STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

THE SANGAMON ARCH

L. L. Whiting
D. L. Stevenson

ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, *Chief* URBANA

CIRCULAR 383 1965

THE SANGAMON ARCH

L. L. Whiting and D. L. Stevenson

ABSTRACT

Thickness and areal extent of Devonian and Silurian carbonates in central and western Illinois were influenced by a major upwarp that was active during Devonian and early Mississippian time. The movement probably began in late Silurian time, but initial uplift cannot be determined because of extensive erosion of Silurian strata.

The upwarp has been named the Sangamon Arch. Although the structure persisted for some time after Middle Devonian deposition, later movement has masked the arch so that it does not show on structure maps of the top of the Galena Group or of the top of the Hunton Megagroup (Devonian-Silurian).

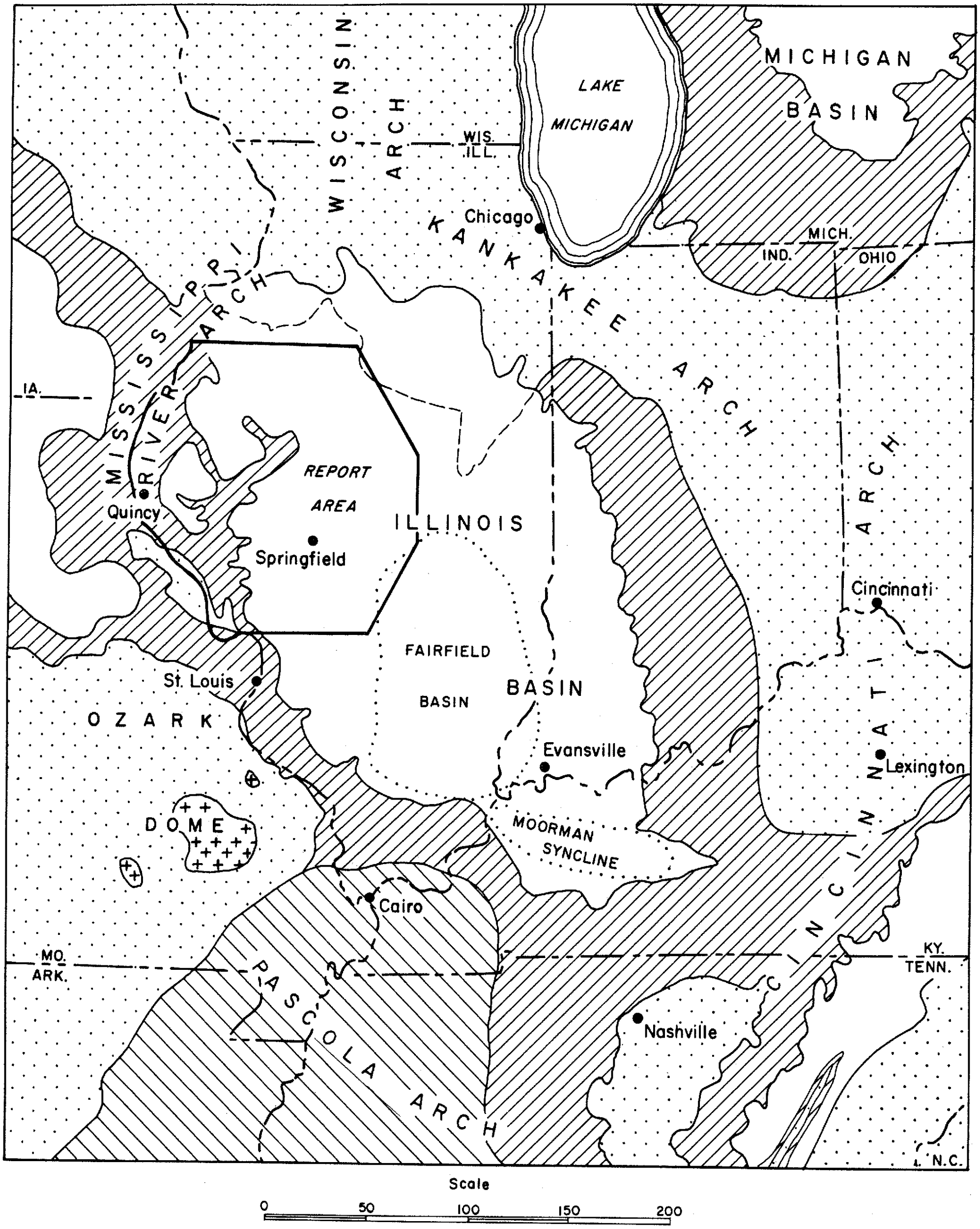
The Sangamon Arch had a significant influence on the distribution of potential petroleum reservoirs in the Devonian and Silurian strata.

INTRODUCTION

The absence of Devonian carbonates in a large east-west section of central western Illinois has been noted in several published works, among them reports by Workman (1940), Workman and Gillette (1956), and Whiting (1956).

This absence is the result of nondeposition and erosion over a broad arch that was created by upward warping during Silurian and Devonian time. The arch was called the Sangamon Arch by Whiting, and the name was first published in a report by Bell et al. (1962, p. 19).

Most of the data used during the preparation of this report was derived from drill cuttings. Electric logs were used mainly to supplement the sample studies because regional correlation of Devonian and Silurian strata based on electric logs is generally unreliable and because no electric logs are available in the northwest half of the area where nearly all the holes were drilled with cable tools. The most useful information was obtained from cores, but many holes were drilled from which no cores were available. Occasionally, in the absence of any other information, a carefully prepared drillers log was considered adequate data for maps and cross sections.



EXPLANATION

- CRETACEOUS AND TERTIARY
- PENNSYLVANIAN
- MISSISSIPPIAN
- MISSISSIPPIAN BOUNDARY BENEATH THE PENNSYLVANIAN
- PRE MISSISSIPPIAN
- PRECAMBRIAN

Figure 1 - Location and geologic setting of the report area.

The relation of the report area to major geologic features is shown in figure 1. The area covers approximately 17,000 square miles and extends north from R. 6 N. to R. 30 N. along the third principal meridian and from T. 3 E. of the same meridian west to the Mississippi River. It includes the northwestern margin of the Illinois Basin and extends westward across the platform area of western Illinois to the Mississippi River Arch.

The southern boundary adjoins the area discussed by Meents and Swann (in preparation) in their report on the Devonian strata of southern Illinois. The eastern border lies in part along the west flank of the LaSalle Anticlinal Belt, and the northern boundary is near the area in northwestern Illinois where Devonian carbonates have been thinned or removed by pre-Pennsylvanian erosion.

STRATIGRAPHY

A generalized columnar section (fig. 2) from the ground surface to the base of the St. Peter Sandstone shows the range of thickness and gross lithology of the major stratigraphic units.

A detailed description of the stratigraphy is limited to the Hunton Megagroup, which comprises the Devonian and Silurian carbonates (Swann and Willman, 1961). The general relations of the formations to each other, as well as to adjacent strata above and below, are shown by the three cross sections in figure 3. These cross sections have a common datum on the top of the Hunton. The wells used in constructing these cross sections are listed in table 1.

Silurian System

Only lower and middle Silurian sediments are present in the report area, the Alexandrian and the overlying Niagaran. Because the Alexandrian here is uniformly about 60 feet thick, the combined thickness of the two series is shown in figure 4. The over-all thinning of the Silurian from east to west is caused primarily by erosion prior to Middle Devonian deposition.

Alexandrian Series

The Alexandrian Series is represented by two formations, the Edgewood Limestone at the base and the Kankakee Limestone above. In the southwestern part of the report area the Edgewood is at its maximum of slightly over 40 feet thick. It thins gradually toward the north and wedges out along a line running through central Brown County, eastward across Cass and Morgan, and into Menard and Sangamon Counties. North and east of Menard and Sangamon the Edgewood reappears and thickens to about 15 feet in Macon and DeWitt Counties (fig. 3, A-A').

In much of the report area the Edgewood is gray or slightly greenish gray to tan, finely crystalline, sucrosic dolomite. In some localities near its northern and western wedge-out in Pike and Brown Counties, the Edgewood has a somewhat pinkish cast and in some places is represented by less than 5 feet of very fine, almost silt-sized, gritty, pink, red, or even green, dolomite pellets mixed with greenish gray shale from the underlying Ordovician Brainard Shale. Lenses of the Noix Oolite Member in the lower part of the Edgewood are scattered along the southwestern part of the area as far north as southern Brown County and as far east as western Macoupin County.

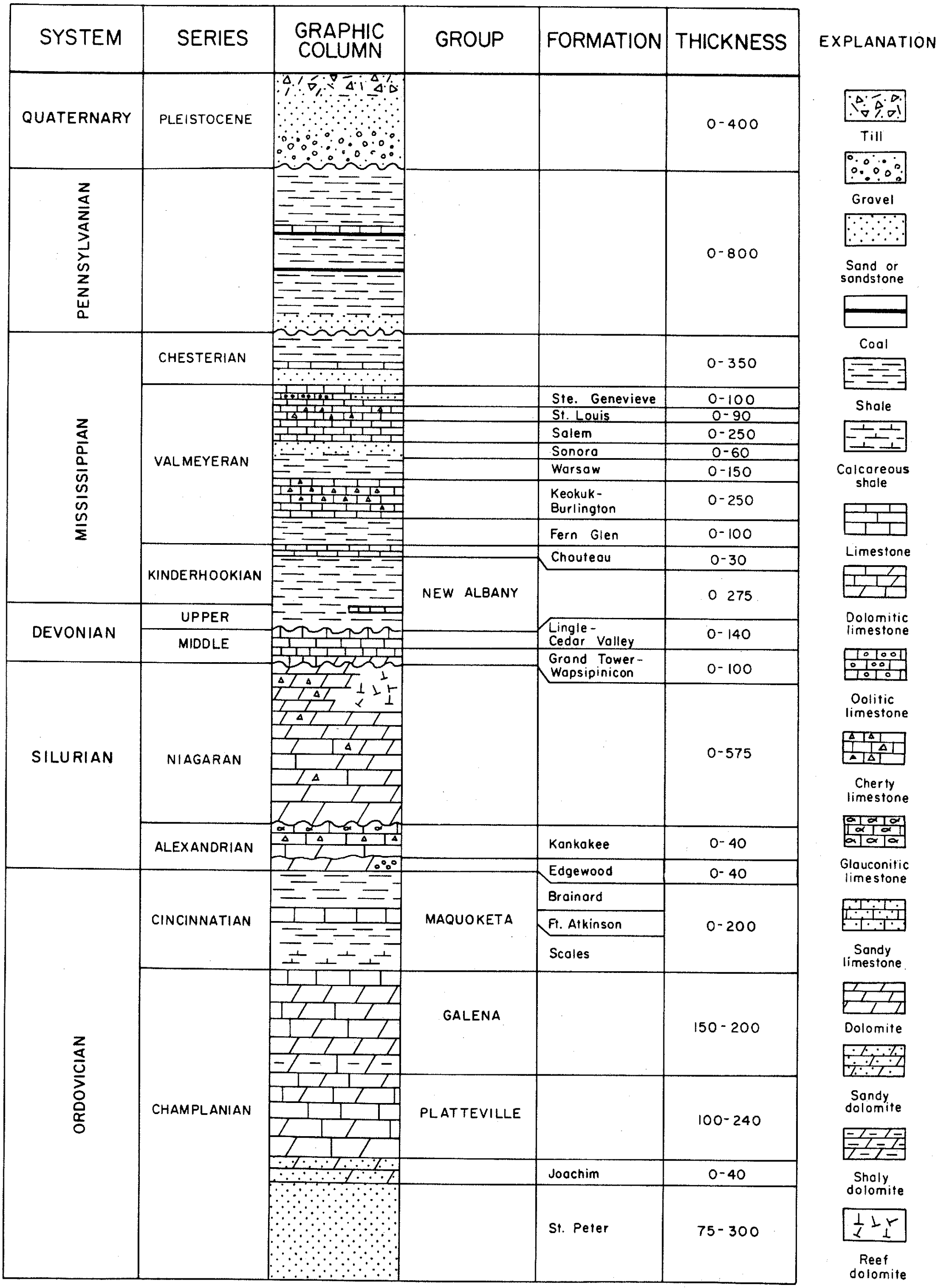


Figure 2 - Generalized columnar section above the base of the St. Peter Sandstone.

The Kankakee Formation unconformably overlies the Edgewood and overlaps it for a considerable distance toward the north. It consists of light greenish gray to very light buff-gray, fossiliferous, dolomitic limestone and dolomite, often mottled with irregular greenish gray or pinkish gray stains. Bluish white chert is common in the lower two-thirds of the formation, and glauconite pellets are fairly abundant in the upper part. This association of chert and glauconite pellets is an important criterion for distinguishing the Kankakee from the overlying Niagaran strata.

The thickness of the Kankakee where overlain by Niagaran generally ranges from 25 to 40 feet. However, it thins to about 5 feet in southern Pike County, where it overlies unusually thick Edgewood (fig. 3). The Kankakee is absent in the westernmost part of the area where the entire Silurian has been removed by erosion (fig. 4).

Niagaran Series

The contact between the Alexandrian and Niagaran appears to be conformable, with the strata above and below being essentially parallel. In many places the rocks on either side of the contact are quite similar, except that the Alexandrian sediments contain the characteristic chert and glauconite pellets and have a definitely pink cast, whereas the Niagaran strata are gray-green and relatively free of chert and glauconite.

Lowenstam (1949) made a study of Niagaran stratigraphy in Illinois based on lithologic character of well cuttings, fossils, and acid-insoluble residues. He classified Niagaran facies into three sedimentation belts trending northeast to southwest across the state (Lowenstam, 1949, p. 8). These include (1) a reef-free, high-clastic belt in southern and southeastern Illinois with a clastic noncarbonate content of 35 to 40 percent, (2) a reef-bearing, low-clastic belt extending from southwestern to northeastern Illinois with a 15 to 20 percent clastic content, and (3) a reef-bearing, clastic-free belt in northwestern and western Illinois whose clastic content is commonly less than 5 percent. The boundaries of these belts are transitional marked by steep clastic content gradients across narrow zones (Lowenstam, 1949, p. 9).

Only the two northern sedimentary belts are represented in the area of this report. Essentially all of the area extending northwest from the Illinois River is in the clastic-free belt, and the area southeast of the river is in the low-clastic belt.

The various formations of the Niagaran Series have been shown as a single unit on the cross sections (fig. 3) and in the generalized columnar section (fig. 2) because the lithology of the Niagaran varies both laterally and vertically, making it difficult to trace individual formations from the outcrops to the subsurface. The lowest Niagaran beds in most of the area are the pink crinoidal limestone of the St. Clair Formation. In the southeastern part of the area the St. Clair is overlain by red and greenish gray argillaceous limestone of the Moccasin Springs Formation. The Moccasin Springs grades laterally into light gray to greenish gray cherty dolomite and dolomitic limestones which are equivalent to the Racine Formation exposed in northeastern Illinois.

The Niagaran beds above and to the northwest of the Moccasin Springs contain various facies that have been classified as reef, reef-flank, and interreef deposits (Lowenstam, 1949). These deposits were discussed in detail with respect to their regional distribution over the entire state by Lowenstam (1949) and in more restricted areas by Lowenstam and DuBois (1946), Lowenstam (1948), and Howard (1963, 1964).

The upper part of the Niagaran contains erosional features resulting from long exposure to weathering agents during the period between the close of Niagaran and the beginning of Middle Devonian deposition. Deep fissures and solution

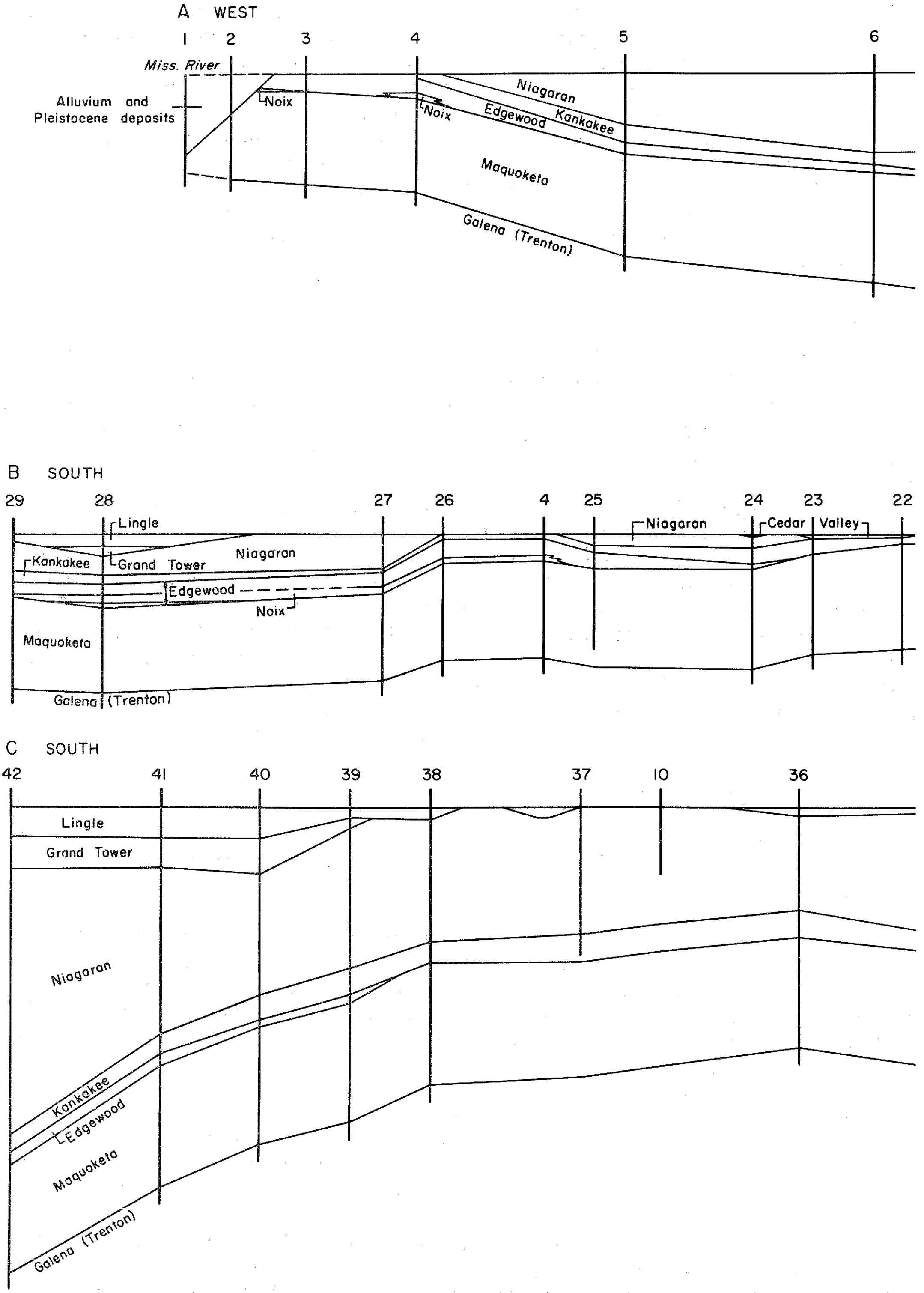
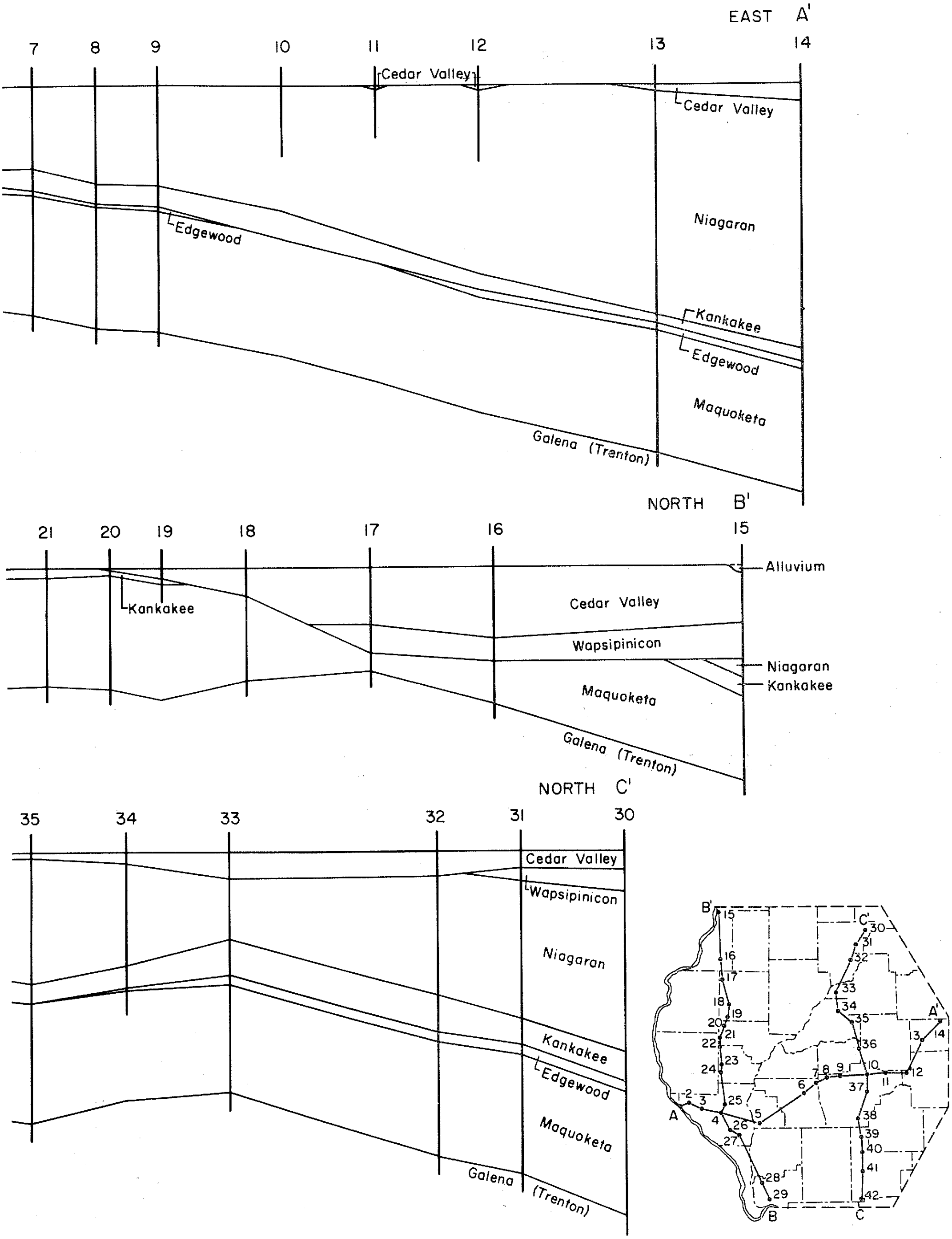


Figure 3 - Stratigraphic cross sections from the top



Location of Cross Sections

of the Galena (Trenton) to the top of the Hunton.

TABLE 1 — LOCATION OF DATA POINTS USED IN CROSS SECTIONS

No.	Operator	Farm	Sec.	T.	R.	County
1.	Approximated section at Miss. R.		7	5 S	7 W	Pike
2.	West Pike Development Co.	1 Reinhardt	35	4 S	7 W	Pike
3.	Mineral Development Co.	2 Hyde	14	5 S	6 W	Pike
4.	Panhandle Eastern Pipeline Co.	1-21 Mumford	21	5 S	4 W	Pike
5.	Bedell	1 Adams	27	13 N	13 W	Scott
6.	Rhodes & Morehead	5 Cleary	8	15 N	9 W	Morgan
7.	Wirth	1-A Leahy	21	16 N	8 W	Morgan
8.	V. S. & S. Drilling Co.	1 Martin Heirs	5	16 N	7 W	Sangamon
9.	V. S. & S. Drilling Co.	1 Tolan	32	17 N	6 W	Sangamon
10.	Kluzek & Warren	1 Long	33	17 N	4 W	Sangamon
11.	Cunningham	1 Hamilton	25	17 N	3 W	Sangamon
12.	Sun Oil Co.	1 Knap	27	17 N	1 W	Macon
13.	Watkins Drilling Co.	1 Lippert	1	19 N	1 E	DeWitt
14.	Lloyd Harris	4 Cora Ryan	21	21 N	3 E	DeWitt
15.	Jenks & Johnson	1 Inman	1	12 N	5 W	Henderson
16.	Krohn	1 Anderson	6	8 N	4 W	Henderson
17.	Egerer	1 Blandinsville City	32	7 N	4 W	McDonough
18.	Salmons	1 Harrell	26	5 N	4 W	McDonough
19.	RNK Oil Co.	1 Scott	34	4 N	4 W	McDonough
20.	Brainard	1 Foster	21	3 N	4 W	Schuyler
21.	Robinson	1 Rainey	18	2 N	4 W	Schuyler
22.	T & T Developers	1 Schone	7	1 N	4 W	Brown
23.	Measley	1 Manney	19	1 S	4 W	Brown
24.	Yakle	3 Carpenter	8	2 S	4 W	Brown
25.	S & S Oil Co.	1 Conkright	34	4 S	4 W	Pike
26.	Dorris & Lucht	1 Witty	31	6 S	3 W	Pike
27.	Erie Drilling Co.	1 Allison	11	7 S	3 W	Pike
28.	Jensen	1 Isringhausen	23	8 N	13 W	Jersey
29.	Elmore & Co.	1 Bell	33	7 N	12 W	Jersey
30.	Prentiss	1 Coon	25	11 N	8 E	Peoria
31.	Varner Well Drilling Co.	Alta School Dist. 303	31	10 N	8 E	Peoria
32.	?	Phillips Farm	2	8 N	7 E	Peoria
33.	Central Ill. Light Co.	1 Fornoff	6	23 N	6 W	Tazewell
34.	Hayes	1 Null	19	22 N	6 W	Mason
35.	Keith R.R. Equipment Co.	1 Wilson	19	21 N	5 W	Mason
36.	Pritchett	1 Dorgan	25	19 N	5 W	Menard
37.	Collins Bros. Oil Co.	1 Bennett Bros.	9	15 N	4 W	Sangamon
38.	Gulf Refining Co.	1 Dambacher	15	13 N	5 W	Sangamon
39.	Stewart Oil Co.	1 Lucas	25	12 N	5 W	Montgomery
40.	Gulf Refining Co.	1 Brandon	1	10 N	5 W	Montgomery
41.	Calvert Drilling Co.	1 Hopkins	24	9 N	5 W	Montgomery
42.	Taylor et al.	1 Worker	35	7 N	5 W	Montgomery

cavities extend in some areas into the top of the Niagaran to depths of 90 feet or more. These cavities are filled with green clay, sand grains, and brownish gray dolomite of Devonian age. Vuggy porosity is well developed in the upper beds of some Silurian carbonates and is at least partially the result of weathering. The development of the porosity is an important factor in the accumulation of oil in Adams and Brown Counties (Howard, 1961) and in the Decatur-Springfield area (Whiting, 1956).

Devonian System

The Devonian strata in the area are of Middle Devonian age and are predominately carbonate rocks. Some of the overlying shale has been assigned to the Upper Devonian but it has been excluded from this study because of the absence of a readily recognizable contact between Mississippian and Devonian shales.

The distribution of the Middle Devonian strata is shown by two isopach maps (figs. 5 and 6). A relatively large area containing no Devonian carbonates extends east-northeast across central Illinois from the western border of Pike County. The absence of these carbonates is interpreted as being the result of nondeposition and erosion along a major positive tectonic feature, the Sangamon Arch, that existed during Middle Devonian time. The arch is discussed in more detail in a later section of this report.

South of the Sangamon Arch, the Middle Devonian consists of the Grand Tower Limestone and the overlying Lingle Limestone. North of the arch, the Middle Devonian formations are called Wapsipinicon and Cedar Valley, for exposures along the Wapsipinicon and Cedar Rivers in Iowa. These names also have been used for Devonian strata south of the arch by Lowenstam (1948, p. 162-164) and Workman (1940, p. 195, 197), but because of the gap between Middle Devonian strata across the Sangamon Arch the Iowa terminology is restricted in this report to the north side of the arch. The Grand Tower and Wapsipinicon are nearly equivalent, and both are shown on the same isopach map (fig. 5). For the same reason, both the Lingle and Cedar Valley are shown on one map (fig. 6). The Devonian rocks on either side of the arch are dealt with separately in the following discussion.

Wapsipinicon Limestone

The Wapsipinicon thickens toward the north and west from the wedge edge along the north flank of the Sangamon Arch, attains a thickness of more than 60 feet in southern Henderson County (fig. 5), and is still thicker farther north and west outside the area. The predominant lithology is yellowish brown to light brown, lithographic to sublithographic limestone. In places, the lower part is dolomitic limestone with abundant, medium sized, well rounded, quartz grains. Fossils are extremely rare.

The Wapsipinicon uncomformably overlies the eroded top of the Maquoketa Shale in most of the western margin of the area. In extreme western Illinois, the entire Maquoketa has been removed (fig. 4) and the Wapsipinicon rests directly on the Galena (Trenton) Limestone. In the northern part of the area, the Wapsipinicon overlies the light gray to greenish gray dolomite of the Niagaran.

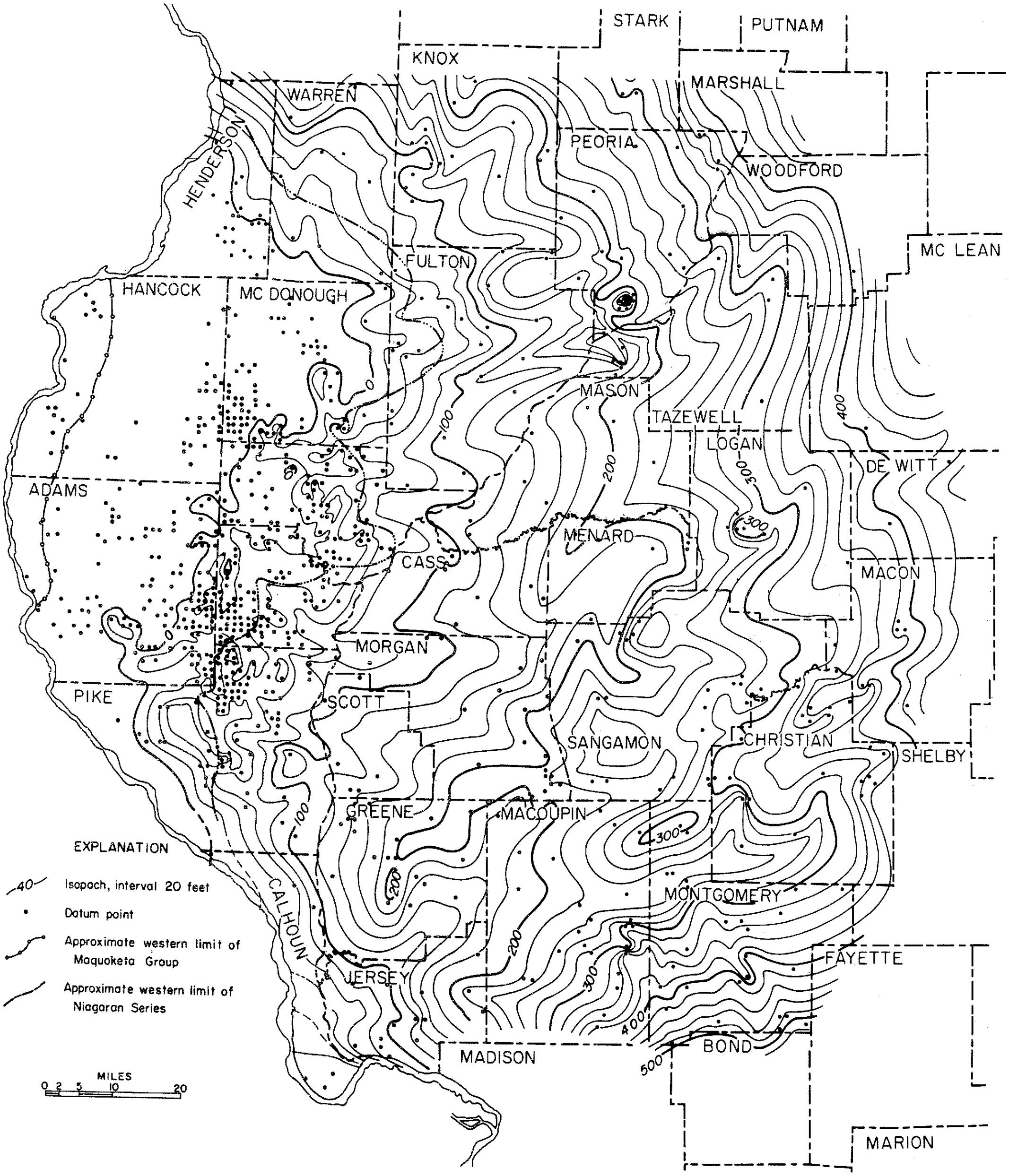


Figure 4 - Thickness of the Silurian System.

Grand Tower Limestone

The Grand Tower Limestone is slightly more than 100 feet thick in the southeastern corner of the area and wedges out along the south flank of the Sangamon Arch (fig. 5). The upper portion of the formation is generally yellowish brown to light brown lithographic limestone quite similar in appearance to much of the Wapsipinicon. One noticeable difference is that fossils are commonly present in the Grand Tower. Sand grains of the type found in the Wapsipinicon are abundant in the Grand Tower and in some areas are sufficiently concentrated to form sandstone lenses.

In the area south of a line roughly coincident with the 40-foot Grand Tower isopach (fig. 5), the lithographic limestone is underlain by a brown, sucrosic, vuggy dolomite. This dolomite thickens to the south, partially by upward gradation into the lithographic unit. No lithographic limestone is recognized south of the heavy dashed line on figure 5 extending through Bond and Fayette Counties (Meents and Swann, in preparation).

The brown dolomite contains floating sand grains in many places. Sandstone occurs at the base of this unit in the form of scattered lenses that may be equivalent to the Dutch Creek Sandstone of southern Illinois (Schwalb, 1955).

The Grand Tower rests unconformably on the irregular eroded surface of the Niagaran.

Cedar Valley Limestone

The Cedar Valley Limestone overlies and generally overlaps the Wapsipinicon, extending farther to the south onto the Sangamon Arch. The one exception to this overlapping is found in a small area in western Adams County where New Albany Shale overlies the Wapsipinicon Limestone. The Cedar Valley is more than 140 feet thick in southern Henderson County (fig. 6), and thins southeastward to the wedge-out along the north flank of the arch. The lower beds are overlapped by successively higher strata so that only the youngest unit is present at the feather edge of the formation. This upper unit is, in most places, a brown to brownish gray, fine-grained dolomite that is locally somewhat shaly and sandy.

The upper unit is underlain by a middle unit of fossiliferous limestone and partly dolomitic limestone ranging in color from light yellowish brown to dark gray. Sand grains of the type found in the Wapsipinicon and Grand Tower are common throughout this unit and sufficiently abundant near the line of pinch-out to form sandstone lenses. This middle unit contains the Hoing sand of the Colmar-Plymouth oil pool in Hancock and McDonough Counties. The Hoing is the lowermost Devonian unit in the pool but probably does not represent the earliest Cedar Valley deposit. The sandstone at Colmar-Plymouth is the largest known concentration of Hoing sand in this area, but other smaller patches of sandstone at approximately the same stratigraphic position are scattered throughout Adams, Hancock, and McDonough Counties. The Hoing is very friable and it is often difficult to determine from examination of drill cuttings whether the drill penetrated a sandy limestone or a sandstone. All that can be seen under the microscope are limestone fragments and abundant uncemented quartz grains. Most of the known sandstone lenses have been found in patches where the Cedar Valley is between 20 and 60 feet thick (fig. 6). As the middle unit thickens to the north and west, it becomes lighter colored and more fossiliferous, containing coralline material and many dark gray to black fossil fragments.

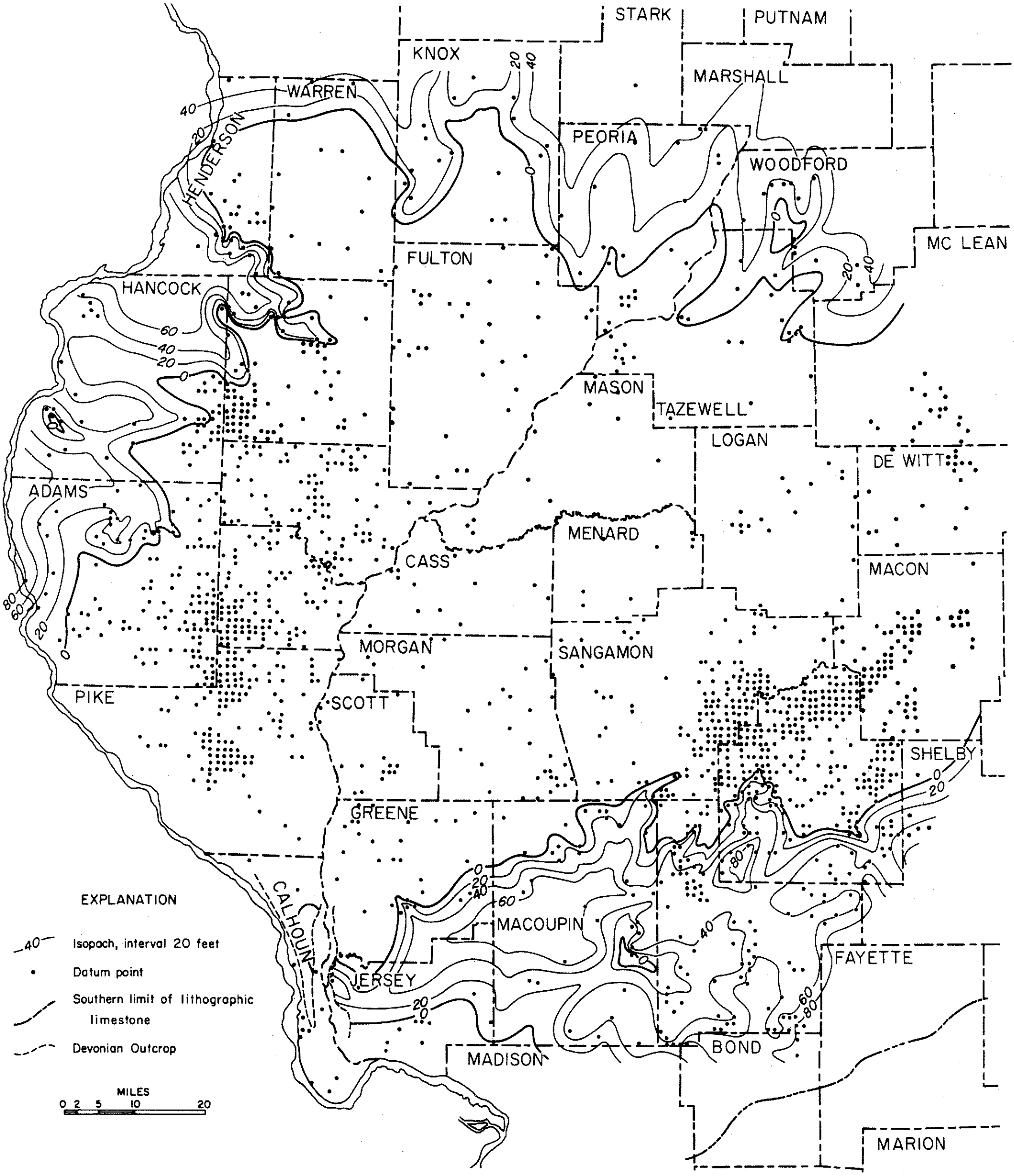


Figure 5 - Thickness of the Grand Tower and Wapsipinicon Formations.

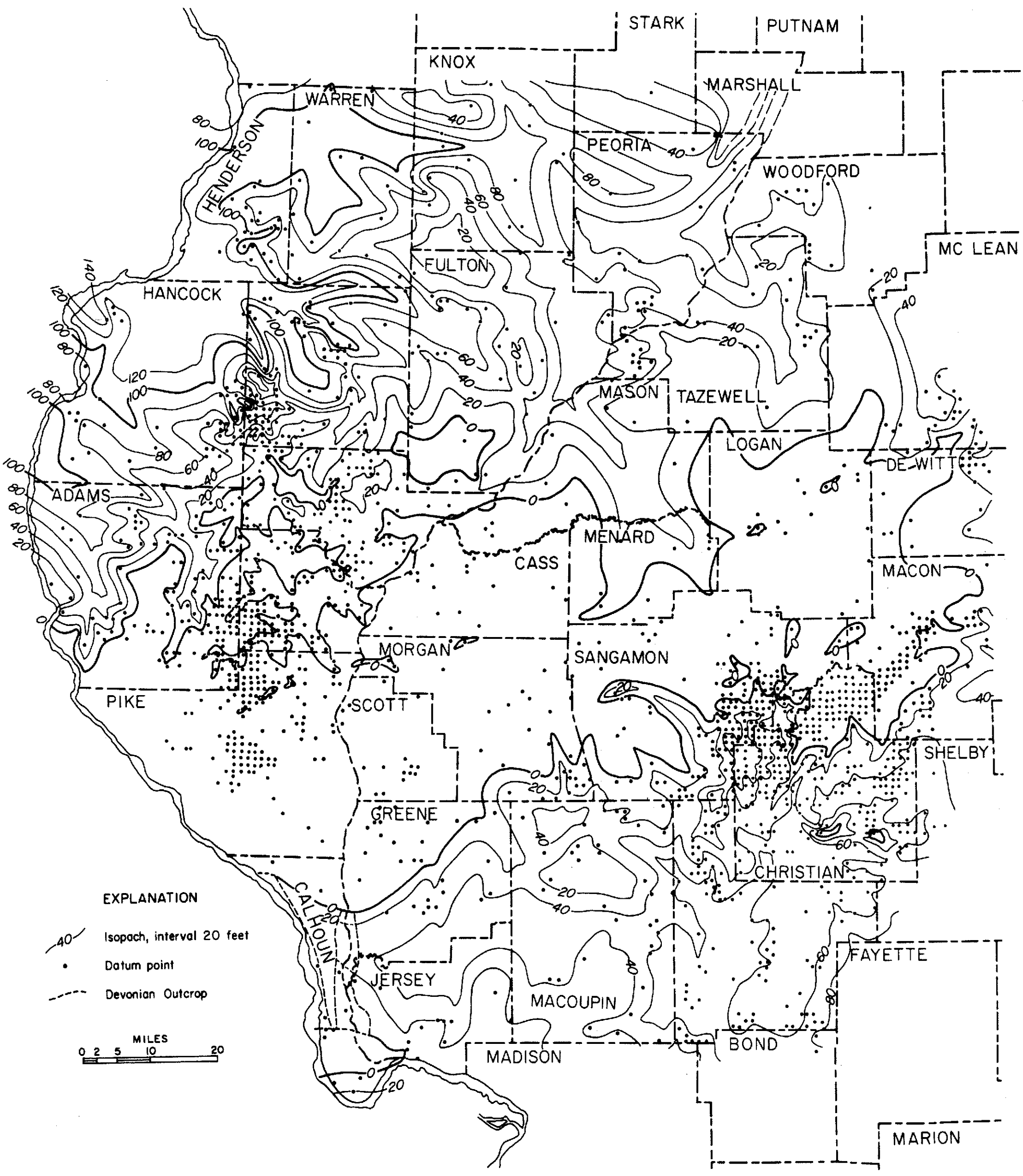


Figure 6 - Thickness of the Lingle and Cedar Valley Formations.

In northern Hancock County, most of Henderson County, and northern Warren County, where the Cedar Valley thickens to 100 feet or more, the lowest unit is a cherty, dolomitic limestone. The chert is light brown, fossiliferous, and displays a characteristic dull, earthy luster on the fractured surfaces. This unit also contains scattered sand grains in various degrees of abundance.

The lowest unit of the formation is present only in areas where the Cedar Valley is thickest, which further demonstrates the overlapping relation of individual beds within the formation as it wedges out over the north flank of the Sangamon Arch.

Local variations exist within the three units described above, but they can be recognized in drill cuttings in most of the area north of the arch.

Lingle Limestone

The Lingle Limestone overlies the Grand Tower Limestone and extends beyond it toward the north, just as the Cedar Valley overlaps the Wapsipinicon. The thickness of the Lingle ranges from zero along the south flank of the Sangamon Arch to a little more than 80 feet in northern Bond County.

The Lingle is dominantly limestone with textures ranging from lithographic to coarsely clastic. Floating sand grains are common throughout the formation and scattered sandstone lenses occur in some places. Some beds are extremely fossiliferous. In several places, notably in eastern Morgan County, southern Sangamon County, and northern Christian County, conglomerate beds have been found at one or more levels in the Lingle. These conglomerates contain subangular pebbles of Niagaran chert and dolomite in a sandy, chalky matrix. Lateral variation within the Lingle makes it virtually impossible to trace individual beds for long distances by either lithologic or electrical characteristics. In many areas where the Lingle overlies the Niagaran, the position of the contact is difficult to determine because numerous fissures and solution cavities in the Niagaran have been filled with Devonian sediments. In many places this difficulty is complicated by the presence of reworked Niagaran material in the conglomerates. This forms a zone containing both Silurian and Devonian deposits that extends for several tens of feet in many wells. In areas farther south the fissure fillings appear to extend through the Grand Tower into the Niagaran (Lowenstam, 1948, p. 164-166). Most of the cores showing fissure fillings in the Niagaran in areas where the Grand Tower is present indicate that the fissures were formed and filled prior to Grand Tower deposition.

TECTONIC HISTORY OF THE SANGAMON ARCH

Evidence of the existence of the Sangamon Arch, from the initial uplift—possibly as early as Silurian time—until it no longer exerted an influence on sedimentation in the Illinois Basin, is clearly recorded in some parts of the stratigraphic sequence but obscured by erosion in others. During the latter part of Ordovician time relatively stable conditions existed and a shallow sea covered the entire report area. The uniformly thick Maquoketa Group was deposited in this shallow sea. The wedging out of the Maquoketa in western Illinois is the result of erosion following Niagaran and preceding Middle Devonian deposition.

The first evidence of upwarping after Ordovician time is the onlapping relationship of the Alexandrian formations on both the north and south flanks of the Sangamon Arch. The Edgewood is present in the southern and northeastern parts of the area but absent throughout much of the central part (fig. 3, C-C').

Several units within the lower Niagaran can be recognized on electric logs and traced for fairly long distances. The thickness of these lower beds increases uniformly to the north and west from Bond County, indicating no uplift and possibly slight downwarping in the area of the Sangamon Arch during their deposition. The electrical characteristics of the upper part of the Niagaran are quite different from that of the lower beds, and individual units cannot be traced from well to well on electric logs. At least three explanations for this difference in electrical characteristics have been offered. One is that an angular unconformity exists at the base of the upper zone (Whiting and Oros, 1957, p. 175-176). If this is an unconformity, some tectonic activity must have taken place to interrupt Niagaran sedimentation before the deposition of the upper zone. A second possibility for the difference in electric characteristics may be that the original lithologies have been altered by weathering to which the Silurian was subjected before being buried by Middle Devonian deposits (Whiting and Oros, 1957, p. 178). A third possibility, that of facies variations brought about by the influx of reef-building organisms early in the Niagaran and the widespread influence of these organisms on sedimentation, was discussed by Lowenstam (1949). The unit shown by Whiting and Oros (1957) above the possible unconformity lies within Lowenstam's Thorn Group and may be a facies within the group. No conclusive evidence was found to support or disprove any one of these possibilities.

Isopach maps of the Silurian system and of the Niagaran Series in the Lowenstam report (1949, figs. 2, 3) and the isopach map of the Silurian System in this paper (fig. 4) do not necessarily indicate any major uplift or folding. They do suggest a strong tilting toward the east and southeast that began after or possibly during Niagaran deposition. Subsequent withdrawal of the Silurian seas initiated an erosion cycle during which several hundred feet of sediments was removed. The exact amount removed in any part of the area cannot be determined, but more than 500 feet of Silurian and some 200 feet of Ordovician (Maquoketa) strata present in the eastern part of the area are absent at the western edge of the state. The western limits of the Niagaran, Alexandrian, and Maquoketa strata are shown on figure 4. This erosion may have continued throughout late Silurian and early Devonian time, for no sediments representing these intervals are present.

The separation of depositional areas during Middle Devonian time, shown by the isopach maps of the Devonian formations (figs. 5, 6), indicates the presence of the Sangamon Arch between these depositional areas. The arch was very broad during Wapsipinicon deposition but was partially inundated and probably breached by Cedar Valley seas. Devonian rocks rest on a very uneven Silurian surface that contains features typical of karst topography. Fissures and cavities filled with conglomerate, green sandy clay, and sandy, chalky dolomite extend below the top of the Silurian to depths of 90 feet or more in some places. Devonian sand in the form of sandstone lenses or very sandy carbonate units is concentrated at the borders of the Sangamon Arch. These sandy units serve as oil reservoirs in some of the pools on both sides of the arch. They may be remnants of bars or beaches associated with the shoreline around the arch.

During Upper Devonian and Kinderhookian (Lower Mississippian) time, 150 to 325 feet of shale, with minor amounts of siltstone and limestone, was deposited over the area. The total thickness of these rocks does not clearly reflect the presence of the Sangamon Arch (Workman and Gillette, 1956, fig. 3). The thickness of some of the individual units within this sequence, however, indicates the arch existed until some time after the close of Kinderhookian time. Some of the formations thin toward the north and west to wedge out along the south flank of the arch. Pre-Pennsylvanian erosion has removed many of these formations in a large area north of the arch, but where they do occur they thicken to the north and west into Iowa.

Near the close of the Kinderhookian, the Chouteau Limestone was deposited in central and southern Illinois, its northern limits coinciding quite closely with that of Lingle. The McCraney, Prospect Hill, and Starrs Cave Formations, which are equivalent to the Chouteau, occur in extreme western Illinois (Workman and Gillette, 1956, fig. 4). The presence of the Sangamon Arch probably was responsible for the wide separation of these correlative units.

Widespread uplift throughout the entire area brought Kinderhookian sedimentation to a close, and resulted in erosion responsible for the unconformity below basal Valmeyeran (Middle Mississippian) sediments (Workman and Gillette, 1956, p. 43). This erosion, along with that which followed Niagaran deposition, prevents the determination of the exact life span of the Sangamon Arch. However, those sediments that are preserved indicate that the arch existed between the close of Niagaran and the beginning of Valmeyeran time.

Structure maps of the area contoured on top of the Galena (fig. 7, in pocket) and on top of the Hunton (fig. 8, in pocket), show no sign of the Sangamon Arch today.

The predominant orientation of structures varies in different parts of the area. A line drawn from the northeast to southwest corners of the maps would divide the area into a northwestern half with structures whose long axes are oriented northwest-southeast, and a southeastern half containing folds with a less pronounced alignment from northeast-southwest to nearly north-south. The southeastward regional dip is quite noticeable in the southeastern half of the area where the folds are smaller and less abundant than in the northwestern half.

In the northeast corners of the maps, an abrupt change in direction and magnitude of dip is caused by strong folding of the LaSalle Anticlinal Belt.

A fairly large area in western Illinois, including most of Schuyler, Brown, Adams, and Hancock Counties, contains randomly oriented structures with little closure and small areal extent.

Both the Galena (fig. 7) and Hunton (fig. 8) structure maps show the same general features mentioned above. The less abundant well control available for the Galena map has resulted in contours smoother than those on the Hunton map.

OIL AND GAS PRODUCTION

More than 18 million barrels of oil had been produced from 31 pools in this area by January 1964 (Whiting, et al., 1964). Nearly 16 million barrels was produced from just 4 pools: Colmar-Plymouth, Edinburg West, Kincaid Consolidated, and Mt. Auburn Consolidated. The production in these and smaller pools comes from three main types of reservoirs—(1) Silurian reefs and related features, (2) permeable zones in Silurian carbonates not related to reefs, and (3) sandstone and sandy dolomite lenses in Devonian carbonates.

Silurian Reefs

Silurian reefs have not produced much oil, but they are important in that they supply a reservoir in the form of permeable reef rock and reef flank beds, and they form a core that is resistant to compaction and erosion over which porous Devonian beds may be draped. In this area they are generally small and difficult to locate in the subsurface except in areas of very dense drilling.

Several wells produce oil from reef rock in Sangamon, Christian, and Macon Counties at Springfield East, Mt. Auburn Consolidated, and Blackland North pools. Most of the production at Wapella East in DeWitt County is from reef rock, but minor amounts come from overlying Devonian dolomite (Howard, 1963). The largest amount of oil produced from a single reef in Illinois has come from Marine pool in Madison County just to the south of this area (Lowenstam and DuBois, 1946; Lowenstam, 1948).

Known reefs in western and central Illinois lie in a broad arcuate belt extending from southwestern Illinois, around the area once occupied by the Sangamon Arch, and then northwestward into northwestern Illinois and eastern Iowa (Lowenstam, 1949, fig. 7). The position of this reef-bearing belt may indicate that uplift of the arch was active during Niagaran time, producing an environment favorable for reef growth around its margin. Howard (1964) made a detailed study of reef distribution in one area within this broad belt but determined no specific trends of reef development.

Permeable Silurian Non-Reef Carbonates

Oil accumulation in permeable Silurian non-reef dolomitic limestone and dolomite has been found in several places, most commonly where the Devonian carbonates are absent and dark shales of the New Albany Group directly overlie the Silurian. Before the New Albany shales were deposited, the Silurian had been subjected to considerable erosion that altered the upper beds from their original state to the present permeable dolomitic sequence. All of the oil and gas production west of the Illinois River, except at the Colmar-Plymouth pool, comes from permeable Silurian dolomites that either directly underlie New Albany shales or are separated from them by a very thin Devonian dolomite interval (Meents, 1958; Howard, 1961).

Most of the Silurian oil production in the Decatur–Mt. Auburn–Springfield area is from similar permeable zones developed in younger Silurian beds (Whiting, 1956).

Devonian Sandstone and Sandy Limestone

Deposits of medium to coarse, well rounded quartz sand have been found in the Cedar Valley and Lingle Limestones as sandstone lenses or sandy limestone zones. This sandstone is concentrated around the margins of the Sangamon Arch, which is outlined by the Cedar Valley–Lingle zero isopach (fig. 6). The quartz grains were probably eroded from Ordovician or older sandstone beds in the areas of the Ozark and Wisconsin Arches and deposited around the Sangamon Arch by currents in the Devonian seas.

Colmar-Plymouth pool in Hancock and McDonough Counties produces oil from two lenses of Hoing sand overlying a small dome. To date, it is the only pool of this type found on the north side of the Sangamon Arch, but it is possible that similar sand deposits occur on domes in some of the untested areas in that part of Illinois.

Kincaid Consolidated pool in Christian County produces oil from a sandstone and sandy limestone pay called the Hibbard (Whiting, 1956, p. 14), which is similar to the Hoing both in the physical character of the sand grains and in its position over an anticline.

Other oil-bearing porous sandy zones in Devonian limestones that overlie anticlines are found at Assumption and Assumption South pools in Christian County.

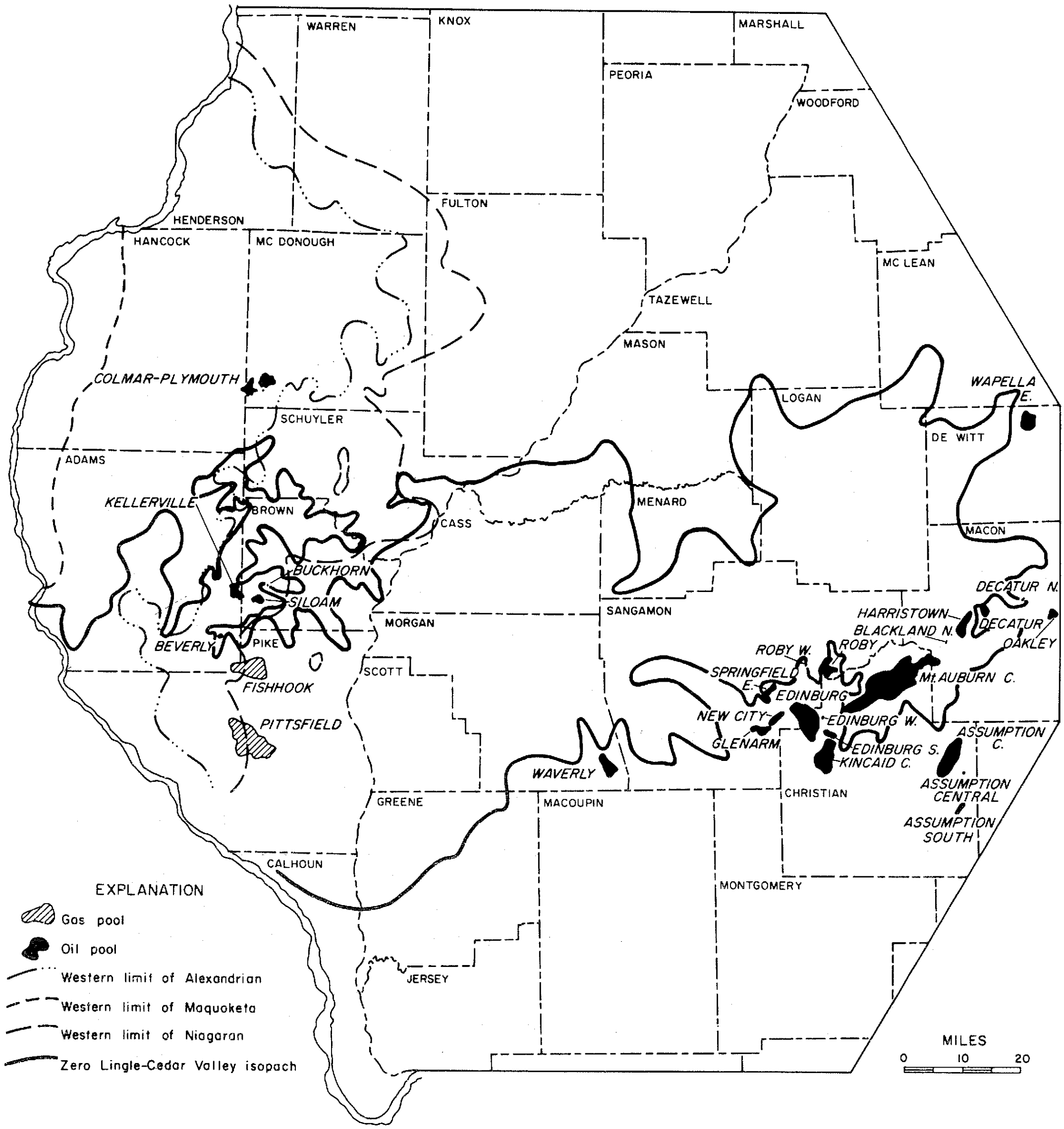


Figure 9 - Location of Devonian and Silurian oil and gas pools.

FUTURE OIL PRODUCING POSSIBILITIES

The Sangamon Arch appears to have had much influence on the stratigraphic and geographic position of all the various types of Silurian and Devonian petroleum reservoirs in this area, with the possible exception of the reefs. Because of this influence, the Sangamon Arch should be considered in future oil exploration.

Current production from the Devonian and Silurian comes from rocks closely underlying the New Albany shales near and roughly parallel to the zero isopach of the Cedar Valley Limestone (fig. 9). The area with greatest potential for future oil discoveries probably lies around the borders of the Sangamon Arch, as it is defined by the zero isopach of the Cedar Valley. Possible pays exist in the wedging-out Cedar Valley and Lingle strata and in permeable zones in the upper part of the Silurian. Other oil-bearing Devonian sandstones and Silurian reefs also are likely to occur throughout the border area.

REFERENCES

Bell, A. H., Oros, M. O., Van Den Berg, J., Sherman, C. W., and Mast, R. F., 1962, Petroleum industry in Illinois, 1961: Illinois Geol. Survey Ill. Pet. 76, 137 p.

Howard, R. H., 1961, Oil and gas in the Adams-Brown-Schuyler County area, Illinois: Illinois Geol. Survey Circ. 325, 23 p.

Howard, R. H., 1963, Wapella East oil pool, DeWitt County, Illinois—A Silurian reef: Illinois Geol. Survey Circ. 349, 15 p.

Howard, R. H., 1964, Niagaran reefs and oil accumulation in the DeWitt-McLean County area, Illinois: Illinois Geol. Survey Circ. 377, 15 p.

Lowenstam, H. A., 1948, Marine pool, Madison County, Illinois—Silurian-reef producer: Illinois Geol. Survey Rept. Inv. 131, 188 p.

Lowenstam, H. A., 1949, Niagaran reefs in Illinois and their oil accumulation: Illinois Geol. Survey Rept. Inv. 145, 36 p.

Lowenstam, H. A., and DuBois, E. P., 1946, Marine pool, Madison County—A new type of oil reservoir in Illinois: Illinois Geol. Survey Rept. Inv. 114, 30 p.

Meents, W. F., 1958, Fishhook gas pool, Pike and Adams Counties, Illinois: Illinois Geol. Survey Circ. 250, 16 p.

Meents, W. F., and Swann, D. H., (in preparation), Grand Tower Limestone and Dutch Creek Sandstone of southern Illinois: Illinois Geol. Survey Circ.

Schwalb, H. R., 1955, The Geneva (Middle Devonian) Dolomite in Illinois: Illinois Geol. Survey Circ. 204, 7 p.

Swann, D. L., and Willman, H. B., 1961, Megagroups in Illinois: Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471-483.

Whiting, L. L., 1956, Geology and history of oil production in the Decatur-Mt. Auburn-Springfield area, Illinois: Illinois Geol. Survey Circ. 211, 17 p.

Whiting, L. L., and Oros, M. O., 1957, Electric log cross sections of the Silurian-Devonian formations of a part of central Illinois: Illinois Acad. Sci. Trans., v. 50, p. 172-179.

Whiting, L. L., Van Den Berg, Jacob, Lawry, T. F., Mast, R. F., and Sherman, C. W., 1964, Petroleum Industry in Illinois, 1963: Illinois Geol. Survey Ill. Pet. 79, 99 p.

Workman, L. E., 1940, Subsurface geology of the Devonian System in Illinois, in Dedication–Mineral Conference: Illinois Geol. Survey Bull. 68, p. 189-199.

Workman, L. E., and Gillette, Tracey, 1956, Subsurface stratigraphy of the Kinderhook Series in Illinois: Illinois Geol. Survey Rept. Inv. 189, 46 p.

Illinois State Geological Survey Circular 383
20 p., 9 figs., 1 table, 1965

Printed by Authority of State of Illinois, Ch. 127, IRS, Par. 58.25.