University of Kentucky

College of Arts and Sciences

KENTUCKY GEOLOGICAL SURVEY

ARTHUR C. McFARLAN, Director
DANIEL J. JONES, State Geologist

SERIES IX

BULLETIN — NO. 17

Geology of the Decide Pool Clinton County, Kentucky

By

Jerome Hunt Perkins

Printed by the authority of the State of Kentucky

LEXINGTON, KENTUCKY

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LETTER OF TRANSMITTAL

June 1, 1955

Dean M. M. White
College of Arts and Sciences
University of Kentucky

Dear Dean White:

The Kentucky Geological Survey is publishing Bulletin No. 17, *Geology of the Decide Pool, Clinton County, Kentucky,* by Jerome Hunt Perkins. This is a pool producing from the Granville pay, mid-Ordovician limestone. It is the only pay for this south-central Kentucky area in which production is long-lived.

The report is an analysis of geological relationships responsible for the pool and probably other Granville pools.

Respectfully submitted,

ARTHUR C. MCFARLAN, Director
Kentucky Geological Survey

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INTRODUCTION

Location

The Decide Pool is located in western Clinton County in sections 12, 18, 19, and 22 of quadrangle D-52 of the Carter coordinate system (figs. 1 and 2), 6 miles northwest of Albany, south-central Kentucky. State Highways 90 and 55 border the producing area on the southwest and east, respectively. The Pool lies to the east of the small settlement of Decide, and it is proposed by the writer that it be designated the Decide Pool.

Clarification of Pool Name

In the early stages of development this Pool was called the "Agee" Pool by operators and later by Jillson (1946) in his report of Clinton County oil pools. This name was taken from the W. L. Agee farm (fig. 2) on which the initial production was obtained. Because of subsequent extensions of the Pool to surrounding farms, and because farm names are more subject to change than are geographic names, the replacement of this original "drillers' term" by the name "Decide" seems justifiable.

An equally inappropriate name has been used by Thomas and others (1950) in their reference to this pool as the "Granville" Pool. The name "Granville" comes from the producing zone in this and several neighboring pools (fig. 1) and originated in the Salt Lick Pool in northwest Clinton County. Any reference to this or any other Granville producing pools as the "Granville" Pool may cause further confusion.

Rowe (1948) referred to this pool as the "Willis Creek Granville" Pool, combining the name of the creek that drains the area with the name of the producing zone. This name also seems inappropriate for reasons given in the foregoing paragraph and because Jillson (1946) previously referred to the adjoining pool to the north as the Willis Pool.

It appears that the more stable and less questionable geographic name of "Decide" is a more plausible term, and, accordingly, this pool shall be designated the Decide Pool throughout this report.

Topography

Mature topography with moderate relief prevails in this area, as it does throughout Clinton County; the maximum relief is about 350 feet. In the southern part of the area the highest well elevation is 1,025 feet[1] with the lowest recorded well elevation of 672 feet being

The writer hereby acknowledges the assistance of Grady Wann of Nixon Blueprint Company, Corpus Christi, Texas, who gratuitously reproduced some of the illustrations during the preliminary preparation of the manuscript.

[1] Surface elevations were recorded on top of well head casings.

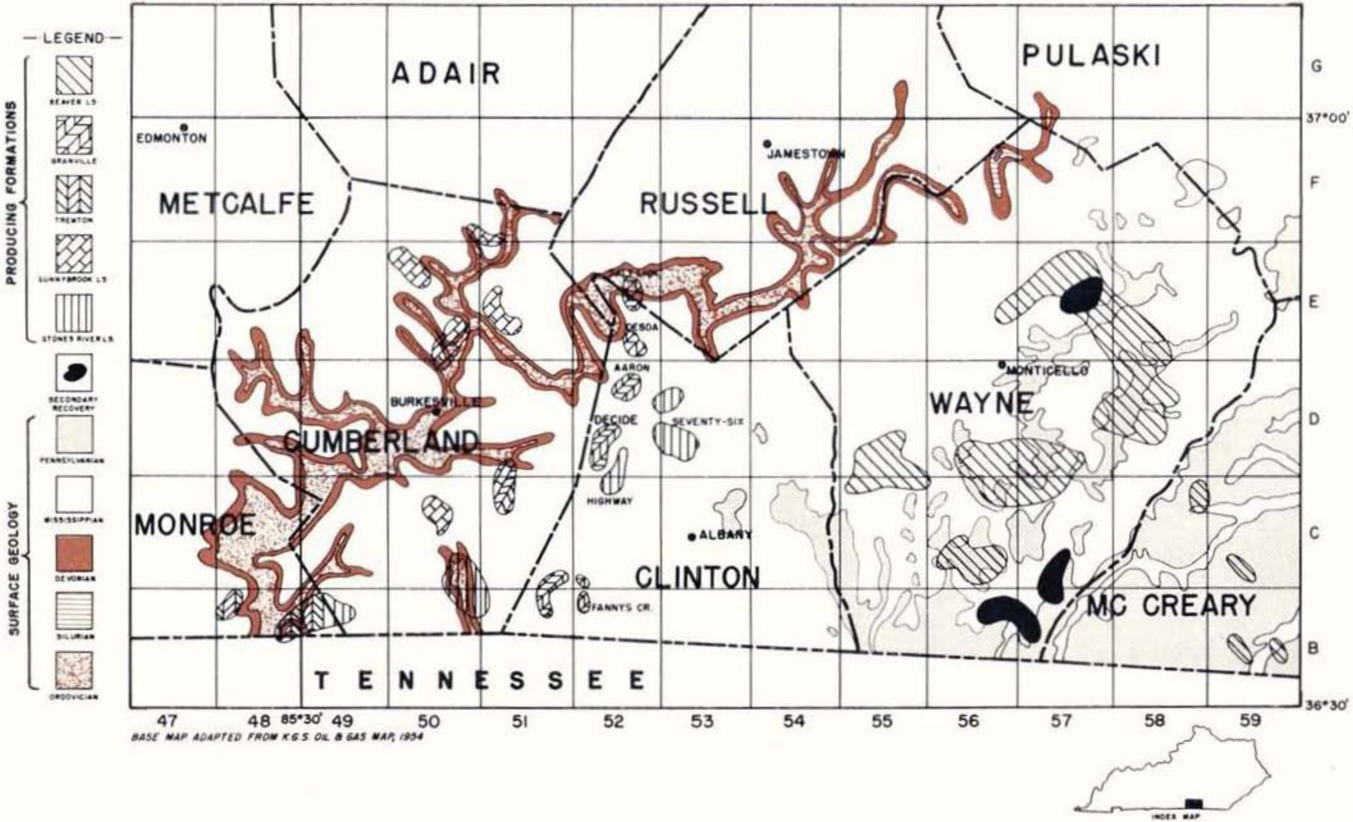


Fig. 1. Areal geology, pool locations, and producing formations in the region of the Decide Pool.

located at the northern extremity of the area along Wills Creek. The steepest terrain is found along this creek, with slopes having sharp dips locally. Willis Creek and its small tributaries drain to the northwest.

HISTORY

Development of the Granville Sand[1]

The producing zone in the Decide Pool is the Granville "sand" (fig. 3), a pure, porous limestone facies in the lower Million formation of the Eden group of Upper Ordovician age (Freeman, 1953, p. 32). Its extent, as shown by productive pools along its trend, is a narrow area about 2 miles wide and 15 to 20 miles long, aligned north-south. Diamond (1943, p. 11) states that the Granville has been logged farther south in Clay County, Tennessee, and also farther to the north in Lincoln County, Kentucky; however, it has not been productive in these wells.

The earliest known oil production from the Granville limestone was in 1861 from the Maltilda Gabbard well in northwest Clinton County, directly south of the Clinton-Russell County line. In southwest Clinton County the Fannys Creek Pool, which is now inundated by Dale Hollow Reservoir, produced from this same zone as early as 1906.

Development of the "sand" was minor until 1937, when oil was produced commercially by the Big Rock Oil Company and Woodson Diamond's Granville Williams No. 4. This well opened the Salt Lick Pool, and it was at this time that the producing zone acquired the name Granville "sand." Development along the western boundary of Clinton County became more rapid as new pools began to be opened. In 1938 the Tearcoat Pool, north of Desda, was opened by Harold Hardwick, *et al.* This same year the Witham Pool, east of Desda, and Aaron Pool, surrounding Aaron Post Office, were drilled. Woodson Diamond and J. Elliot opened the Milton Pool, south of Desda, in 1939 and later combined it with the Witham Pool to form the Desda Pool (fig. 1).

Several years passed before further exploration in 1943 resulted in the opening of the Willis Pool on the Middle Fork of Willis Creek, southwest of Aaron Post Office. This was soon followed by the discovery of the Decide Pool in February 1944, the latest discovery along the Granville trend.

[1] History of the development is derived mostly from two sources: Jillson (1946) and Diamond (1943).

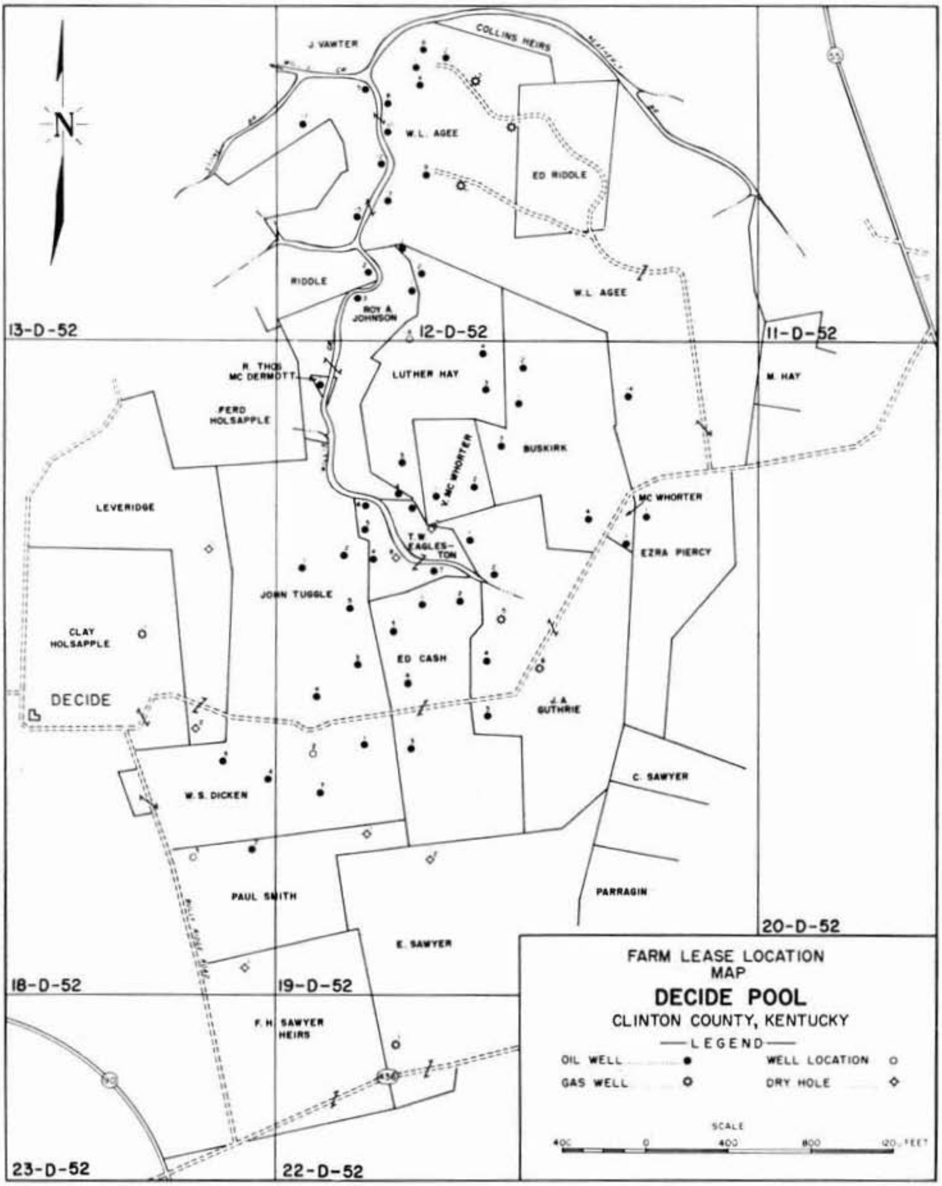


Fig. 2. Farm map of the Decide Pool showing locations of wells.

Pool Discovery and Development[1]

The discovery well in the Decide Pool was J. M. Murphy and U. B. Buskirk's W. L. Agee No. 1, which was spudded on December 22, 1943, and completed on February 25, 1944. Oil rose in the well 475 feet in 8 hours, and the initial production was 50 barrels per day of high-gravity oil; no water was present in the well. Within the next year and a half 16 additional wells were completed on the Agee lease, of which numbers 3, 7, and 11 were gas wells (fig. 2). The No. 11 well produced an initial 50,000 cubic feet of gas, which was of no economic value because of the lack of a market. The remaining 13 wells were commercial oil producers having an average initial capacity of 25 to 50 barrels per day. In at least 1 of these wells (No. 4) it was necessary to acidize the tight "sand" before it would produce commercially.

In the fall of 1944 drilling was begun on the L. Hay lease by R. Thomas McDermott and Company, and in November and December numbers 1 and 2 were completed as commercial oil wells. Of the 3 additional producing wells completed on this lease 2 wells had an initial production of 100 or more barrels per day. Development of the pool proceeded in an orderly fashion as R. Thomas McDermott and Company developed the remainder of the pool with the exception of the Buskirk lease for which data are unavailable.

In 1945 there were 4 commercial oil wells drilled on the Roy A. Johnson lease. Three more leases were developed in 1946, as 6 of 8 wells drilled on the T. W. Eagleston lease proved to be productive, 5 of 8 wells on the John W. Tuggle lease struck oil, and 4 oil wells and 2 gas wells were completed on the J. A. Guthrie farm. The 4 wells on the Guthrie lease have produced more than 40,000 barrels of oil in 8 years, the greatest cumulative production of any group of wells in the pool. Early in 1947 there were 2 wells completed as producers on the Virgil McWhorter farm. In the fall of the same year drilling was begun on the J. E. Cash lease. The 5 wells completed on the lease had the second greatest cumulative production in the pool, with 35,000 barrels to January 1, 1954.

With extensive development of the pool in 1948 wells on the W. S. Dicken, Ezra Piercy, and R. Thomas McDermott leases were completed, and yearly production from the pool reached a peak of 55,000 barrels. In 1949 a decline of yearly production from the previous year is shown, although the Paul Smith lease had 1 well to prove productive. The Smith well was the last productive well completed in the Decide Pool, and yearly production has continued to decline with the discontinued development.

[1] Field data collected from Kentucky Geological Survey files and tabulated in table 3.

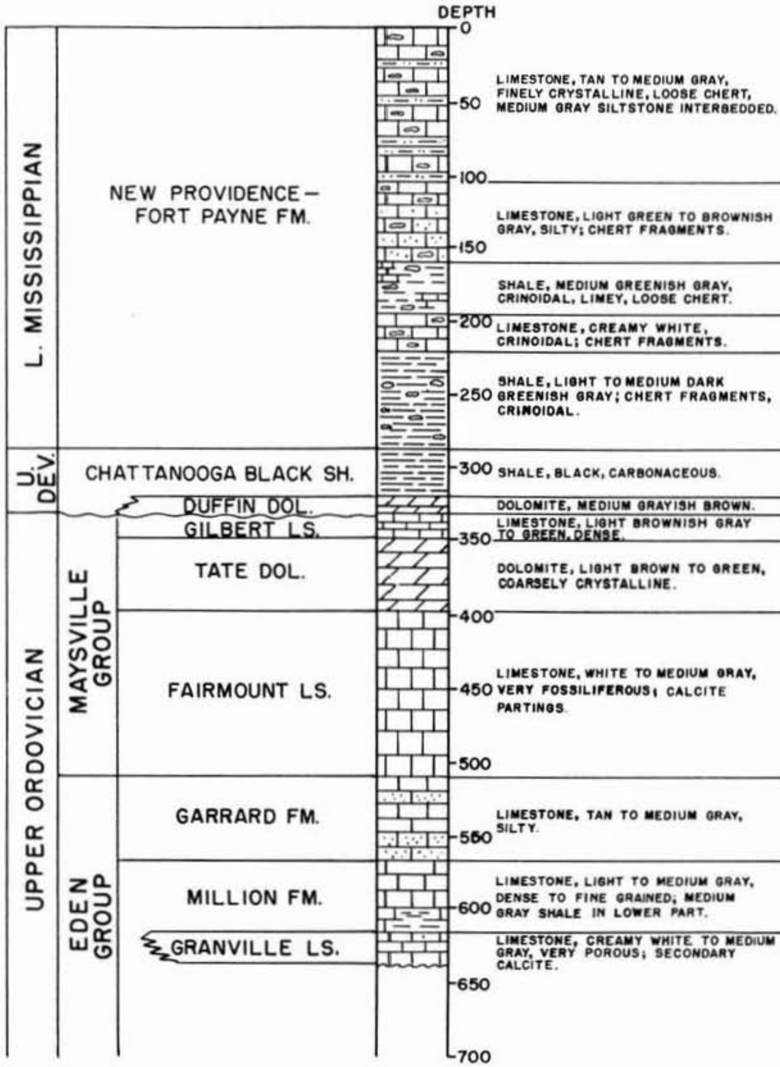


Fig. 3. Lithologic log of the W. L. Agee well #2. (For detailed description, see Appendix.)

A total of 72 wells have been drilled into the Granville limestone, and of this total, 56 wells produce oil, 7 wells produce gas, 6 wells are dry, and there are 3 wells on which data are unavailable but are presumably dry. Sixteen wells have been completed on surrounding leases and should be included in the total, but inasmuch as no historical data were available, they have not been used in this report. Of these 16 wells, there are 9 oil producers, 2 gas wells, and 5 dry holes.

STRATIGRAPHY

General

Lower and middle Mississippian siliceous limestones and shales outcrop at the surface in the vicinity of the Decide Pool, as they do in most of Clinton County. Devonian black shales and some Ordovician limestones outcrop along the Cumberland River in the northwestern part of the county, and lower Pennsylvanian beds outcrop on the ridges in east-central and southeast Clinton County (fig. 1). The subsurface section encountered while drilling in the Decide Pool is represented by upper Devonian shales lying unconformably upon upper Ordovician limestones. The Appendix gives the detailed stratigraphy logged in the W. L. Agee Well No. 2, which is at the north edge of the pool and contains a near-average thickness of the producing zone. Figure 3 shows the columnar section of the Agee well. A general stratigraphic section is given in table 1 and is followed by a general description of the formations.

TABLE 1
General Stratigraphic Section

	Thickness (in feet)
Middle Mississippian	
Warsaw formation	0-100
Lower Mississippian	
New Providence-Fort Payne formation	35-445
Upper Devonian	
Chattanooga black shale	32
Duffin member	0-10
Unconformity	
Upper Ordovician	
Richmond group	0-35
Maysville group	
Gilbert limestone	0-20
Tate dolomite	25-70
Fairmount formation	100-150
Eden group	
Garrard limestone and siltstone	30-70
Million formation	50-?
Granville facies	11-36

Middle and Lower Mississippian

Alternating beds of shales, siltstones, and limestones comprise the middle and lower Mississippian sequence, which ranges in thickness

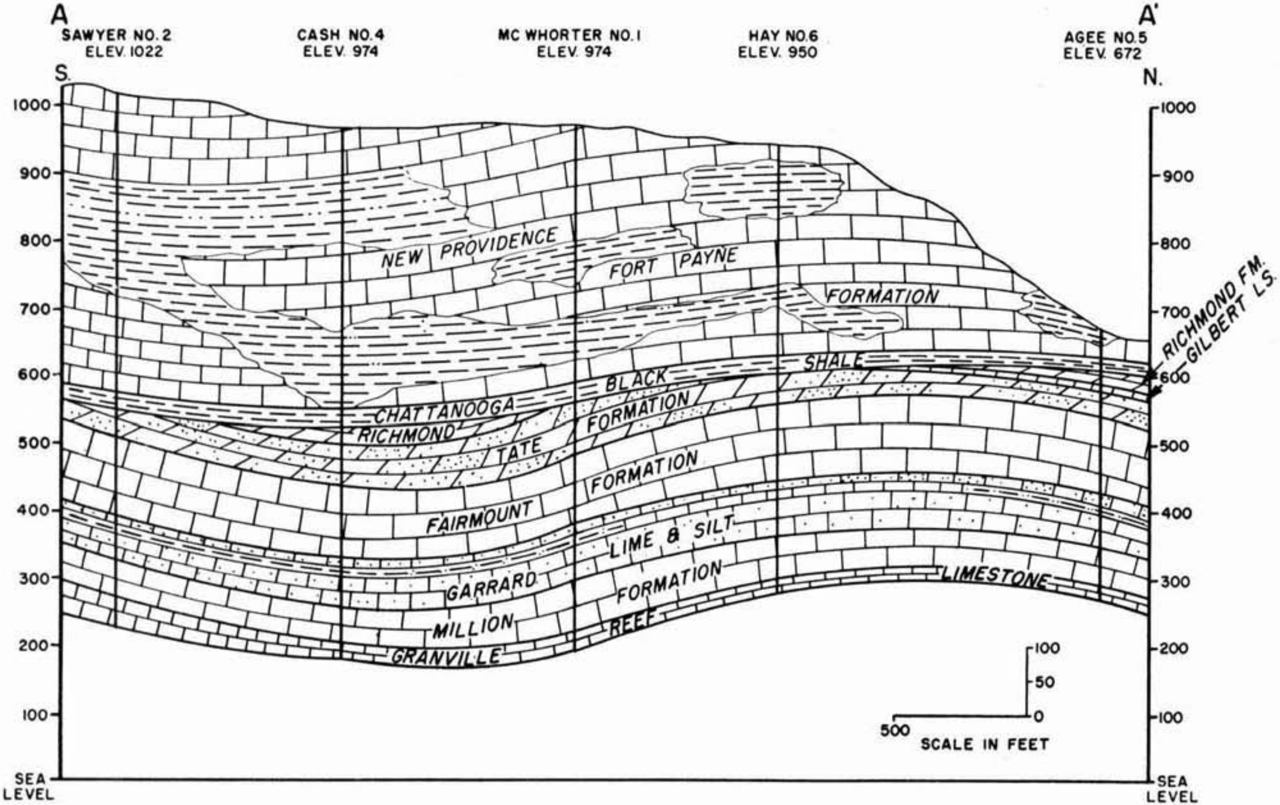


Fig. 4. North-south stratigraphic and structural cross section, Decide Pool. (For location of cross section, see fig. 6.)

from more than 445 feet in the southern part of the pool to about 35 feet in the northern part. The upper 90-100 feet of the southern section represents the Warsaw formation (Freeman, 1953, pp. 110-116) of middle Mississippian age and consists of sandy limestones and chert beds with some shale layers. The Warsaw is not extensive over the pool because of the irregularly eroded land surface.

The New Providence-Fort Payne formation of lower Mississippian age forms the bulk of the Mississippian sequence. It is present over the entire pool, but because of erosion only the lower part is present toward the north (fig. 4). In this area the New Providence-Fort Payne is mainly an undifferentiated formation, although elsewhere in Kentucky it is easily divisible into shale and chert formations (New Providence and Fort Payne formations, respectively). The interval consists of light-green to greenish-gray limestone, greenish-gray to gray calcareous shale, and minor lenses of gray siltstone and sand. Abundant chert fragments are present in the limestones in many wells.

Upper Devonian

Chattanooga black shale, of upper Devonian age, is continuous over the pool, with approximately 15 feet of variation in thickness and an average thickness of about 32 feet. The Chattanooga is characteristically a black, fissile, carbonaceous shale with a dolomite zone, called the Duffin member, appearing, in places, at the base; this member is found only in the extreme northern part of the Decide Pool. The Duffin member, an argillaceous, dark grayish-brown dolomite, is about 5-10 feet thick when present.[1]

Throughout the area the upper Devonian beds rest directly upon strata of the Richmond or Maysville groups, thereby forming a major unconformity. Thus, an interval involving the complete Silurian period and Lower and Middle Devonian epochs is unrepresented by sediments.

Upper Ordovician

The undifferentiated Richmond group is rarely encountered in drilling because of its erosion in pre-Chattanooga time. Freeman (1953, pp. 108-122) has recorded a few feet to 35 feet of green, argillaceous dolomite of Richmond age in several wells, but this occurs only in the lows of the pre-Chattanooga structural surface (fig. 4). The Richmond beds, when present, lie either on the dense, dark-gray Gilbert limestone, upper formation of the Maysville group, or upon the silty, greenish-gray to brown Tate dolomite and limestone, middle formation of the Maysville group. Incorporated into the

[1] Correlation of the Duffin member has been variously interpreted, but it is generally placed within either the Chattanooga (Ohio) shale or the Boyle limestone. For a more specific discussion see McFarlan and White (1952).

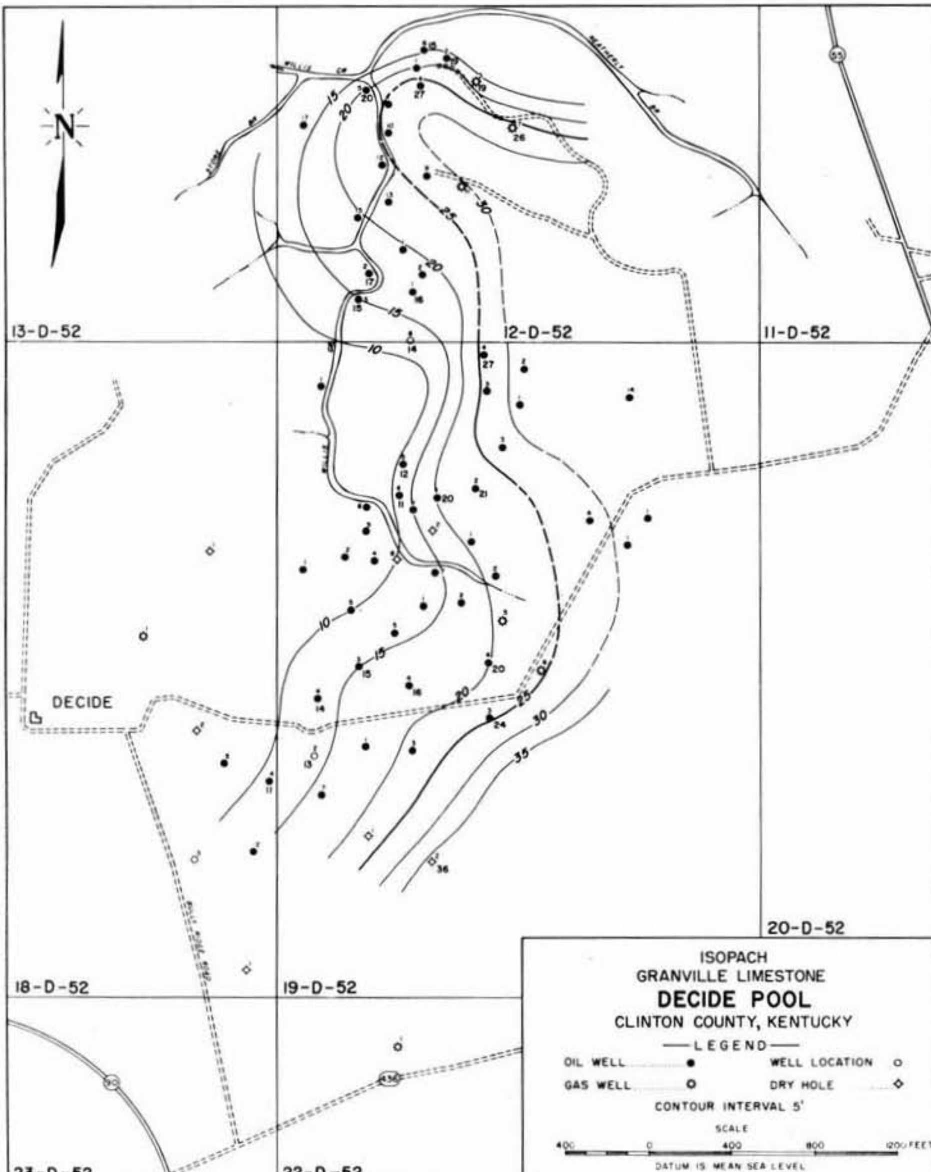


Fig. 5. Isopach map of the Granville limestone in the Decide Pool.

upper Gilbert is probably the Mount Auburn formation, which is undifferentiated in this area by Freeman (1953, pp. 107-124) but lies above the Gilbert to the north in central Kentucky. Where the Tate formation thickens in the absence of the Gilbert the upper Tate presumably includes the undifferentiated Mount Auburn and Gilbert formations. The Gilbert formation ranges in thickness from 0 to 20 feet and is overlain by either Richmond beds or by the Chattanooga black shale (fig. 4). The underlying Tate formation ranges in thickness from 25 to 70 feet and averages about 50 feet. It is overlain by either the Gilbert limestone, Richmond dolomite, or the Chattanooga black shale in different locations throughout the area (fig. 4). Underlying the Tate is the Fairmount limestone, lower formation of the Maysville group. It is a series of limestone beds, very fossiliferous and slightly phosphatic, with some interbedded thin shales. The Fairmount is continuous over the pool and averages about 120 feet in thickness, ranging from 100 to 150 feet thick; it has a sharp lithologic contact with the overlying Tate dolomite and the underlying Garrard beds of siltstone and yellow limestone.

The upper portion of the Eden is the Garrard formation, a yellow to gray, silty, fossiliferous limestone in this area with some interbedded siltstone and shale. Elsewhere east of the Cincinnati arch this interval is mainly comprised of siltstone. It ranges from 30 to 70 feet thick and averages about 60 feet in thickness. The Garrard is usually readily discernible from the underlying Million formation because of its silty character.

The Million formation is predominantly gray-brown limestone and has some thin shale layers and shale streaks. The only portion of the Million logged, which may or may not represent its entire interval, is the 50-70 feet of beds above the Granville limestone, a porous facies within either the lower Million or upper Cynthiana formation. Since no beds below the Granville have been logged, it is uncertain where the top of the Cynthiana actually lies, and, therefore, the Granville will be considered as part of the lower Million. The Granville, a porous, reef-like limestone facies, is the reservoir containing the Decide Pool. It is creamy-white to tan, highly pure and porous limestone which contains pinkish-white calcite crystals. Its thickness ranges from 11 to 36 feet, thinning toward the west and lying in an areal strip extending roughly north-south (fig. 5).

STRUCTURE

Regional

The Granville reservoir is on the east flank of the Cincinnati Arch, about 13 miles east of the axis. Trending east of north, this strip of Granville zone lies roughly parallel to the trend of the axis of the

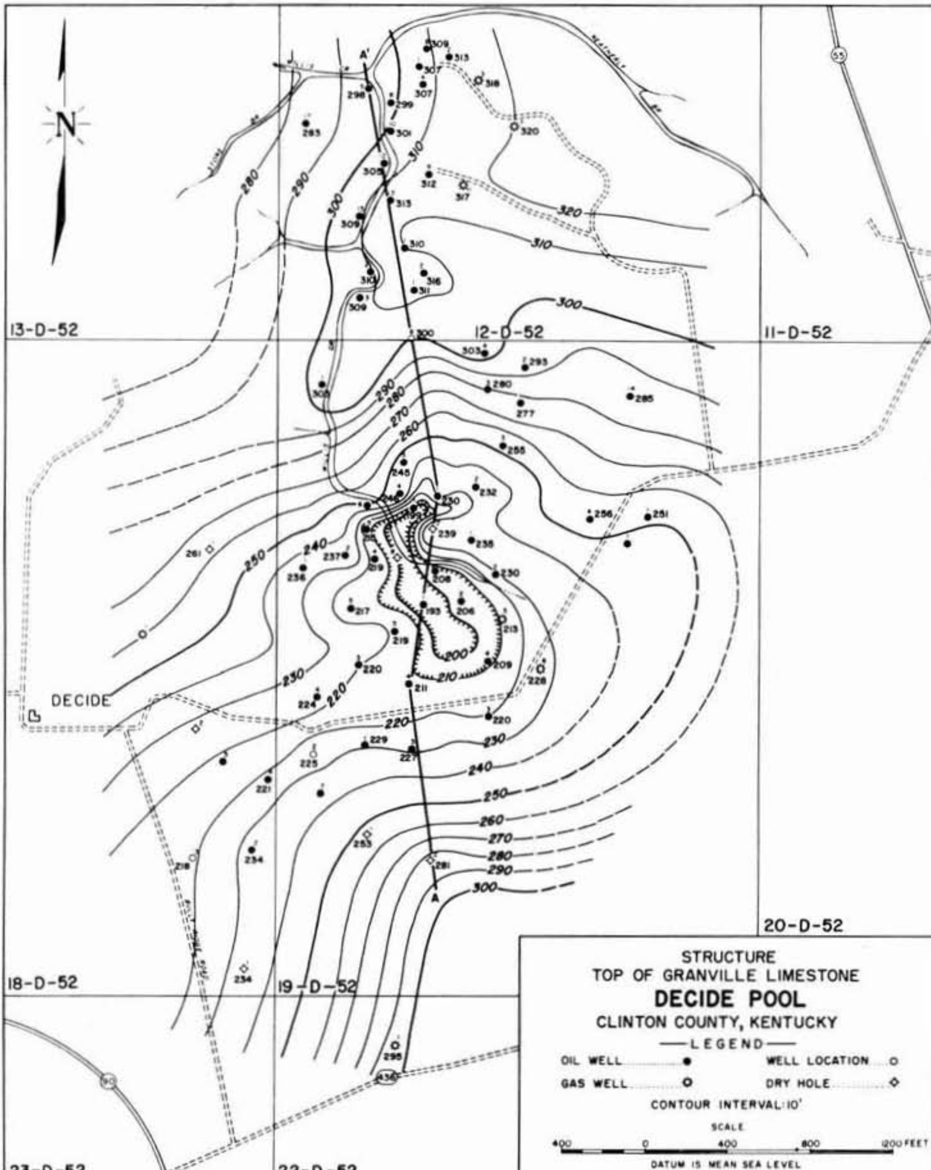


Fig. 6. Structure map of the Decide Pool, with contours on top of the Granville limestone. (See fig. 4 for profile of cross section A-A'.)

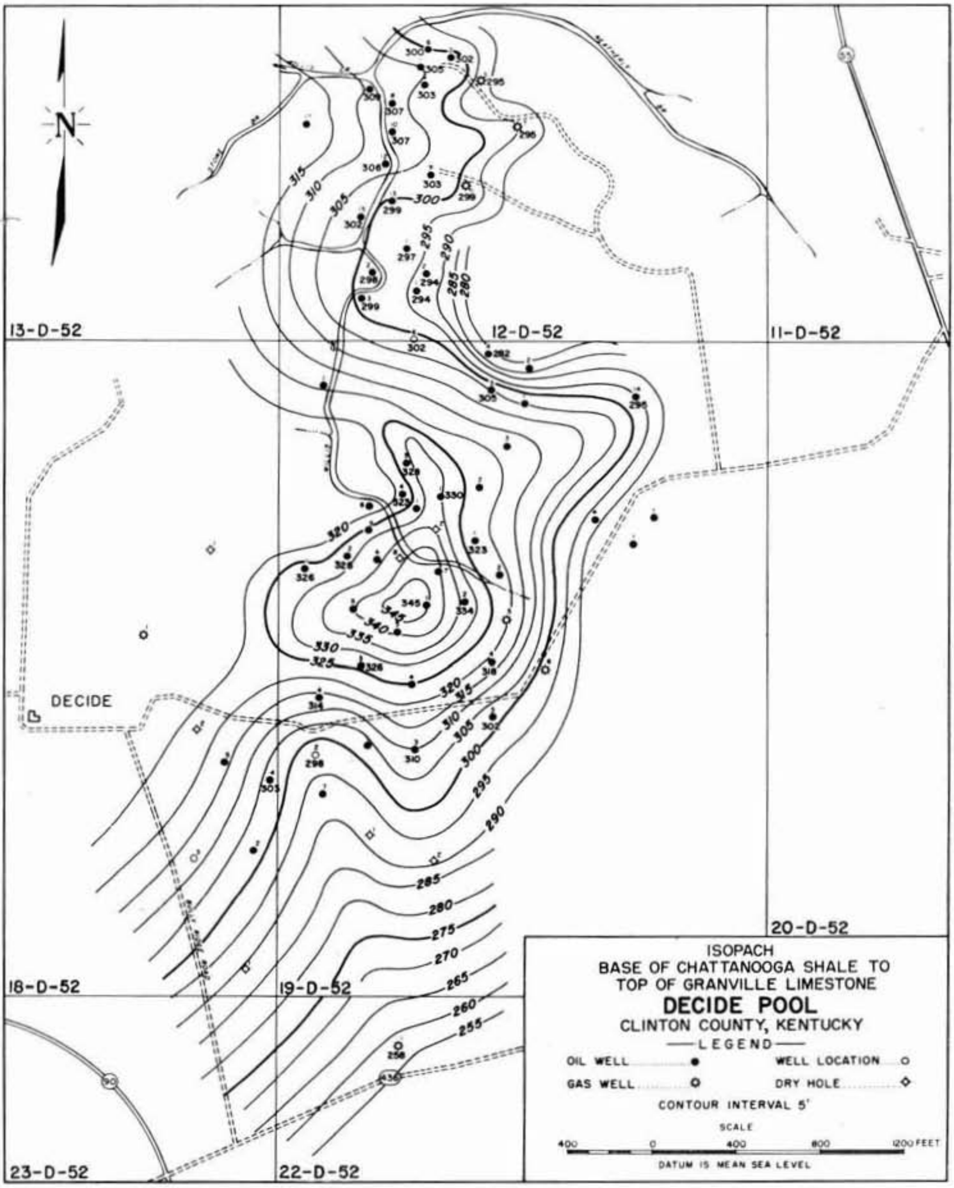


Fig. 7. Isopach map of the interval between the base of the Chattanooga shale and the top of the Granville limestone, Decide Pool.

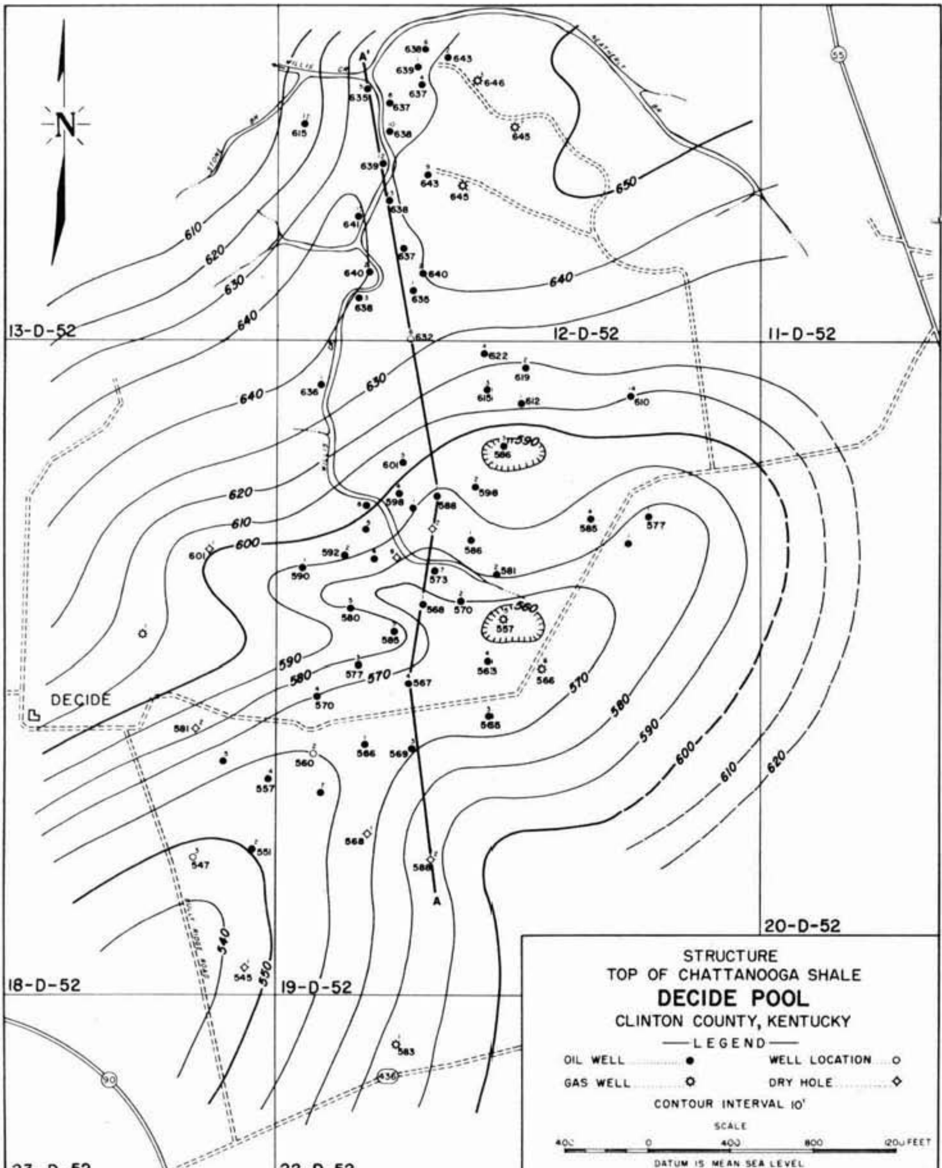


Fig. 8. Structure map of the Decide Pool, with contours on top of the Chattanooga shale.

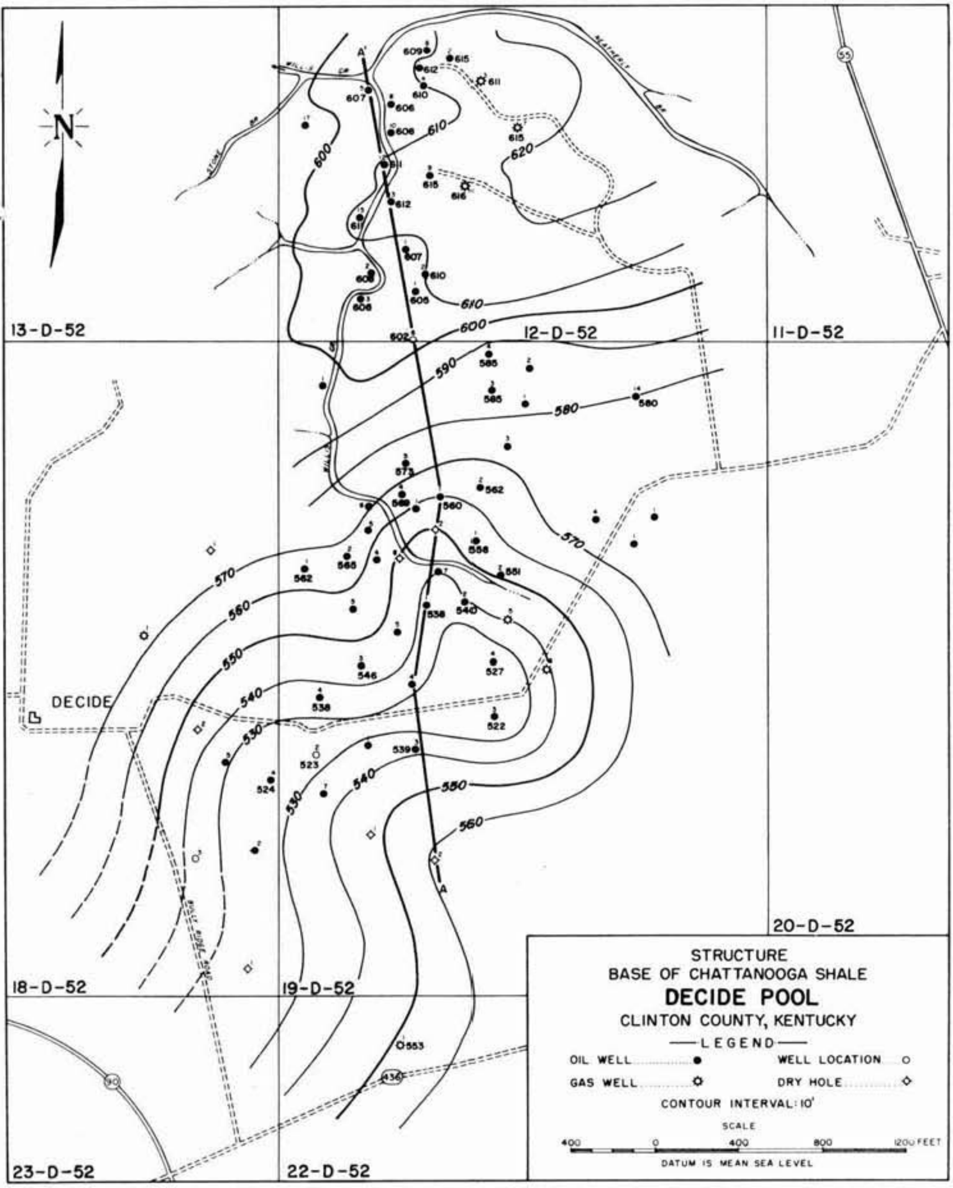


Fig. 9. Structure map of the Decide Pool, with contours on the base of the Chattanooga shale.

Arch. Diamond (1943, pp. 3-5) states that the Granville strip lies along the crest of the north-south trending Ill-Will anticline. However, evidence of this anticline's presence is not apparent on local or regional structure maps and possibly is obscured by the numerous minor folds.

Local

Pre-Chattanooga

In the north-south cross section A-A′ (fig. 4) the pre-Chattanooga erosion surface is shown to have cut into pre-existing structural "highs," indicating that much of the folding occurred prior to the erosion. Richmond dolomite lies in the "lows" off the flanks of the folds but has been eroded from the crests with continued exposure in post-Richmond time.

Structure contours drawn on top of the Granville limestone (fig. 6) reflect, with minor differences, the major axes of folding in the Decide area. A southwesward-trending anticlinal nose, located in the northern part of the area, runs parallel to the southwestward-plunging syncline in the central part. A depression in the bottom of the syncline has a closure of 20 feet or more[1] but apparently has no significance in regard to oil accumulation. From this depression the southern flank rises about 5 degrees toward the southeast.

The isopach of the interval between the base of the Chattanooga black shale and the top of the Granville limestone (fig. 7) indicates a closure of more than 20 feet where post-Granville and pre-Chattanooga sediments fill the depression in the Granville surface. This interval thins toward the southeast and northeast, the positions of the structural "highs" of the Granville limestone.

Upper Devonian-Lower Mississippian

Structure contours on both the base and top of the Chattanooga black shale (figs. 8 and 9) show that the Chattanooga folds dip less steeply than those on top of the Granville (fig. 6) and apparently are directly superimposed over the Granville folds. The southwestward-trending anticline and syncline occupy about the same positions on both strata, indicating that recurring uplift following Chattanoogan deposition acted along approximately the same fold axes formed by pre-Chattanooga disturbances. Synclinal flanks of the Chattanooga surface have less than 2 degrees rise to the northwest and southeast, in contrast to the steeper underlying folds shown as an unconformity in the north-south cross section A-A′ (fig. 4).

[1] The Eagleston No. 6 well log records the top of the Granville at 147 feet above sea level, which is about 100 feet lower than would be expected for its position relative to other wells. Therefore, it has not been used because of the possibility of a recording error.

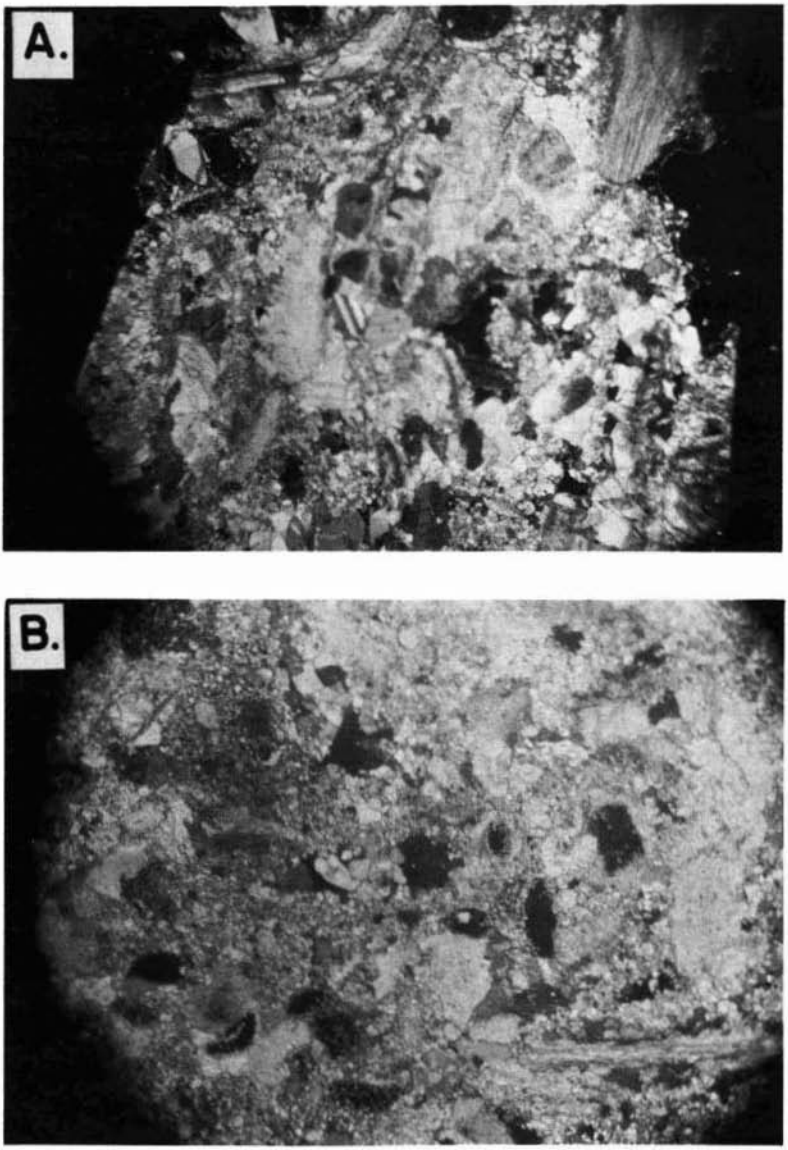


Plate 1. A. Fragmental texture; pores lined with small calcite crystals. W. L. Agee well #3, 614-20 feet. Crossed nicols, X 22.

B. Fragments of organic remains and secondary calcite crystals. Note porosity. W. S. Dicken well #3, 731-42 feet. Crossed nicols, X 80.

RESERVOIR

Characteristics

The Granville reservoir rock is a creamy-white to tan, finely crystalline to fine-grained, porous limestone which is very pure throughout most of its thickness. Random samples of well cuttings treated with diluted hydrochloric acid indicate an estimated 95 percent carbonate content. The remaining 5 percent is mainly argillaceous and pyritic aggregates. Cores are not available for precise porosity and permeability tests, but a microscopic examination of well cuttings reveals approximately 10-15 percent of pore space available for oil accumulation. These vugs are characteristically lined with inclusions of small, secondary, pinkish-white calcite crystals which are otherwise rare (pls. 1 and 2). Variable amounts of shell fragments and coralline or bryozoan structure are recognizable in the cuttings.

Three thin sections were made of the Granville fragments from three different wells, and in each of these sections fragmentary organic remains predominate (pls. 1-3). Crinoid plates and bryozoan and brachiopod shells can be recognized in a matrix of fine-grained clastic carbonate grains. Some recrystallization has occurred, as indicated by the relatively large, uniform, clear calcite crystals that comprise an estimated 10 to 15 percent of the rock (pls. 1 and 2). Because of its fragmental texture the rock has a rough, brecciated appearance in thin section. The porous nature of the Granville is very distinctive in all of the slides (pls. 1-3). Presence of dolomite in the

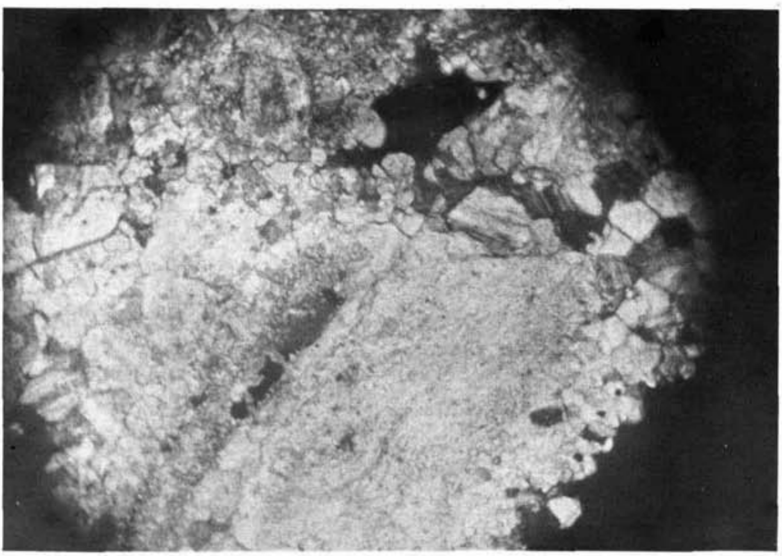
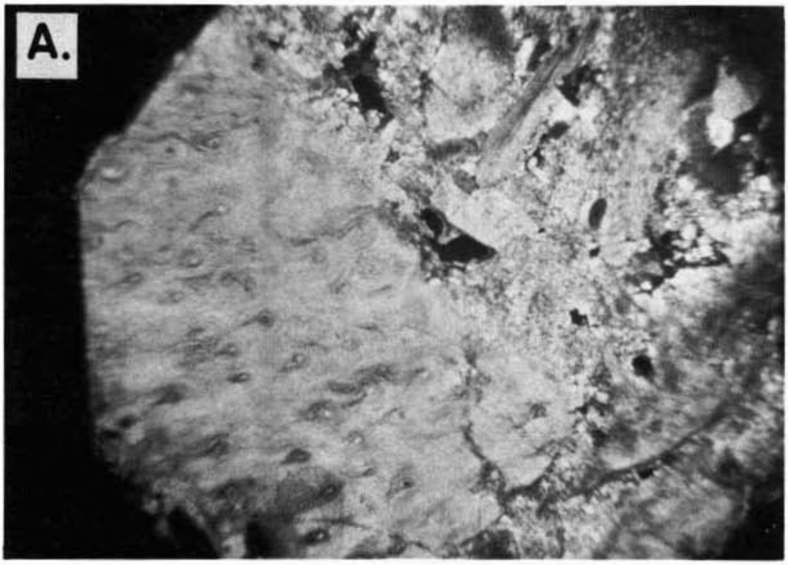


Plate 2. Organic fragments partially recrystallized. W. S. Dicken well #4, 731-42 feet. Crossed nicols, X 80.



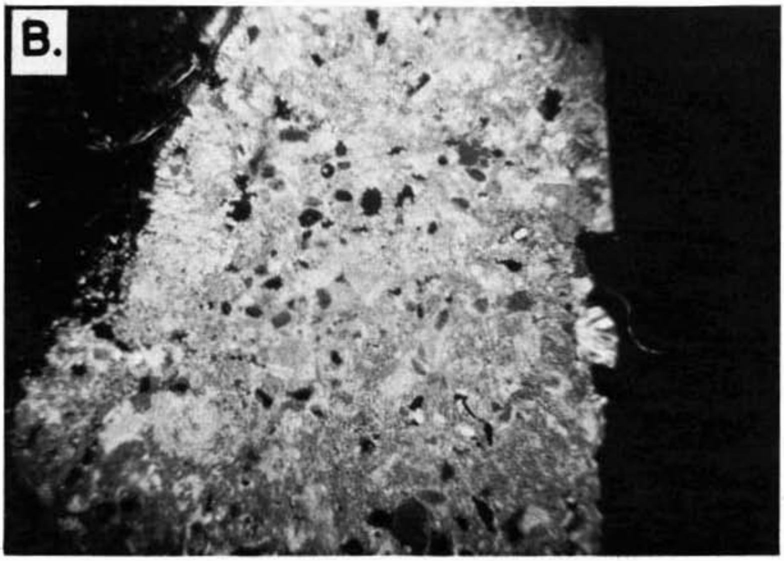


Plate 3. A. Organic fragments; bryozoan tangential section in lower portion within a fine-grained matrix. W. L. Agee well #3, 614-20 feet. Crossed nicols, X 22.

B. Fragments of organic remains and secondary calcite crystals. (Similar to pl. 1-A, but at low magnification.) W. L. Agee well #4, 585-90 feet. Crossed nicols, X 22.

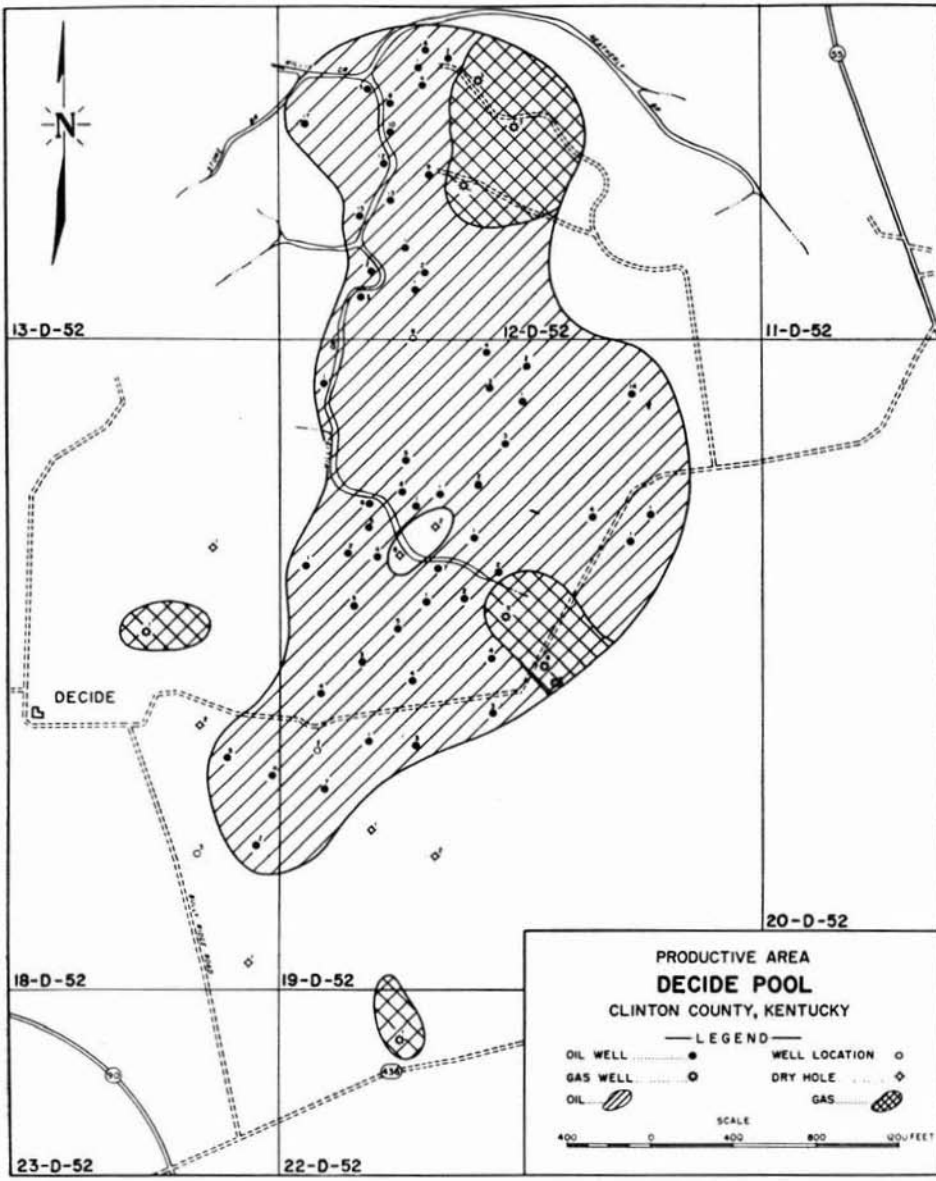


Fig.10. Map of the Decide Pool showing oil and gas producing areas.

slides is questionable, but several grains in one of the thin sections show two directions of parallel twinning and are possibly dolomite grains. Dolomite probably does occur in varying amounts throughout the reservoir.

The Granville has been referred to as a bioherm, or reef rock, by Freeman (1953, p. 32). The character of the reservoir, as described above, and its narrow north-south trend (fig. 5), lying at an angle to the main structural trends in the area (fig. 6), indicate that this reference to the reservoir is presumably correct. Furthermore, by definition (Pettijohn, 1949, pp. 296-99, and Cumings, 1932, pp. 333-35) this lenslike, recrystallized porous limestone, its cavities lined with small calcite crystals, would be classified as a biohermal limestone. Although the rock is principally an accumulation of shell debris rather than a continuous growth *in situ,* it may broadly be termed a reef rock because of these dominating characteristics stated above.

Average thickness of the Granville is 19 feet, but the most productive wells are situated in the pool where the average net effective "sand" thickness is about 15 feet, centering on an irregular north-south trend. Water has not been found in any wells to date, and, therefore, it is highly improbable that production is aided by an effective water drive. The small gas cap located on the upper portion of the anticlinal nose in the north part of the pool and the dissolved-solution gas drive combine to give an effective gas drive to the oil. Small isolated gas pockets also seem to be present (fig. 10) in several places along the northwest and southeast flanks of the syncline in the center of the pool. Reservoir pressures, temperatures, gas-oil ratios, and other vital engineering data necessary to evaluate a reservoir satisfactorily have not been gauged in any wells in the pool. It is noted that reservoir pressures were initially great enough to cause the oil to rise several hundred feet in most wells.

Accumulation Control

A lithologic reef-type trap, modified slightly by a favorable structure, serves to control the accumulation of oil in the Decide Pool. Lithologic conditions of the porous reservoir rock are the main factors in the accumulation control as evidenced by the presence of oil in the synclinal depression shown in figure 6, in contrast to its absence from the structurally more favorable southeast and northwest flanks. Variation in the "sand" is also noted by the small gas pockets isolated from the main area of accumulation.

A thinning of the reef to the west is probably accompanied by an addition of clay and dolomite in the lower part of the Granville, thus forming a lithologic closure. The limits of the productive area where the zone thickens to the east are not well defined, but it doubtlessly has a similar closure. Oil migration upward is prohibited by the numerous shale layers and the lack of good porosity in the limestone beds of the upper Million.

Structural control seems to be of minor importance in accumulation, but the anticlinal nose, which is the highest part of the structure (fig. 6), affords a favorable position for the small free gas cap present in the upper portion of the pool. Several underlying Ordovician limestones, known to contain oil in surrounding pools, are the best probable source of the oil found in the Decide Pool. Oil migration was presumably along an intricate fracture system, upward through intervening limestones of low permeability into the naturally porous reef limestone. The oil is not believed to be indigenous because of the large amount of production obtained from such a small reservoir.

It has been suggested by Freeman (personal communication) that slight faulting or slumping basinward possibly occurred previous to Granville deposition. This postulated slumpage trace approximately paralleled the Cincinnati Arch in the same manner as coastal faults parallel the present day coastlines. The high side of such a fault or slump would provide a favorable habitat for reef-forming organisms or shell accumulation. Also, it would be highly susceptible to the recrystallizing solutions which worked through the rock soon after reef growth was completed.

Actuality of this proposed structure is not determinable with present well data. In the future, deeper wells that pass through the Granville and give better regional control may confirm this hypothesis or indicate similar structural relationships.

PRODUCTION

Drilling Practices

All wells have been drilled with small cable tool rigs, mostly the light portable type, to facilitate moving in the wooded area. Fuel to operate the drilling apparatus, as well as the pumping equipment, is obtained from the gas wells in the pool, which otherwise would be plugged. In completing the wells an 8¼-inch diameter hole was drilled through the surface rocks and down to the base of the Chattanooga black shale. Here 6⅝-inch casing was usually set. The hole was completed a foot or two below the Granville "sand."

Acidization has been necessary on very few wells, and when acid has been used to loosen the "sand," the wells have become commercial producers. The John Tuggle No. 2 Well produced 120 barrels per day after acidization, one of the largest initial production rates in the pool.

With only two known exceptions all the wells have bottomed immediately below the producing zone at an estimated average depth of 700 feet. The E. Sawyer No. 1, a gas well, has a total depth of 1,460 feet (table 3), and the J. E. Cash No. 5, a producing well, was drilled 1,915 feet (table 3); no further saturated zones were encountered in either well. No coring has been done in any of the pools along the Granville trend; well cuttings from only a limited number of wells are available for inspection.

Production Data

Cumulative production from the 56 producing wells to January 1, 1954, totals 242,525 barrels of 42° API gravity oil from all leases in the Decide Pool, with the exception of the Buskirk lease from which figures were unavailable. Yearly and cumulative production data (table 2) have been compiled from lease production figures (table 3) obtained from the Southern Kentucky Purchasing Company of Somerset, Kentucky, the only major pipeline company serving the area. The production is shown graphically in figure 11. This chart shows that major development of the pool took place in 1947, and this is reflected in the 1948 production runs of 55,513 barrels of oil. Decline in yearly production has been almost as rapid as the growth of the pool, which is partially a result of the termination of development. The main cause of production decline, however, is probably due to the loss of reservoir pressure.

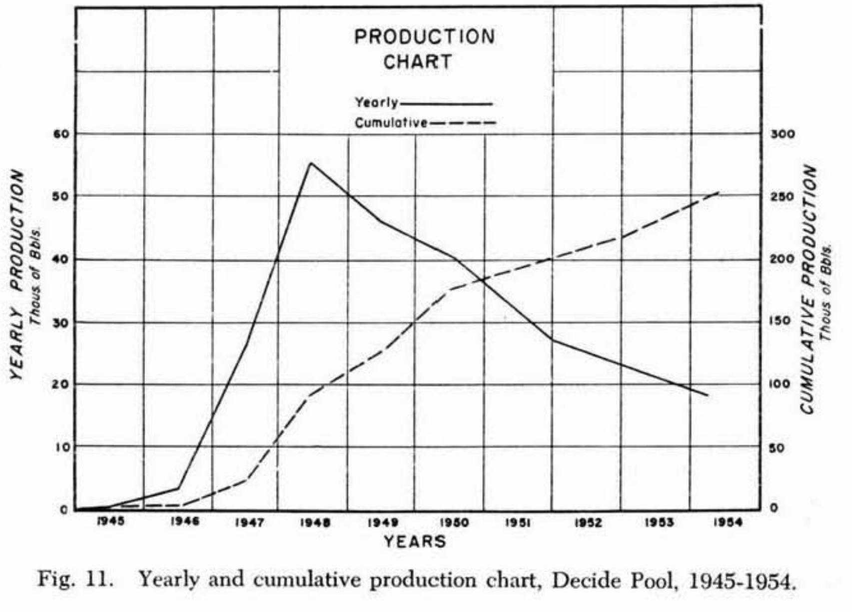


Fig. 11. Yearly and cumulative production chart, Decide Pool, 1945-1954.

TABLE 2
Production Figures

Year	*Yearly (bbls.)*	*Cumulative (bbls.)*
1945	237.45	237.45
1946	3,278.85	3,516.30
1947	26,172.99	29,689.29
1948	55,513.01	85,202.30
1949	46,782.99	131,985.29
1950	40,816.59	172,801.88
1951	27,277.51	200,079.39
1952	23,303.11	223,382.50
1953	19,142.55	242,525.05

Proved productive area, as determined by planemetry of the shaded area shown in figure 10, is calculated to be approximately 126 acres, which extends about 1 mile north-south and ¼ mile east-west. A volume of 2,394 acre-feet is calculated to be present, by using the production area of 126 acres and an average reservoir thickness of 19 feet.

Ultimate production from the pool by primary means is obtained by plotting the yearly production rate against the cumulative production (fig. 12). Disregarding the minimum economic rate, the ultimate recoverable oil is shown to be more than 340,000 barrels. Secondary recovery by repressuring with gas injection should slightly raise the percent of recoverable oil from the total in place.

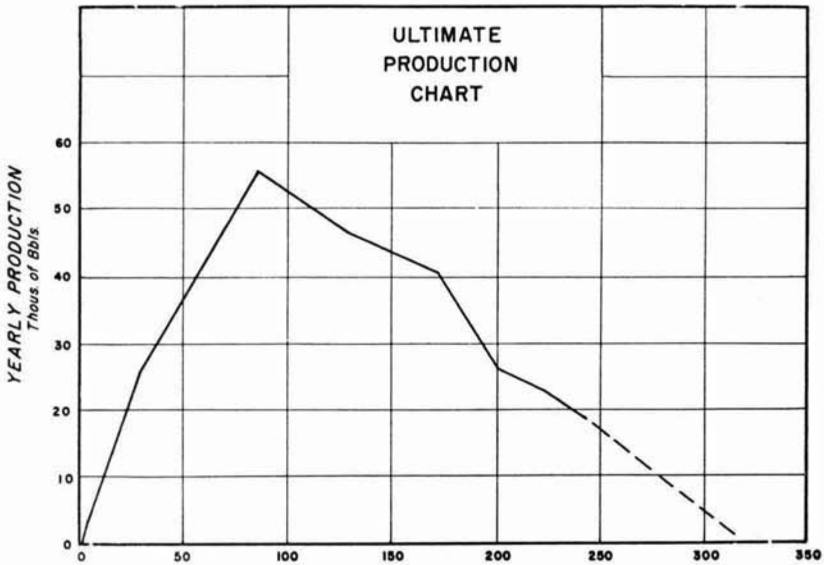


Fig. 12. Production chart, Decide Pool, showing probable ultimate recovery by primary methods.

TABLE 3.[a] WELL DATA

Operator	Lease	Well no.	Compl. date	Surf. elev.	Chattanooga sh. Top elev.	Chattanooga sh. Thickness	Chatt. sh.—Granville interval	Granville Top elev.	Granville Thick-ness	Total depth	Lease prod. (cumul., in bbls.)
Murphy & Buskirk	Agee, W. L.	1	2/44	909	639	27	305	307	....	613	18,055.90
		2	3/44	930	643	28	302	313	19	634	....
		3	3/44	934	646	35	293	318	19	633	....
		4	4/44	888	637	27	303	307	27	602	....
		5	7/44	672	635	28	309	298	20	390	....
		6	6/44	893	638	29	300	309	15	601	....
		7	7/44	935	645	30	295	320	26	631	....
		8	8/44	674	637	31	307	299	....	390	....
		9	8/44	906	643	28	303	312	....	611	....
		10	10/44	686	638	30	307	301	....	399	....
		11	10/44	937	645	29	299	317	....	635	....
		12	12/44	690	639	28	306	305	....	399	....
		13	4/45	700	638	26	299	313	....	403	....
		14	5/45	987	610	30	295	285	....	718	....
		15	6/45	701	641	30	302	309	....	406	....
		17	......	898	615	....	......	283	....	630	....
Murphy & Buskirk	Buskirk, U. B.	1	......	970	612	....	......	277	....	710	....
		2	......	948	619	....	......	293	....	672	....
		3	......	956	586	....	......	255	....	714	....
		4	......	1017	585	....	......	256	....	780	....
R. Thos. McDermott	Cash, J. E.	1	8/47	979	568	30	345	193	....	802	35,103.06
		2	9/47	937	570	30	334	206	....	748	....
		3	......	996	569	30	310	229	....	783	....
		4	......	974	567	30	......	211	16	777	....
		5	......	983	585	....	......	219	....	1915	....

[a] Well data has been largely collected from the files of the Kentucky Geological Survey. Limited data is from Freeman (1953).

TABLE 3—Continued

Operator	Lease	Well no.	Compl. date	Surf. elev.	Chattanooga sh. Top elev.	Chattanooga sh. Thickness	Chatt. sh.—Granville interval	Granville Top elev.	Granville Thick-ness	Total depth	Lease prod. (cumul., in bbls.)
R. Thos. McDermott	Dicken, W. S.	1	......	996	566	....	....	229	....	779	23,387.53
		2	......	936	560	37	298	225	13	725	....
		4	......	952	557	33	303	221	11	747	....
		7	......	985	579	....	......	253	....	753	....
	Eagleston, T. W.	1	......	936	......	....	......	199	....	751	28,920.42
		2	......	963	......	....	......	239	....	739	....
		4	......	953	......	....	......	219	....	755	....
		5	......	941	......	....	......	215	....	746	....
		6	......	827	......	....	......	147[b]	....	719	....
		7	......	958	573	....	......	208	....	763	....
		8	......	......	......	....	......	......	....	......	....
R. Thos. McDermott	Guthrie, J. A.	1	6/46	986	586	28	323	235	....	764	40,519.25
		2	10/47	987	581	30	321	230	....	773	....
		3	......	975	565	43	302	220	24	772	....
		4	......	968	563	36	318	209	20	774	....
		5	......	974	557	....	......	213	....	778	....
		6	......	977	566	....	......	228	....	762	....
R. Thos. McDermott	Hay, L.	1	11/44	913	637	30	297	310	....	620	31,124.85
		2	12/44	944	640	30	294	316	....	646	....
		3	4/46	953	615	30	305	280	....	690	....
		4	7/46	983	622	37	282	303	....	696	....
		5	6/47	961	601	28	328	245	....	734	....
		6	......	949	632	30	302	300	14	664	....
	Johnson, Roy	1	2/45	935	635	30	294	311	....	641	18,272.93
		2	9/45	720	640	32	298	310	....	427	....

[b] Elevation not used on Granville structure map because of possibility of recording error.

TABLE 3—Continued

Operator	Lease	Well no.	Compl. date	Surf. elev.	Chattanooga sh. Top elev.	Chattanooga sh. Thickness	Chatt. sh.–Granville interval	Granville Top elev.	Granville Thick-ness	Total depth	Lease prod. (cumul., in bbls.)
	Johnson, Roy	3	11/45	733	638	30	299	309	....	440	....
		4	8/46	914	598	29	323	246	....	681	....
	Leveridge	1	......	945	601	....	......	261	....	693	....
		2	......	1001	581	....	......	......	....	845	....
R. Thos. McDermott	McDermott, R. T.	1	......	818	636	....	......	303	....	531	1,706.90
R. Thos. McDermott	McWhorter, V.	1	1/47	974	588	28	330	230	20	760	9,386.66
		2	......	999	598	36	351	232	21	785	....
R. Thos. McDermott	Piercy, Ezra	1	......	994	577	....	......	251	....	757	12,121.43
R. Thos. McDermott	Sawyer, E.	1	......	1025	583	30	258	295	....	1460	....
		2	......	1022	588	....	......	281	36	777	....
R. Thos. McDermott	Sawyer Heirs	1	......	968	545	....	......	234	....	742	....
	Smith, Paul	1	......	993	568	....	......	253	....	753	2,606.55
		2	......	996	551	....	......	234	....	779	....
		3	......	975	547	....	......	218	....	769	....
R. Thos. McDermott	Tuggle, John W.	1	8/46	968	590	28	326	236	....	747	21,319.57
		2	11/47	971	592	27	328	237	....	750	....
		3	......	945	577	31	326	220	15	742	....
		4	......	929	570	32	314	224	14	723	....
		5	......	974	580	....	......	217	....	775	....

FUTURE POSSIBILITIES

Only two deep tests (1,460 feet and 1,915 feet, table 3) have been drilled in the Decide area, both in the synclinal trough (fig. 6) and both proving unproductive below the Granville. Further tests in deeper Ordovician zones that have proved to be favorable producing horizons in surrounding pools may be successful on the anticlinal nose in the north part of the area, where conditions favor structural accumulation. Showings of oil and gas have been noted while drilling through shallow beds, but commercial production from any of these is highly improbable.

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APPENDIX

Detailed Subsurface Stratigraphy

Log of Murphy and Buskirk's W. L. Agee Well No. 2, NW NE SW section 12-D-52, Elevation 930 feet, Decide Pool, Clinton County, Kentucky.

	Depth in feet
Lower Mississippian	
New Providence-Fort Payne formation	
Limestone, light- to medium-gray to tan, finely crystalline; white to tan silica inclusions; medium-gray siltstone interbedded, more in lower part than in upper	0-100
Limestone, light-green to greenish- and brownish-gray, silty; some chert inclusions; loose calcite fragments in lower part	100-60
Shale, medium greenish-gray, crinoidal, limy; calcite inclusions; loose chert	160-90
Limestone, creamy-white, crinoidal; calcite and milky chert fragments, and some pyrite present	190-215
Shale, medium-dark greenish-gray, very crinoidal; light-brown calcite-replaced crinoid stems; some chert fragments	215-50
Shale, light- to medium greenish-gray, pyritic, non-fossiliferous	250-87

Upper Devonian

Chattanooga black shale

Shale, black, carbonaceous, fissile; inclusions of pyrite cubes.. 287-315

Duffin member

Dolomite, medium grayish-brown, argillaceous 315-25

Unconformity

Upper Ordovician

Maysville group

Gilbert limestone

Limestone, light brownish-gray to green, dense; some pyrite, chert, and quartz inclusions 325-45

Tate dolomite

Dolomite, light-brown and green, coarsely crystalline, pyritic; medium-gray dolomite in lower part 345-95

Fairmount formation

Limestone, medium-gray, fossiliferous, very phosphatic; some pyrite, calcite, and milky chert fragments 395-420

Limestone, medium- to light-gray, fossiliferous; light-brown calcite and some chert fragments present 420-65

Limestone, very fossiliferous, medium-gray, dense, with medium-brown calcite fragments 465-75

Limestone, medium-gray, phosphatic, fossiliferous, dense, with calcite partings 475-85

Limestone, white to medium-gray mottled, dense to fine-grained, fossiliferous; slightly pyritic 485-95

Limestone, fine-grained to dense, medium greenish-gray, fossiliferous, with light-brown calcite inclusions 495-510

Eden group

Garrard limestone

Limestone, very dense, medium-gray 510-15

Limestone, tan to light-gray, fine- to medium-grained, fossiliferous, silty 515-20

Limestone, as above; some medium-gray, dense 520-25

Limestone, as above; pyritic 525-30

Limestone, white to light-gray, medium-grained, fossiliferous, silty 530-40

Limestone, as above, with some chert; some brown silty limestone 540-65

Million formation

Limestone, light brownish-gray to medium-gray, fine-grained to dense, fossiliferous 565-75

Limestone, as above, crystalline; some tan calcite 575-600

Limestone, medium-gray, dense, calcite intermixed; some medium-gray, calcareous shale 600-05

Limestone, light-gray, fine-grained; phosphatic inclusions 605-10

Limestone, light-brown, porous, crystalline; some shale, medium-gray, calcareous 610-17

Granville facies

Limestone, white to cream, vugular, with secondary calcite crystals; some pyrite 617-25

Limestone, cream to medium-gray, coralline; some calcareous shale 625-30

Limestone, as above, with calcitic coralline or bryozoan structure 630-34