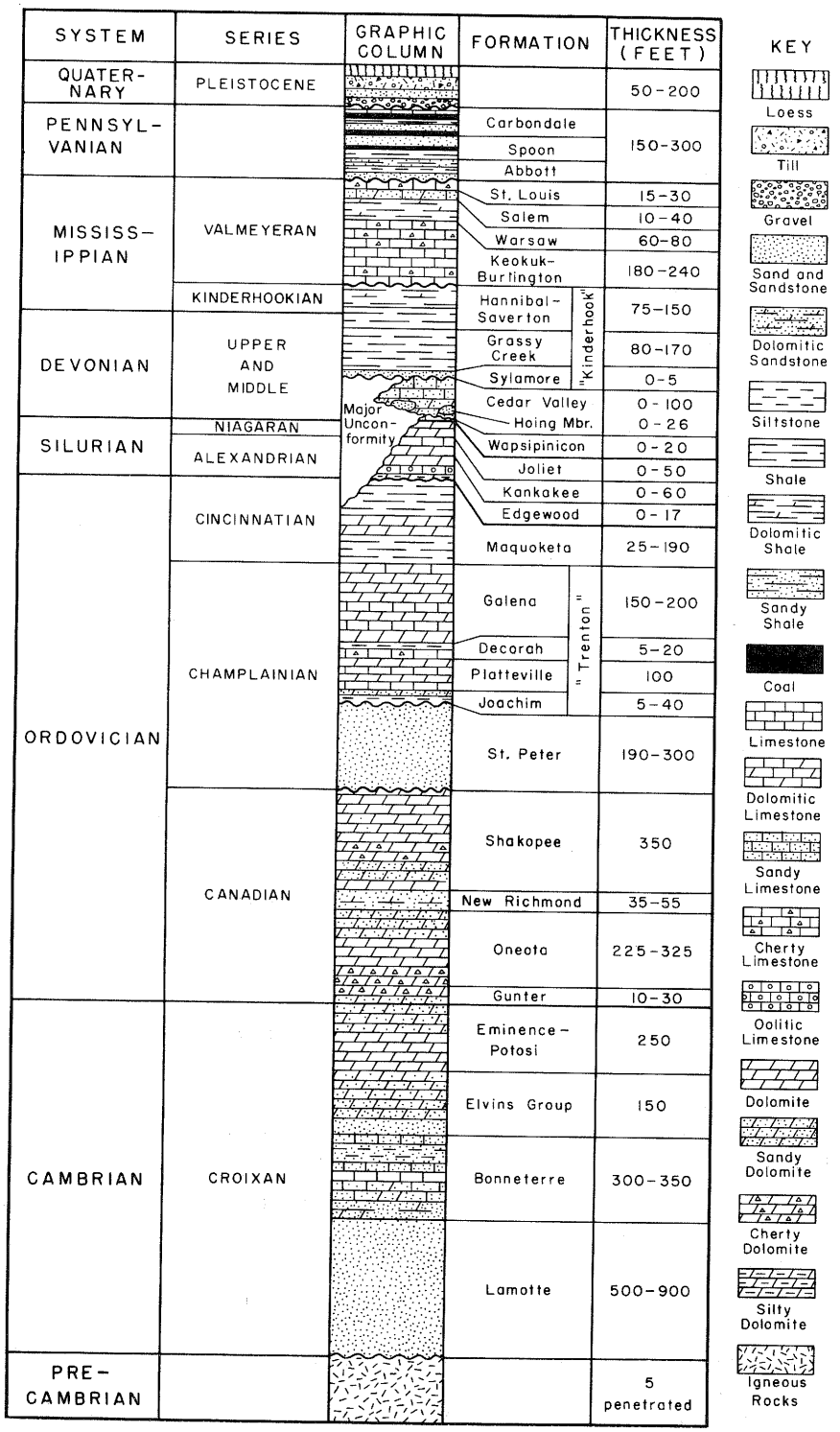


Fig. 3 - Generalized columnar section.

and brownish gray in the lower portion. The Mississippian-Devonian contact probably is near the bottom of this unit, which is 75 to 150 feet thick. The underlying 80 to 170 feet of Grassy Creek Shale is brown, black, and greenish gray, thinly laminated, and contains sporangites. It is equivalent to part of the New Albany Shale of eastern and southern Illinois. The Sylamore (Hardin) Sandstone beneath the Grassy Creek consists of very fine to medium, angular to rounded quartz grains cemented with calcite and pyrite. It generally is but a few inches thick, although in rare instances it reaches 4 or 5 feet.

Devonian Carbonates

Devonian carbonate sediments, absent in the southern half of the area, are thickest along the northwest, north, and northeast fringes of the area.

Cedar Valley and Wapsipinicon Limestones. - The Cedar Valley Limestone rarely is differentiated in well records from the underlying Wapsipinicon, which it overlaps. Although both are brown to brownish gray limestones, the Cedar Valley is more coarsely crystalline, more fossiliferous, and sandier than the Wapsipinicon. The Cedar Valley also is more widespread and thicker than the Wapsipinicon and comprises most of the 120 feet of Devonian carbonates at the western edge of the area. A major erosional unconformity at the base of the Cedar Valley extends through Silurian rocks and into the Maquoketa Shale in parts of the area. A lenticular sandstone at the base of the Cedar Valley, the Hoing Sandstone Member, is the producing stratum in the Colmar-Plymouth field, where it rests on the Maquoketa.

Silurian System

Silurian strata are present throughout the area except on the western and northwestern sides, where they have been removed by post-Silurian erosion.

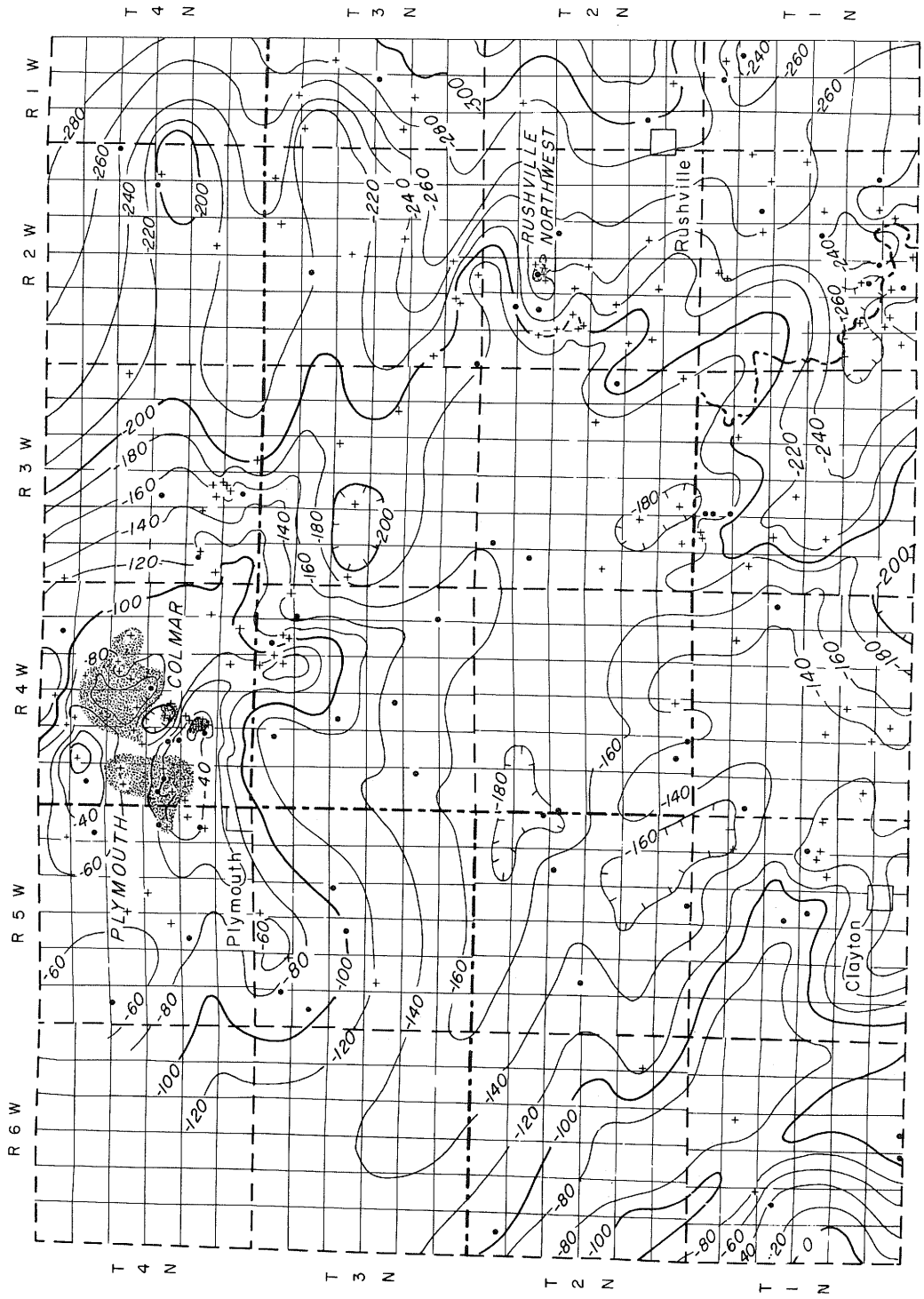
Niagaran Series. - Niagaran strata are present at only the eastern edge of the area where they comprise as much as 50 feet of light gray, fossiliferous, and more or less porous dolomite assigned to the Joliet Formation.

Alexandrian Series. - Alexandrian strata in the area are the Kankakee and Edgewood Formations, which reach a maximum thickness of about 65 feet.

The Kankakee Formation is predominantly a white to light gray limestone with abundant pinkish grains, is lithographic to obscurely coarse crystalline, and contains abundant green stylolitic shale partings. It is dense and tight and is the caprock above the pay zone in the Fishhook gas pool.

A dolomite facies in the Kankakee is oil-bearing in the Kellerville-Siloam area. It consists of light gray to light greenish gray, sucrosic, vuggy dolomite with some green shale partings and streaks of gray to greenish gray, dense dolomite throughout. Its maximum known thickness is 7.5 feet in the Kellerville-Siloam area. Oil-stained, vuggy, porous dolomite is present in the Kankakee caprock in the Fishhook gas pool. Rubey (1952) found a similar limestone-dolomite facies relationship of the Kankakee (Brassfield) in Calhoun County, 40 miles to the south.

The Edgewood Formation is best developed in the Fishhook area where approximately 15 feet of light tan-gray, sucrosic, vuggy dolomite composes the gas zone. The Noix Oolite Member of the Edgewood consists of less than 18 inches of dense, light tan to light gray, coarsely oolitic limestone. It underlies both the gas zone at Fishhook and the oil-bearing dolomite in the Kellerville-Siloam area. Over the entire area as much as 5 feet of very fine, green, pyritic, silty dolomite,


T 4 N
T 3 N
T 2 N
T - N
R 1 W
R 2 W
R 3 W
R 4 W
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R 6 W
RUSHVILLE NORTHWEST
Rushville
COLMAR
PLYMOUTH
Plymouth
Clayton

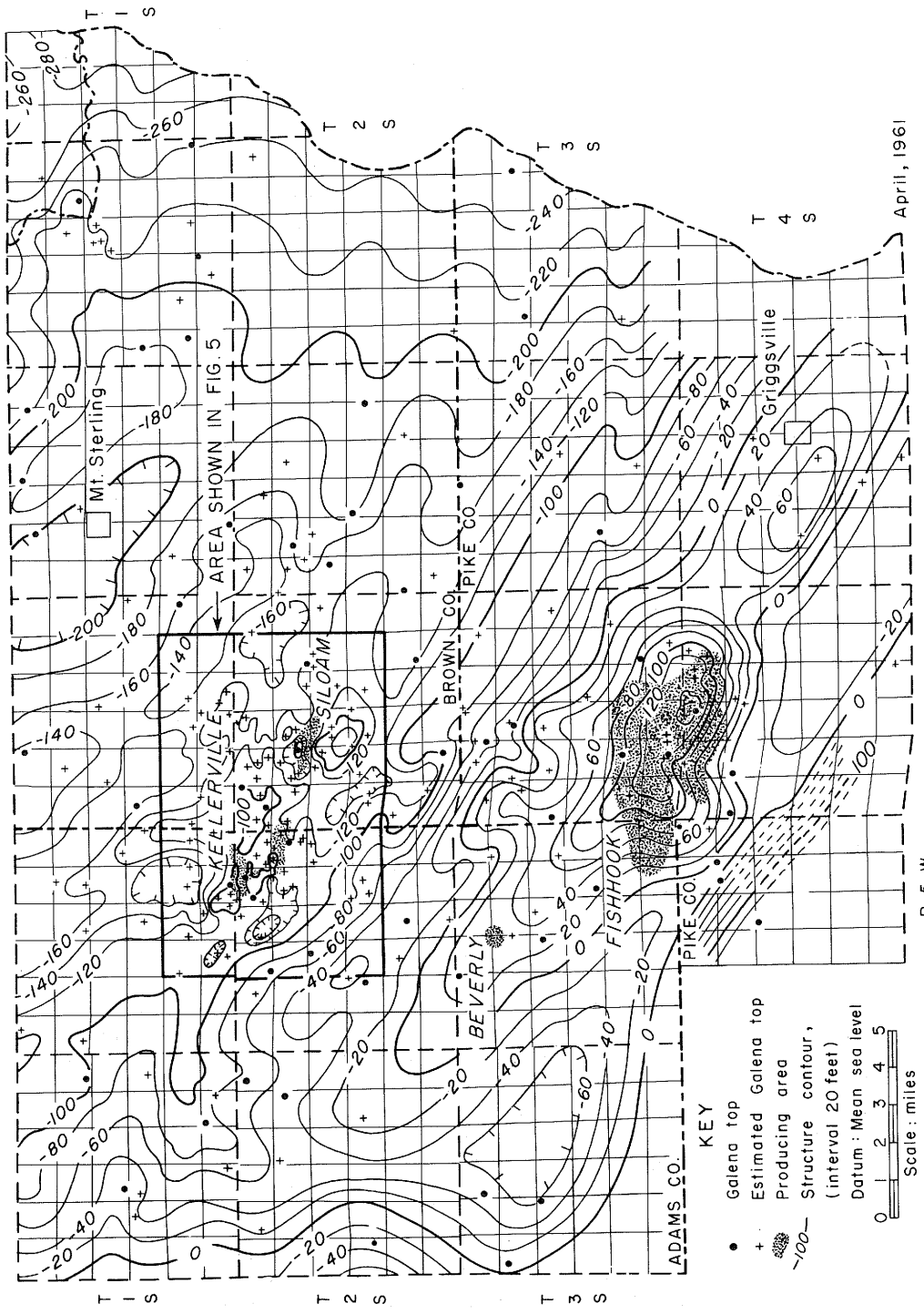

Fig. 4 - Structure map on the top of the Galena ("Trenton") Formation.

probably Edgewood, overlies the Maquoketa Shale.

The dolomite in the Edgewood Formation above the Noix Oolite pinches out within a short distance north of Fishhook. Only a dense limestone of the Kankakee type and the Noix Oolite were present in a core from the Vickery No. 1 Cutforth, sec. 28, T. 2 S., R. 5 W. In the Kellerville-Siloam area the Noix Oolite is the uppermost Edgewood that is readily distinguishable.

The Kankakee-Edgewood boundary is questionable over most of the area. Krey (1924), Rubey (1952), and Savage (1917) all asserted that the Kankakee rests unconformably on the Edgewood south and west of the area discussed in this report. Rubey also discussed a limestone-dolomite facies relationship within the Edgewood in Calhoun County.

Ordovician System

Maquoketa Shale. - The Maquoketa Shale underlies the entire area. Where Silurian strata are present, they rest on the Maquoketa. Where the Silurian is absent, the Maquoketa is unconformably overlain by Devonian strata. The Maquoketa is composed of an upper green shale zone, a relatively minor middle zone of tan to light greenish gray, silty dolomite, and a lower zone of brown to brownish gray shale. The thickness of the Maquoketa varies from 25 feet in the northwest corner of the area to over 190 feet in central Schuyler County. Where the Maquoketa is overlain by Silurian rocks it rarely is less than 165 feet thick.

Galena Formation. - The Galena Formation is a light brown to greenish gray, medium to finely crystalline dolomite or dolomitic limestone in which vesicular porosity is common. The formation ranges in thickness from 150 to 200 feet, thickening northwestward across the area.

Stratigraphy below the Galena is shown in figure 3 but is not discussed in this report because the known commercial accumulations of oil and gas in the area occur only in Devonian and Silurian rocks. Few holes in the area penetrate strata below the Galena.

Structure

The report area is high on the northwest flank of the Illinois Basin, the major structural depression between the Ozarks and the Cincinnati Arch (fig. 2). It is only a few miles east of the crest of the north-south trending Mississippi River Arch.

Figure 4 shows structure on the top of the Galena (Trenton) Limestone. Though over most of the area it occurs 170 to 190 feet below the base of the present producing strata, the top of the Galena is the best available structural mapping surface because it is relatively free of erosion. The top of the Galena was estimated in holes that bottomed in the Maquoketa by using nearby known Maquoketa thicknesses. More control points were used than are shown (fig. 4) in the areas of dense control around the producing areas.

Regional dip is about 8 feet per mile toward the east. However, local warping has produced structures that tend to obscure regional dip. The most prominent local structural feature is the Fishhook Anticline. It is about 7.5 miles long and trends east-southeast, parallel to the Pittsfield-Hadley Anticline, located just south of the report area. Structure contours on the top of the Galena show at least 100 feet of closure. Structural nosing continues for another 9 miles to the northwest. The few holes drilled around Griggsville suggest a southeasterly continuation of the Fishhook trend.

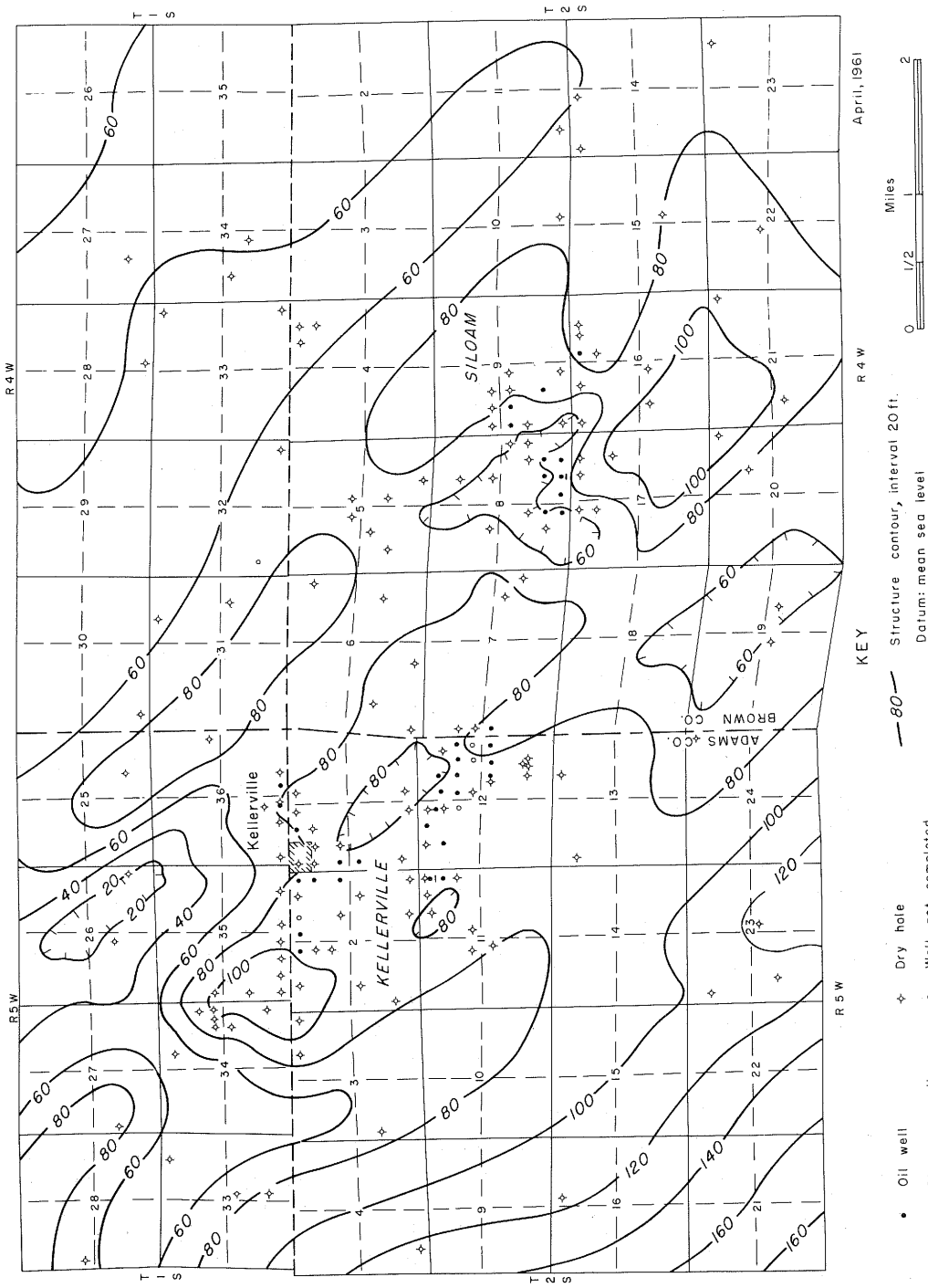

Fig. 5 - Structure map on the base of the Kinderhook - New Albany Shale in the Kellervillle - Siloam area.

Oil accumulation in the Kellerville and Siloam pools is located on a terrace on the northeast flank of, and 250 feet lower on structure than, the Fishhook Anticline. There is some minor closure on this terrace (fig. 5). The area between Kellerville and Plymouth, 20 miles to the north, is lower, for the most part, but comparatively flat.

The Colmar-Plymouth structure is an irregularly shaped anticline and terrace complex about 7 miles long that trends east-southeast. Whereas 80 to 100 feet of closure is present on the base of the Kinderhook-New Albany, only 60 feet is shown (fig. 4) on top of the Galena.

Many structural highs and lows of various sizes that trend northwest-southeast and east-west are present in the eastern half of the area.

OIL AND GAS PRODUCTION

Five oil pools have been discovered in the area discussed in this report: Colmar, Plymouth, Kellerville, Siloam, and Rushville Northwest. Table 1 contains brine and oil analyses for these pools. These analyses were made by the Illinois Geological Survey's Analytical Chemistry Section. Table 2 gives the gas-oil ratios (cubic feet of gas per day per barrel of oil produced) of the Siloam pool. The gas-oil ratios were measured and computed by Wayne F. Meents. Fishhook and Beverly are the only gas pools in the area.

Colmar-Plymouth Area

Discovery and Development

The discovery well of the Colmar pool was completed April 30, 1914, on the J. Hoing farm in the $SE\frac{1}{4}$ $SW\frac{1}{4}$ $SW\frac{1}{4}$ sec. 16, T. 4 N., R. 4 W., McDonough County. The well flowed 40 barrels of oil a day from a sand, subsequently called the Hoing Sandstone, at a depth of 417 feet.

Hinds (1914) had recommended the area for oil prospecting on the basis of a structure map of the Colchester (No. 2) Coal showing pronounced doming two miles northeast of Plymouth.

By the end of 1914 about 200 holes had been drilled in secs. 9, 10, 15, and 16 of T. 4 N., R. 4 W., of which 60 were dry.

The Plymouth pool was discovered early in 1915 when the no. 1 Roberts, located near the center of sec. 24, T. 4 N., R. 5 W., Hancock County, $2\frac{1}{2}$ miles southwest of the Colmar pool, was completed initially for 45 barrels of oil a day from the Hoing. Although tests to the north, west, and south encountered only salt water in the Hoing, wells drilled half a mile to the east in sec. 10, T. 4 N., R. 4 W., were completed for 100 barrels. Most of the Plymouth production has been from section 19 and the south part of section 18.

Geologic Occurrence of Oil Accumulation

In the Colmar-Plymouth area, carbonates and sandstones of Middle Devonian age assigned to the Cedar Valley Formation rest unconformably on the Maquoketa Shale of Ordovician age. Although the Cedar Valley is 20 to 55 feet thick in the oil field, it pinches out 3 miles to the south. The upper 15 to 25 feet of the Cedar Valley consists of gray, sandy, dolomitic limestone. Beneath this the Hoing Sandstone Member may occur.

Table 1. - Analysis of Brine and Oil in the Kellerville, Siloam, Rushville Northwest, Colmar, and Plymouth Pools

Pool	Operator, farm, well no.	County	Location Sec.T.R.	BRINE (ppm) Chlorides	BRINE (ppm) Total solids	OIL Gravity (API@60°F)	OIL Viscosity (centistokes) @100°F	OIL Viscosity (centistokes) 77°F	OIL Viscosity (centistokes) 50°F
Kellerville	C.A. Beckman, Pierce #1	Adams	SE SE SW 36-1S-5W	-	9,434	35.17	6.73	9.91	22.80
Kellerville	Mike Callihan, Noftz #1	Adams	SE NE NE 2-2S-5W	5,648	9,552	36.75	5.48	7.69	14.91
Siloam	E.C. Reeves, Davis #2-A	Brown	NE SW SE 8-2S-4W	5,360	9,110	35.17	7.21	10.19	21.39
Siloam	James Yakle, Carpenter #1	Brown	SW SE SE 8-2S-4W	5,405	9,177	-	-	-	-
Siloam	James Yakle, Carpenter #2	Brown	NW SE SE 8-2S-4W						
Rushville NW	Pal Oil, Walker #1	Schuyler	NE SW SE 9-2N-2W	-	-	36.95	5.08	6.97	12.22
Colmar	Ohio Oil Co., Robinson	McDonough	NE SE 9-4N-4W	3,239	5,791	35.17	8.62	9.76	16.25
Plymouth	Ohio Oil Co., Hamm #16	McDonough	NW SW 19-4N-4W	-	-	34.97	6.79	10.55	17.77

Table 2 - Gas-Oil Ratios in the Siloam Pool

Pool	Operator, farm, well no.	County	Location Sec. T. R.	Date	Production (bbls) Oil	Production (bbls) Water	Gas volume (cu ft per day)	Gas gravity	Ratio
Siloam	James Yakle, Carpenter #1	Brown	SW SE SE 8-2S-4W	2-60	180	80	132,000	.60	733
Siloam	James Yakle, Carpenter #2	Brown	NW SE SE 8-2S-4W	5-60	132	80	99,000		750
				5-61	19	50	19,000	.67	1000
Siloam	James Yakle, Carpenter #2	Brown	NW SE SE 8-2S-4W						

The Hoing varies from a white to brown, fine to medium, rounded, porous quartz sand to a more or less porous, brown, sandy dolomite (Workman, 1934). Its average thickness in the area is about 12 feet. The lenticular nature of the sand and its relative structural position are the factors determining the location of oil accumulation. Figures 6, 7, 8, and 9 show the thickness and structural position of the Hoing in the producing area. The figures are taken directly from a report of the U. S. Bureau of Mines on air injection in the Colmar-Plymouth area (Keithly and Jennings, 1944).

Most of the oil occurs in two separate lenses of Hoing Sandstone. The Plymouth lens is 160 feet above sea level on an anticline trending east-southeast (fig. 8); the Colmar lens is 90 feet above sea level on a terrace to the northeast (fig. 9). Thicknesses of the Hoing range from 4 to 22 feet in the Plymouth pool (fig. 6) and from 7 to 26 feet in the Colmar pool (fig. 7). Both lenses reach maximum thickness along their north or northwest margins. The fact that salt water occurs beneath the oil on the anticline 40 to 70 feet higher than it does on the terrace proves that the lenses are separate.

Completion Practices

All the wells in the Colmar-Plymouth area were drilled with cable tools. Eight- or ten-inch surface casing was set through the alluvium and glacial drift on Pennsylvanian or Mississippian bedrock. A six-inch water string was run through the water-bearing Burlington-Keokuk and set a few feet into the top of the Hannibal-Saverton "Kinderhook" Shale. When oil was found in the Hoing, the pay zone frequently was shot with nitroglycerine. The well was then put on the pump and produced, generally with no casing run through the Kinderhook-New Albany.

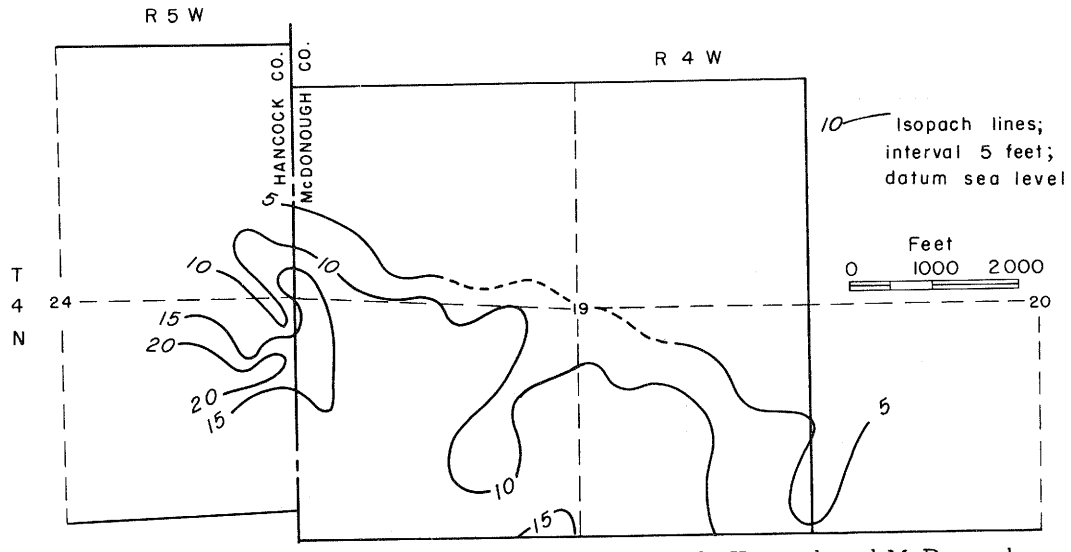

Fig. 6 - Isopach map of Hoing Sandstone, Plymouth pool, Hancock and McDonough Counties. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

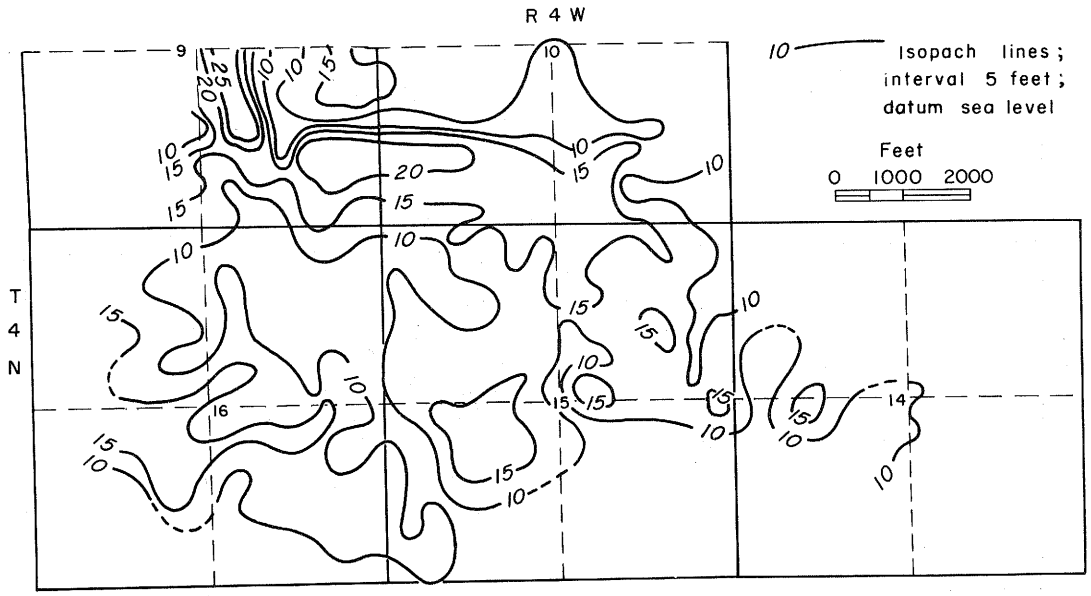

Fig. 7 - Isopach map of Hoing Sandstone, Colmar oil pool, McDonough County. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

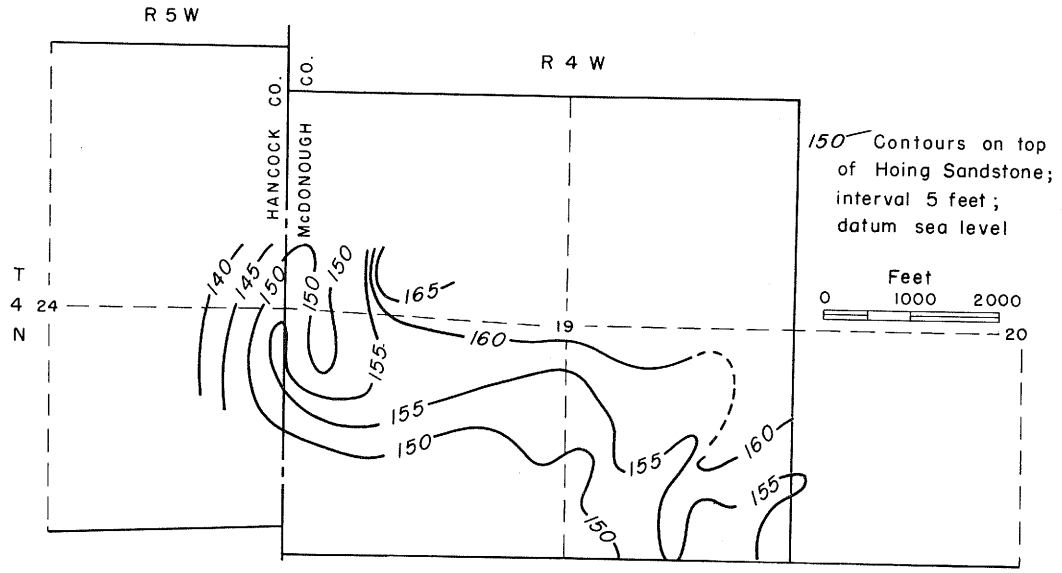

Fig. 8 - Structure map on the top of the Hoing Sandstone, Plymouth oil pool, Hancock and McDonough Counties. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

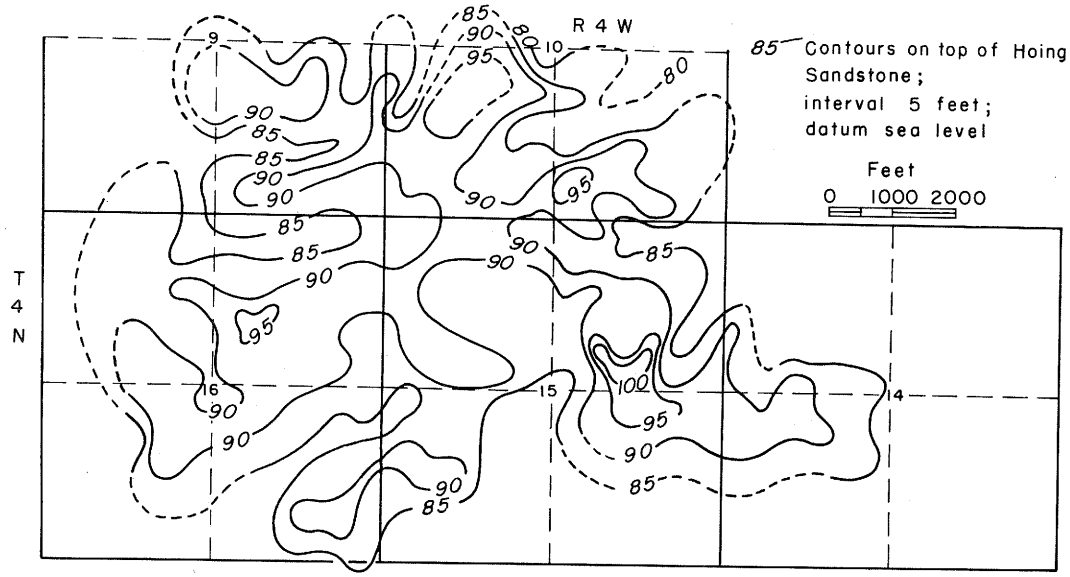

Fig. 9 - Structure map on the top of the Hoing Sandstone, Colmar oil pool, McDonough County. (Reprinted from U. S. Bureau of Mines Rept. Inv. 3783.)

Production History

Most of the more than 500 producing wells in the area were completed by the end of 1916 for average initial production of 20 to 35 barrels of oil per day. Approximately 225 wells are still producing, at the average rate of about three-fourths of a barrel of oil per day. Over 4,300,000 barrels of oil had been produced by the end of 1960.

In May 1926, The Ohio Oil Company, the major lease-holder in the area, subjected the Hoing sand in both pools to vacuum. Almost immediately, average daily production increased over 20 percent. The operation was continued until air injection was begun.

Air injection in the Hoing was begun by The Ohio Oil Company in the Plymouth pool in 1934 and in the Colmar pool the following year. In four years production was reported to have increased from 800 barrels per week to 3500 barrels per week. The air injection system is still in operation.

In 1943 The Ohio Oil Company started a pilot waterflood in sections 9, 10, 15, and 16, T. 4 N., R. 4 W. Unfiltered, untreated Burlington-Keokuk water from two supply wells was pumped into nine injection wells. The first result was a sizeable increase in production from surrounding wells. After a short while, however, production from these same wells began to decrease rapidly. It was believed that impurities and bacteria in the injected water were sealing off the permeable oil sand, and the operation was abandoned.

Kellerville-Siloam Area

Discovery and Development

The discovery well of the Kellerville oil pool was drilled in May 1959 by Ray Starr on the Wendell Doole farm in the NE¼ NE¼ NE¼ sec. 11, T. 2 S., R. 5 W., Adams County. It was drilled 150 feet south of a dry hole that had a slight show of oil at approximately 650 feet. The well was completed in a porous dolomite at a depth of 639 feet for three barrels of oil a day.

In August 1959 the C. Arthur Beckman no. 1 Pierce, drilled in the SE¼ SE¼ SW¼ sec. 36, T. 1 S., R. 5 W., extended Kellerville production 1¼ miles northeast. This well was completed for 10 barrels of oil and 80 barrels of water a day from the same porous dolomite at 651 feet.

The Ray Starr no. 2 Mildred Milliron, drilled in September 1959, extended the producing area three-fourths of a mile east of the discovery well. Drilled in the SW¼ NW¼ NE¼ sec. 12, T. 2 S., R. 5 W., the well blew in with gas and oil and was completed for 216 barrels of oil per day from the 628 to 634 foot interval.

The discovery well of the Siloam pool was drilled in October 1959 by Charles Eager on the W. L. Davis farm in the SE¼ SW¼ SE¼ sec. 8, T. 2 S., R. 4 W., Brown County. The well came in flowing at the rate of 120 barrels of oil per day from porous dolomite at 634 feet and was then completed for 530 barrels per day. Initial production from offset wells ranged from 70 to 300 barrels of oil per day.

In May 1960 an extension to the Siloam pool, the Henry L. Bush no. 2 Henry R. Bush, was drilled in the NW¼ NW¼ NE¼ sec. 16, T. 2 S., R. 4 W. Completed after being acidized with 1000 gallons for 24 barrels per day from the 664 to 668 foot interval, the well produced for only a few days.

The T. W. Pannell no. 2-P Kenneth Lee, drilled in the NE¼ NW¼ SW¼ sec. 9, T. 2 S., R. 4 W., in May 1960, came in blowing gas and oil over the mast at

the rate of 500,000 cubic feet of gas and 100 barrels of oil a day. After being acidized with 1000 gallons, the well was completed for 70 barrels of oil and 20 of water per day from the 671 to 676 foot interval.

Meanwhile, two more extensions to the Kellerville pool were drilled. In November 1959, the Mike Callihan no. 1 Vernon Allen Community was drilled midway between the discovery well and the no. 1 Pierce. Located in the SW¼ SW¼ NW¼ sec. 1, T. 2 S., R. 5 W., the well was completed for 10 barrels of oil and 60 of water from the 634 to 635 foot interval.

The Ray Starr no. 1 C. A. Hendricks, drilled in February 1960, extended production three-quarters of a mile farther northwest to the NE¼ NE¼ NW¼ of sec. 2, T. 2 S., R. 5 W. It was completed for 200 barrels of oil per day from a depth of 639 feet.

Geologic Occurrence of Oil Accumulation

Most of the Kellerville-Siloam area is free of Devonian carbonates and sandstones. A dry hole in the SW¼ SW¼ NW¼ sec. 28, T. 1 S., R. 5 W., encountered 7 feet of Cedar Valley Limestone. Over the rest of the area shown in figure 5, the Kinderhook-New Albany rests directly on the Kankakee Formation of Silurian age. However, several miles west of the area the Silurian is absent and the Kinderhook-New Albany rests on Maquoketa Shale. A description of the only core taken from the pay zone in the Kellerville-Siloam area follows. The core was taken with a cable tool core barrel.

Robert A. Betz no. 1 Louderback

NE¼ NE¼ SE¼ sec. 12, T. 2 S., R. 5 W., Adams County

Top of core taken at depth of 646.0 feet

	Thickness (feet)	Depth (feet)
Silurian System (top 645 feet)		
Kankakee Formation		
Limestone, light gray, dense, tight; numerous green stylolitic shale partings	12.0	658.0
Dolomite, light brown; oil-saturated pinhead vugs throughout; few vugs over one centimeter; faintly fossiliferous; streaks of gray to greenish gray, dense dolomite throughout	7.5	665.5
Edgewood Formation		
Limestone, very light gray, coarsely oolitic, dense (Noix Oolite)	1.0	666.5
Limestone, light gray, dolomitic, dense, pyritic; some oil-saturated pinhead vugs	0.3	666.8
Dolomite, laminated greenish gray and gray, glauconitic, very pyritic, finely sandy	0.1	666.9
Dolomite, light greenish gray, dense, earthy, silty, slightly pyritic	0.1	667.0

(The top of the Maquoketa Shale undoubtedly occurs within 2 feet below the bottom of the core.)

The average combined thickness of the Kankakee and Edgewood Formations in the Kellerville area is 11 to 15 feet. They thicken southeastward to an average thickness of 25 to 28 feet in the Siloam area. A maximum thickness of 53 feet occurs in the SE¼ NE¼ SE¼ sec. 8, T. 2 S., R. 4 W.

The pay zone, a vuggy and sometimes cavernous, faintly fossiliferous dolomite, occurs in the bottom half of the Kankakee Formation. The bottom of the pay zone generally is within a foot or two of the top of the Maquoketa Shale. The drill bit was reported to have dropped a foot or more upon encountering the pay zone in several wells, indicating the cavernous nature of the pay. Horn corals half an inch long and other fossil fragments were recovered from this zone in one such well.

The thickness and lateral extent of the dolomitized pay zone are very erratic. The core described above contains the area's maximum known pay thickness of 7.5 feet. The northeast offset and five other tests in the same quarter section had no dolomitized pay zone.

In regard to oil accumulation, the presence or absence of effective porosity is more significant than a well's structural position. The two highest areas on the Kellerville-Siloam terrace have several dry holes, attesting to the lack of porosity. Oil and gas, if present, are found in the highest parts of a porous lens. Salt water occurs in the lens beneath the oil and/or gas, and, in their absence, fills it.

Completion Practices

Of the 187 holes shown in figure 5, 185 were drilled with cable tools, only two with rotary tools. The shallow depth of the hard Mississippian limestones makes the use of light, truck-mounted rotary rigs impractical. The expense of moving in larger, more efficient rotary rigs to drill relatively shallow 650-foot Silurian tests is prohibitive.

Casing practices during drilling in the Kellerville-Siloam area are much the same as those used in the Colmar-Plymouth area. Eight-inch casing is set through the alluvium and glacial drift. Six-inch casing is set below the water-bearing part of the Burlington-Keokuk, usually a few feet into the top of the Hannibal-Saverton "Kinderhook" Shale. In the great majority of the producing wells, a four- or five-inch production string is run through the Kinderhook-New Albany and set in or on top of the Silurian limestone to prevent occurrence of problems involving caving shale. However, the fact that the Kinderhook-New Albany is cased off in only a few of the hundreds of producing wells in the Colmar-Plymouth area indicates that casing might not be necessary in the Kellerville-Siloam area where similar relationships between the shale and the producing horizon exist. Wells in the Kellerville-Siloam area completed with only two-inch tubing run through the Kinderhook-New Albany have not been troubled by caving shale. The casing expense thus saved amounts to more than half the cost of the original drilling.

A well can be acidized through the tubing by using a tubing packer. The Robert Betz no. 5 Louderback, in the NE¼ NW¼ SE¼ sec. 12, T. 2 S., R. 5 W., was thought to be a dry hole, as no break was detected in the Silurian. However, when 15 feet of oil came into the hole overnight, two-inch tubing was run and the well was treated with 3000 gallons of acid. It was then completed for 60 barrels of oil per day. This type of treatment may prove to be very useful in this area where the porosity is so erratic that nonproductive wells occur short distances from producers.

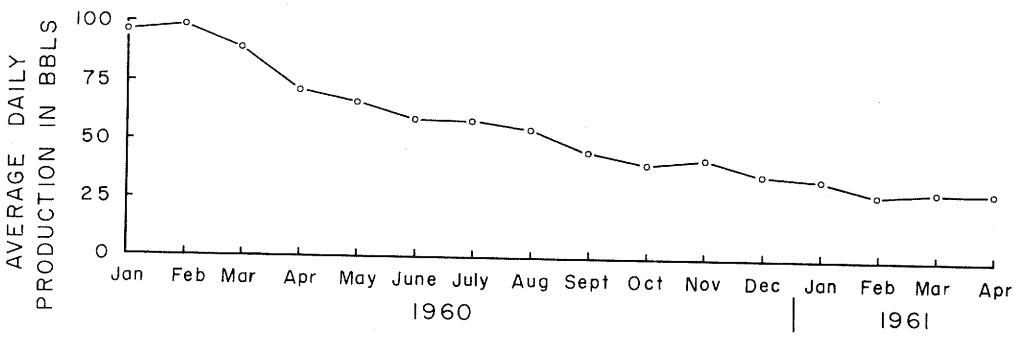

Fig. 10 - Production decline curve of the Mike Callihan no. 1 Cecil Noftz, Kellerville oil pool, SE¼ NE¼ NE¼ sec. 2, T. 2 S., R. 5 W., Adams County.

Production History

Twenty-two wells in the Kellerville pool produced over 53,000 barrels of oil by the end of 1960. Of this amount over 51,000 barrels came from four wells. The pool is currently producing about 2000 barrels of oil per month.

Eight of the eleven producers in the Siloam pool accounted for virtually all of the 96,000 barrels of oil produced by the end of 1960. The pool is currently producing at the rate of 2300 barrels of oil per month.

Production decline curves of the best single wells in the Kellerville and Siloam pools are shown in figures 10 and 11, respectively. Average daily production is plotted against producing months. The production figures used were taken from the Illinois Pipeline Production Report with the permission of the Tri-State Oil Scouts Association.

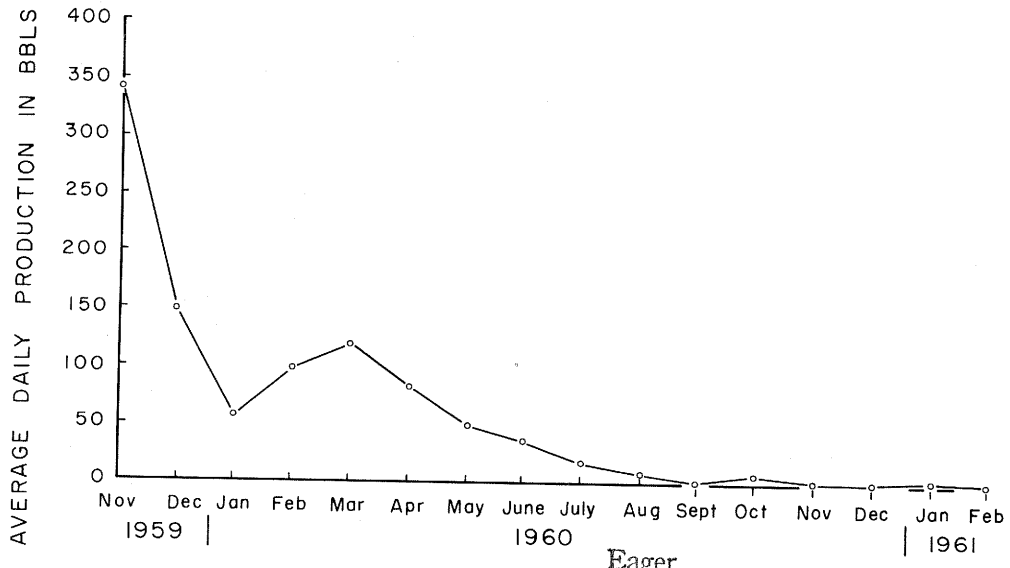

Fig. 11 - Production decline curve of the Charles Edgar no. 1 W. L. Davis, Siloam oil pool, SE¼ SW¼ SE¼ sec. 8, T. 2 S., R. 4 W., Brown County.

Rushville Northwest Oil Pool

In May 1960 Pal Oil drilled the discovery well of the Rushville Northwest pool on the Walker farm in the NE¼ SW¼ SE¼ sec. 9, T. 2 N., R. 2 W., Schuyler County. The well was completed, after acidizing, for 14 barrels of oil and 3 of water from a finely crystalline, more or less porous dolomite in the Silurian from the 674 to 677 foot interval. The well produced oil until November, at which time its cumulative production was 489 barrels. The well was drilled near an old Indian Refining Company test that had reported shows of oil from the Silurian at 651 feet and from the dolomite interval in the middle of the Maquoketa at 751 feet. Three tests subsequently drilled north and east of the discovery well were dry.

Fishhook-Beverly Area

In March 1955 the discovery well of the Fishhook gas pool was drilled by W. Vette on the Layne farm in the NE¼ NE¼ NE¼ sec. 30, T. 3 S., R. 4 W., Pike County. The well, completed in the Silurian at a depth of 460 feet, had an open-flow gauge of 1,140,000 cubic feet of gas per day. The pay zone consists of about 15 feet of sucrosic, vuggy dolomite assigned to the Edgewood Formation and is the same as that of the now-abandoned Pittsfield gas pool (Coryell, 1919) just south of the report area.

Fifty-seven gas wells with open-flow gauges averaging 624,000 cubic feet per day have been drilled in the pool, and all are shut in for lack of market. Illinois Geological Survey Circular 250 (Meents, 1955) contains the results of the tests run on nearly every well in the pool, as well as several gas analyses and diamond core analyses.

The Beverly gas pool, located four miles northwest and on the same structural trend as Fishhook, was discovered in February 1957, by the G and W Oil Company no. 1 Binson. It was drilled in the NW¼ NW¼ NW¼ sec. 10, T. 3 S., R. 5 W., Adams County, and had an open-flow gauge of 218,000 cubic feet per day from near the top of the Silurian at 416 feet. The G and W Oil Company drilled the only other well in the pool a quarter of a mile southwest of the discovery well. It had an open-flow gauge of 565,000 cubic feet per day from the same horizon at 491 feet. Both wells are shut in.

RECOMMENDATIONS FOR FUTURE DRILLING

The reservoir strata in the oil and gas pools discussed in this report have one thing in common — the lenticular nature of the porosity. Relative structural position of the beds is important only within a given porosity lens. The discovery of porosity lenses with some structural relief is, therefore, the first prospecting goal. Any oil or gas in a given lens will be concentrated above salt water on the crests or flanks of structural highs.

Silurian strata are either very thin or absent in all of R. 6 W. (fig. 4) and all of R. 5 W. north of T. 1 S., and in all of R. 4 W. and R. 3 W. north of T. 2 N. The chances of finding Silurian production in these areas are, therefore, slight. Silurian strata thicken eastward over the rest of the area. Although it is impossible to predict the amount of porosity that is likely to be encountered in the Silurian, the structural position of the potential reservoir strata is shown in figure 5 and can be readily inferred from figure 4.

A southeastward extension of the Fishhook structure is indicated by the

5 holes drilled around Griggsville. All the tests except the one in sec. 22, T. 4 S., R. 3 W., encountered salt water; several had shows of gas. A show of oil was encountered in the NW¼ NE¼ NW¼ sec. 27, T. 4 S., R. 3 W. (not shown in fig. 4). The fact that the Fishhook porosity pinches out at the southeast end of the pool suggests the possibility of oil accumulation above the salt water in the Griggsville area.

In the Kellerville-Siloam area chances are good for the merging of the two pools in sec. 7, T. 2 S., R. 4 W. The vicinity of the 80-foot structure contour (fig. 5) northeast of and parallel to the Kellerville-Siloam producing area is structurally favorable for oil accumulation if the necessary porosity can be located.

An area approximately 4 miles wide immediately southeast of the Siloam pool and extending about 10 miles southeast across the south half of T. 2 S., R. 3 W., is recommended for further prospecting. Eight of the tests in this area had Silurian salt water fill-ups of 150 to 400 feet. Another two, in the SW¼ NW¼ NW¼ sec. 21, T. 2 S., R. 3 W., and the SE¼ SE¼ SE¼ sec. 24, T. 2 S., R. 4 W., respectively, flowed salt water. The former produced a considerable amount of gas with the salt water.

The area trending southwest from the Colmar-Plymouth field has possibilities for Hoing sand production. A structural high in the north half of T. 3 N., R. 5 W., coincides with an indicated Hoing sand accumulation. Tests in sections 3, 5, and 6 of T. 3 N., R. 5 W., that encountered 5, 10, and 11 feet of Hoing, respectively, suggest the existence of a sizable sand body in this vicinity. No shows of oil were reported, however.

In Illinois Geological Survey Bulletin 31, Morse and Kay (1915b) pointed out that sec. 13, T. 4 N., R. 5 W., had not been sufficiently prospected. To date no holes have been drilled in this section.

The possibilities of oil and gas accumulation in the Trenton in Illinois were discussed by Bays (1945). In the area discussed in the present report, considerable quantities of salt water and sulfur water were encountered in many Trenton tests, and slight shows of oil were reported in a few. The occurrence in the Trenton of stratigraphic traps similar to those existing in the Silurian is possible.

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