STATE OF ILLINOIS
HENRY HORNER, *Governor*
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*

REPORT OF INVESTIGATIONS—NO. 40

# THE GEOLOGY AND OIL AND GAS POSSIBILITIES OF PARTS OF MARION AND CLAY COUNTIES

## With a Discussion of the Central Portion of the Illinois Basin

BY

J. MARVIN WELLER AND ALFRED H. BELL

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS

1936

# Contents


PAGE

Chapter I—Summary of conclusions .... 5
Chapter II—Introduction .... 7
Chapter III—Structure and oil possibilities, by Alfred H. Bell .... 9
  Subsurface structure .... 9
    Contour map on pre-Pennsylvanian unconformity .... 9
    Cross-section .... 15
    Causes of local highs and lows in pre-Pennsylvanian unconformity .... 15
  Surface structure .... 17
    Introduction .... 17
    Louisville anticline .... 17
    Omega anticline .... 19
    Xenia and Iola domes .... 20
  Oil and gas prospects .... 20
    Development .... 21
    Possible oil producing horizons .... 21
    Recommendations .... 23
Chapter IV—Description of outcropping beds, by J. Marvin Weller .... 25
  Key beds .... 25
  Stratigraphic intervals .... 25
  Beds below Omega limestone .... 27
  Omega limestone .... 29
  Beds overlying Omega limestone .... 32
  Fresh-water limestones .... 34
  Beds overlying fresh-water limestones .... 37
  Black slaty shale .... 39
  Beds overlying black slaty shale .... 40
  Massive friable sandstone .... 40
  General observations .... 41
Appendix I—Well Logs .... 43

# Illustrations

FIGURE PAGE

1. Index map showing location of areas mapped in figures 2 and 4 . . . . . . 6
2. Central portion of the Illinois Basin . . . . . . 14
3. East-west cross-section A-A′ across Illinois Basin. For location of wells, see figure 2. 16
4. Structure contour map of parts of Clay and Marion counties, Illinois; key horizon, top of the Omega limestone, datum sea-level . . . . . . facing 20
5. Correlation of outcropping beds with the general stratigraphic section of the McLeansboro strata in Illinois . . . . . . 26
6. Ferruginous limestone in the bed of the west fork of Bee Branch . . . . . . 28
7. Solution-pitted upper surface of the Omega limestone . . . . . . 30
8. Calcareous sandstone that lies between the platy fresh-water limestone and the Omega limestone . . . . . . 33
9. Platy fresh-water limestone . . . . . . 35
10. Black slaty shale and underlying beds . . . . . . 37

# THE GEOLOGY AND OIL AND GAS POSSIBILITIES OF PARTS OF MARION AND CLAY COUNTIES

## With a Discussion of the Central Portion of the Illinois Basin

J. MARVIN WELLER AND ALFRED H. BELL

## CHAPTER I

## SUMMARY OF CONCLUSIONS

Stratigraphic and structural studies of outcropping Pennsylvanian strata have revealed the presence of closed structures in eastern Marion and western Clay counties, Illinois. It seems probable that at least two of four closed structures described herein extend into the deeper strata and that they may have caused accumulation of oil and gas in some of these strata.

Available data indicate that the following territory is located on the higher parts of these structures:

(1) Louisville anticline: Secs. 23 and 24, N. ½ sec. 25, T. 4 N., R. 5 E.; S. ½ sec. 19, N. ½ sec. 30, T. 4 N., R. 6 E., Clay County.

(2) Omega anticline: SW. part of sec. 5, secs. 6 and 7, W. ½ sec. 8, W. ½ sec. 18, T. 3 N., R. 4 E.; E. part sec. 1, secs. 12, 13, and 24, E. ½ sec. 23, T. 3 N., R. 3 E., Marion County.

(3) Xenia dome: sec. 23, E. ½ sec. 22, W. ½ sec. 24, T. 3 N., R. 5 E., Clay County.

(4) Iola dome: S. part sec. 6, NW. part sec. 7, T. 4 N., R. 5 E., Clay County; E. part sec. 12, T. 4 N., R. 4 E., Marion County.

Sandstones in the Lower Chester strata are productive in the Sandoval and Carlyle fields 10 miles west of the area mapped in figure 4, and in the Lawrence County field 50 miles east of this area. These and deeper strata have not been tested in the area described. A favorable indication is the showing of oil found in the Benedum-Trees Oil Company Harrell well, sec. 27, T. 4 N., R. 5 E., Clay County (datum point No. 30) in a sandstone in the middle part of the Chester series (Fig. 4). This test was located high on the Louisville anticline.

Because of lack of outcrops the structure in parts of the area mapped is not known in detail, and for this reason it is recommended that the known information be supplemented by shallow test drilling or by geophysical surveys, or both, prior to the location of deep tests for oil and gas.

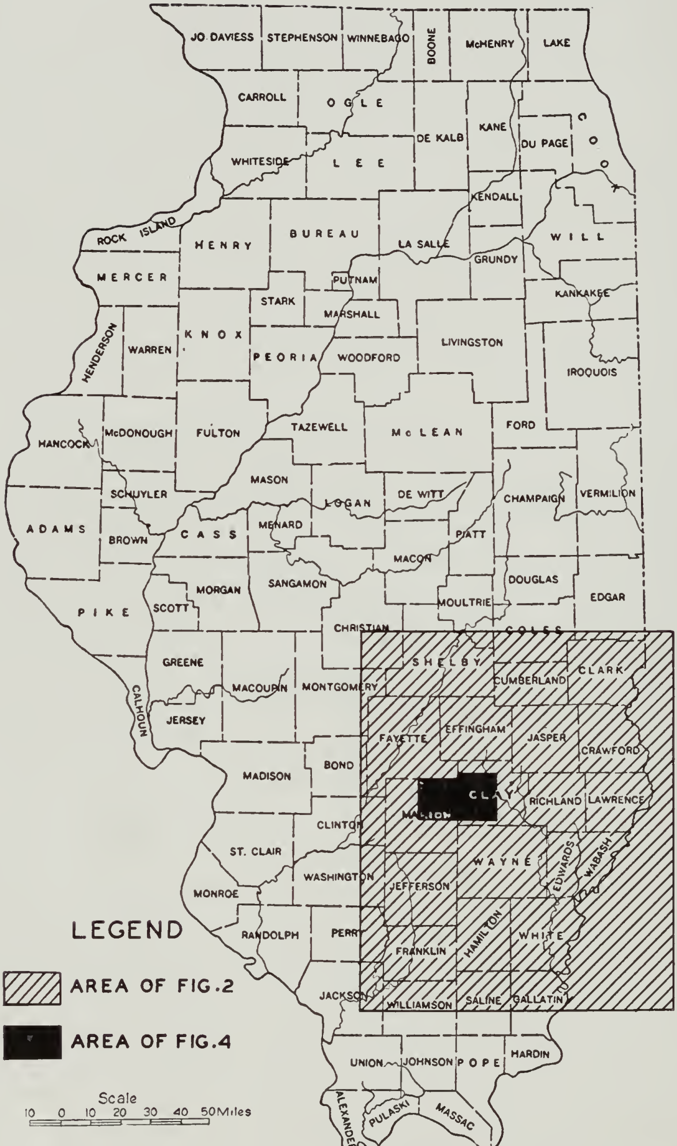


Fig. 1.—Index map showing location of areas mapped in figures 2 and 4.

# CHAPTER II

# INTRODUCTION

## GENERAL STATEMENT

For several years the Illinois State Geological Survey has been carrying on a state wide investigation of Pennsylvanian stratigraphy. This study has revealed the presence of structures that appear favorable for the accumulation of oil and gas. Although the investigation is not yet completed, it seems desirable to publish the available data regarding the most promising of the favorable structures found so far, especially in view of the recent revival in interest in the search for new oil and gas fields.

The discovery of oil in 1927 in the Mt. Pleasant district in Michigan, located centrally in a structural basin that is comparable in extent to the structural basin of Illinois, and the subsequent development there of the most important oil field in Michigan, has led to a new interest in the oil prospects of the Illinois Basin. The structural features herein described in eastern Marion County and western Clay County are located not far from the deepest part of the Illinois Basin (Figs. 1 and 2).

The central part of the Illinois Basin and the LaSalle anticline which delimits it to the east are structural features which have long been known as a result of deep drilling. However, recent stratigraphical studies of the Pennsylvanian system in Illinois, by J. Marvin Weller, have revealed that the structure of the surface beds does not correspond to the structure of the pre-Pennsylvanian formations. Throughout about a dozen counties lying south of Clark County and east of the Third Principal Meridian an extremely limited stratigraphic section of upper Pennsylvanian beds outcrops. The surface beds of this region are, therefore, if viewed broadly, practically horizontal although in this same area the underlying Mississippian rocks possess a structural relief of over 2500 feet.

As shown by elevations on the base of the Pennsylvanian system, somewhat less than half of this structure was produced by post-Mississippian pre-Pennsylvanian folding and the remainder probably resulted from numerous comparatively small warpings distributed at intervals throughout early Pennsylvanian time. Although subsidence of the Illinois Basin as a whole probably continued to some extent throughout later Pennsylvanian time no important accentuation of the LaSalle anticline south of the Martinsville dome in Clark County was accomplished nor has post-Pennsylvanian movement, which raised the Ozark region to the westward and the Cincinnati arch to the eastward, affected the southern portion of the LaSalle anticline.

Although the surface beds in the central part of the Illinois Basin are practically horizontal in a regional sense, gentle dips, variously directed, are the rule. Because of irregular depositional conditions during Pennsylvanian time, many of the beds, particularly the clastic ones, thicken and thin irregularly and more or less rapidly, and contours drawn upon any two horizons will not correspond. Therefore, it should not be assumed that the common gentle dips of any one bed are the result of diastrophic structure or that they might be expected to persist beneath the surface; they are more likely to have been produced by original inequalities of deposition or by subsequent differential compaction.

There are, however, areas within the basin where steeper, more or less local dips, or gentle dips of more than usual constancy suggest that actual structural conditions may be reflected. If so, it is possible that the magnitude of these surface structures will increase considerably with depth. The region considered in this report is one of the most noteworthy of these areas.

The mapping of structures in the central part of the Illinois Basin is dependent upon the identification and correlation of Pennsylvanian rocks. Because there is no publication adequately describing the Pennsylvanian stratigraphy of the central part of the Illinois Basin and because the strata outcropping in Marion and Clay counties are also exposed at many places in adjoining counties, the stratigraphy of this area is considered in some detail in the following pages. The more important beds are informally referred to by tentative names, mainly lithologic, and present conclusions regarding their correlation are stated (Fig. 5). Field work has not yet been completed in this part of the State, however, and it must be emphasized that future field studies may necessitate changes in these correlations.

## LEASING BY OIL COMPANIES

During the time of preparation of this report geological field work in portions of the Illinois Basin has been carried on independently by certain oil companies, and on the basis of such information independently gained, some of the territory discussed herein is now under lease.

## ACKNOWLEDGEMENTS

Mr. W. A. Newton of the State Geological Survey assisted in the stratigraphic studies, and Messrs. P. S. McClure and W. C. Imbt of the Survey staff, carried on the instrumental leveling and mapping, by plane-table and alidade, of outcrops and wells in the area shown in figure 4.

# CHAPTER III

# STRUCTURE AND OIL POSSIBILITIES

Alfred H. Bell

## SUBSURFACE STRUCTURE

Prospecting for petroleum in the Illinois Basin area is hampered by lack of knowledge of the subsurface stratigraphy and structure. The coal strata which are used elsewhere in the State as structural key horizons, especially Herrin (No. 6) coal which is used in most of southwestern Illinois, cannot be definitely traced at present into the deeper parts of the basin. Even less is known of the lower Pennsylvanian and of the pre-Pennsylvanian rocks. There is at present no known structural key horizon within the Pennsylvanian system which can be used throughout the basin area. However, the position of the pre-Pennsylvanian unconformity can be recognized in some well logs, especially where sets of sample cuttings are available, and by correlation this horizon can be recognized with some degree of assurance in most driller's logs of wells from which no samples are available.

**Contour map on pre-Pennsylvanian unconformity.**—By plotting the elevation of the base of the Pennsylvanian strata wherever the data were available, it has been possible to construct a very generalized contour map of the base of the Pennsylvanian (Fig. 2). Although not strictly a structure map because it depicts a surface of unconformity, this map does present a generalized picture of the form of the basin. It is subject to correction in detail when additional subsurface data become available.

All of the wells shown in figure 2 provide data on the base of the Pennsylvanian system. All but three of them actually reach that horizon; in the remaining three the depth to it is estimated by correlation with other logs. (Table 1.) Wells which were too shallow or too poorly logged to provide data on the base of the Pennsylvanian system are not included on the map, which is therefore not a complete dry-hole map.

Those interested in obtaining all available data on drilling in specific areas may do so by communicating with the Chief, Illinois State Geological Survey, Urbana, Illinois.

TABLE 1.—WELL DATA TO ACCOMPANY CONTOUR MAP ON BASE

| Map No. | Location | | | | | Company |
|---|---|---|---|---|---|---|
| | County | Location in section | Sec. | T. | R. | |
| 1 | Clay | SW.SE.NE | 9 | 5N. | 6E. | Clay Oil Corporation |
| 2 | | NE. corner | 27 | 4N. | 5E. | Benedum Trees and Grayson |
| 3 | | SE. NW. | 15 | 3N. | 5E. | Benedum Trees |
| 4 | | NE. SW. SE | 8 | 2N. | 7E. | Amber Oil Company |
| (b) 5 | Clinton | NE. corner | 36 | 2N. | 1W. | Ohio Oil Company |
| 6 | Crawford | NE. SW | 23 | 8N. | 14W. | O. C. Sutherland |
| 7 | | NE.SE.NE | 12 | 7N. | 14W. | Associated Producers |
| 8 | | SE.NW | 25 | 7N. | 13W. | Ellison et al |
| (b) 9 | | S. cen. SE. NW | 22 | 7N. | 12W. | D. C. Jones |
| 10 | | SE.SW.NE | 24 | 7N. | 11W. | Stevens, Karnes |
| 11 | | Near center | 12 | 6N. | 13W. | Zahnizer |
| 12 | | S. cen. NE. SW | 26 | 6N. | 13W. | Fred Patchel |
| 13 | | SE.SW.SE | 13 | 5N. | 13W. | Silurian Oil |
| 14 | | NW.SE.SE | 23 | 5N. | 12W. | Jessup et al |
| 15 | | N. cen. NW. NW | 3 | 5N. | 11W. | W. C. McBride |
| 16 | Cumberland | SW.NE | 13 | 10N. | 10E. | Ohio Oil Company |
| 17 | | SE.SW.NE | 16 | 10N. | 8E. | Central Illinois Petroleum Company |
| 18 | | NE.NE.NE | 11 | 9N. | 10E. | Pure Oil Company |
| 19 | | SW.NE.SW | 14 | 9N. | 10E. | Petroleum Exploration |
| 20 | Edwards | NW.SE.SW | 31 | 1N. | 11E. | Ohio Oil Company |
| 21 | | SW.NW.NW | 3 | 2S. | 10E. | Leach Brothers |
| 22 | Effingham | SW.SW.NW | 16 | 8N. | 7E. | W. C. Kremer |
| 23 | | NW.SW.SW | 20 | 7N. | 4E. | Stockholders Oil and Gas |
| 24 | Fayette | NE.NW | 22 | 9N. | 1W. | ? |
| 25 | | ? | ? | 7N. | 3E. | ? |
| 26 | | ? | 13 | 6N. | 2E. | Ohio Oil Company |
| 27 | | ? | 36 | 6N. | 1W. | Vandalia Oil and Gas Company |
| 28 | | SW.SW.SW | 28 | 5N. | 1E. | Big 4 Oil and Gas Company |
| 29 | Gallatin | NE.NE.SE | 27 | 7S. | 8E. | Omaha Oil and Gas Company |
| 30 | | SW.SW | 32 | 7S. | 8E. | ? |
| 31 | | NW.NW.SE | 31 | 9S. | 9E. | C. T. Pierce |
| 32 | Hamilton | NE.NE.NE | 4 | 6S. | 6E. | C. A. Morrison |
| 33 | Jasper | ? | 4 | 8N. | 14W. | Pure Oil Company |
| 34 | | NE.NW.SW | 15 | 8N. | 14W. | ? |
| 35 | | NE.SE.NE | 6 | 6N. | 10E. | Federal Royalty Company and Bayou-Teche Oil Company |
| 36 | | NE.SE.NW | 7 | 6N. | 9E. | Richard Eke |
| 37 | | SW.SW.NW | 23 | 6N. | 9E. | Newton Oil Company |
| 38 | Jefferson | NE.SW.NW | 8 | 1S. | 3E. | Pure Oil Company |
| 39 | | NE.SW.SE | 17 | 1S. | 2E. | Busch-Everett |
| 40 | | SW.SW.NW | 4 | 1S. | 1E. | Ohio Oil Company |
| 41 | | NW.SW | 6 | 1S. | 1E. | Roleum |
| 42 | | SW.SE.NW | 32 | 2S. | 2E. | Shiloh Oil Company |
| 43 | | SE.NW.NW | 17 | 3S. | 4E. | Opdyke Oil Company |
| 44 | | NW.NW.SE | 24 | 4S. | 2E. | Phillips Petroleum Corp. |
| 45 | | NE.NW.NE | 16 | 4S. | 3E. | E. R. List |

*See p. 15 for footnotes.*

OF PENNSYLVANIAN SYSTEM, DATUM SEA-LEVEL (FIG. 2)

| Farm | Total depth (feet) | Curb elevation (feet) | Source (a) | Base of Pennsylvanian | |
|---|---|---|---|---|---|
| | | | | Depth (feet) | Elevation (feet) |
| Williams | 2387 | 441 | E | 1981 | —1540 |
| J. H. Harrell | 2302 | 534 | A | 1900 | —1366 |
| C. Anderson | 2076 | 541 | A | 1930 | —1389 |
| Curry | 2401 | 431 | A | 2130 | —1699 |
| L. Thierer | 1685 | 485 | A | 975 | —490 |
| Matheny | 1256 | 530± | F | 1000 | —470± |
| Comly No. 7 | 1518 | 500 | A | 1013 | —513 |
| M. K. Coulter | 1332 | 534 | F | 1332+ | —798— |
| C. E. Davis | 1330 | 551 | A | 1225 | —674 |
| Walker | 1451? | 435± | B | 1088 | —653± |
| Jones | 4620 | 525 | F | 1377± | —852± |
| Shipman No. 5 | 1388 | 496 | A | 1122± | —626± |
| Petty No. 1 | 1497 | 432 | G | 1330 | —898 |
| Conover | 1795 | 550± | C | 1340 | —790± |
| Oldham | 1731 | 530 | G | 1315 | —785 |
| E. Chrysler | 1913? | 624 | A | 640 | —16 |
| Dobbs | 2315 | 630± | D | 1555 | —925± |
| A. M. Philips | 1050 | 623 | A | 950 | —327 |
| O. D. McFarlin | 1532 | 620± | D | 1262 | —642± |
| Fullerton | 2754 | 507 | A | 2350 | —1843 |
| Jos. Ellen | (c) 4785 | 510± | D | 2504 | —1994± |
| D. Ordner | 1830 | 610± | D | (d) 1940 | —1330± |
| H. Radloff | 2052 | 620± | D | 1550 | —930± |
| A. Aylward | 2825 | 651 | A | 1170 | —519 |
| St. Elmo | 1300 | 618± | C | (d) 1450 | —832± |
| G. A. Parks | 1610 | 560± | D | 1365 | —805± |
| Thos. Inman | 2961 | 530± | D | 1280 | —750± |
| G. W. Albert | 1841 | 510 | B | 1172 | —662 |
| M. M. Davis | 1790 | 370 | C | 1620 | —1250 |
| W. D. Forester | 1807 | 350 | C | 1510 | —1160 |
| Drone | 3612 | 355 | C | 855 | —500 |
| F. Pitman | 2564 | 445 | A | 1915 | —1470 |
| A. Leamon | 1417 | 580± | D | 1010 | —430± |
| 1st State Bank | 1382 | 540± | D | 1040 | —500± |
| C. F. Ross | 2202 | 500± | C | 2065 | —1565± |
| R. Klier | (e) 2540 | 540± | D | 2291 | —1751± |
| Geo H. Da[illegible] | 2583 | 550± | D | 2138 | —1588± |
| Wm. Meyers | 1930 | 530 | D | 1733 | —1203 |
| Talbot | 2020 | 521 | A | 1725 | —1204 |
| G. P. Baldridge | 1831 | 575 | A | 1665 | —1090 |
| M. Hardy | 1668 | 532 | A | 1300 | —768 |
| C. Mannen | 1940 | 458 | C | 1685 | —1227 |
| R. I. Estes | 2370 | 523 | A | 2020 | —1497 |
| Moss | 2928 | 417 | A | 1694 | —1277 |
| Knowles | 2028 | 448 | A | 1834 | —1386 |

*See p. 15 for footnotes.*

Table 1 *Concluded.*—Well Data to Accompany

| Map No. | Location | | | | | Company |
|---|---|---|---|---|---|---|
| | County | Location in section | Sec. | T. | R. | |
| 46 | Lawrence....... | SW.SW.NW.... | 19 | 4N. | 10W. | Shell Petroleum........... |
| 47 | | Cen. NE.NE.... | 35 | 5N. | 13W. | Ohio Oil Company........ |
| 48 | | SW.SW........ | 17 | 4N. | 12W. | Ohio Oil Company........ |
| 49 | | NW.SE.NW.... | 29 | 4N. | 12W. | W. C. McBride........... |
| (*b*) 50 | | NE. corner SW.. | 7 | 3N. | 12W. | Ohio Oil Company........ |
| 51 | | SW.SE..... | 20 | 3N. | 12W. | Big Four Oil and Gas Company................. |
| 52 | | SE.SW.SE...... | 25 | 3N. | 12W. | Associated Producers...... |
| 53 | | NE.SE.NW..... | 23 | 2N. | 12W. | Risely et al.............. |
| 54 | Marion......... | NE.NW.SW.... | 6 | 4N. | 3E. | Southwestern Oil and Gas.. |
| 55 | | NW.SE..... | 20 | 4N. | 2E. | Riggs................... |
| 56 | | NE.SE..... | 9 | 4N. | 1E. | Ohio Oil Company........ |
| 57 | | SE.SW..... | 20 | 4N. | 1E. | Riggs................... |
| 58 | | SW. corner...... | 16 | 3N. | 1E. | Ohio Oil Company........ |
| 59 | | NW.SW.... | 17 | 3N. | 1E. | F. J. Casey.............. |
| 60 | | SW.NE..... | 27 | 3N. | 1E. | Ohio Oil Company........ |
| 61 | | SW.SE..... | 35 | 3N. | 1E. | E. R. Steiner and A. H. Gibson................... |
| 62 | | SW corner. | 25 | 3N. | 4E. | Ohio Oil Company........ |
| 63 | | SW.SE..... | 4 | 2N. | 4E. | Kelley and Finn.......... |
| 64 | | NW.SE.NW.... | 24 | 2N. | 3E. | Kelley and Finn.......... |
| 65 | | SW.NE..... | 33 | 2N. | 2E. | Lorenzen............. |
| (*b*) 66 | | SW.SW..... | 28 | 2N. | 1E. | Ohio Oil Company........ |
| 67 | | NE.NW..... | 8 | 2N. | 1E. | Treat-Crawford.......... |
| 68 | | NE.SW.NW.... | 30 | 1N. | 1E. | Petro. Oil and Gas Company |
| 69 | | NE.NW.... | 16 | 1N. | 1E. | Centralia Oil Company..... |
| 70 | | SE.NE..... | 16 | 1N. | 3E. | Benoist and Finn.......... |
| 71 | Perry........... | SW.NW.... | 5 | 6S. | 1W. | J. H. Forester............ |
| 72 | Richland........ | SW.SE.SW. | 28 | 4N. | 14W. | P. E. Hill............... |
| 73 | Saline.......... | NW.NE.SW.... | 28 | 8S. | 7E. | Epi Denno Medicine Company................. |
| 74 | | NE.SW.NE..... | 22 | 9S. | 7E. | Cottage Oil Company...... |
| 75 | | NE.SW.NE..... | 11 | 10S. | 6E. | Saline County Oil Company |
| 76 | Shelby.......... | SW.SW.SW..... | 19 | 12N. | 5E. | Big 4 Oil and Gas Company |
| 77 | | SE.SW..... | 8 | 11N. | 4E. | W. E. Eddy.............. |
| 78 | | NE.NW.NW... | 3 | 11N. | 6E. | A. M. Myers............. |
| 79 | | SE.SW.NE..... | 25 | 10N. | 4E. | A. L. Ginther............. |
| 80 | | NE.SW.SW..... | 34 | 10N. | 4E. | ? |
| 81 | Wabash......... | NE.SE.NW..... | 14 | 1N. | 12W. | Karnes and Miller......... |
| 82 | | SW.SE.SW..... | 1 | 1S. | 13W. | Forman and Miller........ |
| 83 | White........... | NE.NE.NW.... | 18 | 7S. | 10E. | Byrd Company........... |
| 84 | Williamson...... | NE.NE.NW.... | 12 | 8S. | 3E. | Madison Coal Corporation.. |
| (*b*) 85 | Gibson, Indiana.. | ? | 10 | 3S. | 12W. | ? |
| (*b*) 86 | Knox, Indiana... | NW.... | 35 | 1N. | 12W. | Eastern Gulf Oil Company.. |
| (*b*) 87 | Posey, Indiana... | NW.NW.SW.... | 28 | 4S. | 13W. | Smith et al.............. |
| (*b*) 88 | | ? | 7 | 7S. | 13W. | Wolf and Harlem.......... |
| (*b*) 89 | | ? | 2 | 8S. | 14W. | W. E. Hastings well....... |
| (*b*) 90 | | ? | 33 | 6S. | 12W. | Hagemann drillings........ |
| (*b*) 91 | Union, Kentucky. | 1 mile S. of Spring Grove........ | | | | ? |

*See p. 15 for footnotes.*

Contour Map on Base of Pennsylvanian System

| Farm | Total depth (feet) | Curb elevation (feet) | Source (a) | Base of Pennsylvanian Depth (feet) | Base of Pennsylvanian Elevation (feet) |
|---|---|---|---|---|---|
| A. and M. Lohr | 1717 | 431 | F | 1287 | —856 |
| N. J. Updike No. 21 | 1645 | 435 | F | 1305 | —870 |
| Westall No. 11 | 1440 | 435 | F | 1155 | —720 |
| Bowers and Ross No. 7 | 1631 | 449 | A | 1110 | —661 |
| W. B. Gray No. 2 | 2000 | 486 | F | 1485 | —999 |
| A. Gray | 2059 | 465 | F | 1561 | —1096 |
| J. F. Snyder | 1805 | 454 | F | 1305 | —851 |
| Brooks | 2083 | 471 | B | 1490 | —1019 |
| Morris | 1918 | 543 | A | 1370 | —827 |
| Oglesby | 1740 | 536 | A | 1270 | —734 |
| L. F. Green | 1633 | 514 | G | 1050 | —536 |
| Chandler | 1640 | 470 | D | 1000 | —530 |
| Carrigan | 1622 | 489 | (B or E) | 970 | —481 |
| Gerrish | 1600 | 480 | (B or E) | 1000 | —520 |
| Sebastian | 2280 | 531 | (B or E) | 1082 | —551 |
| Joe Cannon | 1680 | 520 | C | 1080 | —560 |
| H. Henninger | 2213 | 522 | A | 1910 | —1388 |
| Wooldridge | 1780 | 473 | A | 1685 | —1212 |
| Williams | 2236 | 511 | A | 1807 | —1296 |
| Lorenzen | 1750 | 552 | A | 1520 | —968 |
| Guthrie | 1625 | 487 | A | 1275 | —788 |
| A. E. Benoist No. 1 | 1566 | 518 | A | 960 | —442 |
| Frazier | 1500 | 508 | F | 1103 | —595 |
| Brown | 1667 | 504 | A | 1460 | —956 |
| Finn | 2056 | 581 | A | 1825 | —1244 |
| J. H. Forrester | (f) 3316 | 465 | C | 502 | —37 |
| P. and H. Kocher | 2481 | 562± | C | 2332 | —1770 |
| Sutton | 1818 | 378 | B | 1420 | —1042 |
| W. J. Clark | 3350 | 360± | C | 1265 | —905 |
| Herrick | 1655 | 365± | C | 1090 | —725 |
| Horn | 1930 | 570± | D | 1390 | —820 |
| W. E. Eddy | 1535 | 563 | A | 1400 | —837 |
| W. O. Storm | 1202 | 720± | D | (d) 1690 | —970 |
| W. Prosser | 1630 | 620 | A | 1580 | —960 |
| Wm. Hoagland | 1505 | 595 | A | 1500 | —905 |
| Price No. 3 | 2055 | 440 | A | 1480 | —1040 |
| O. Ginther No. 2 | 2621 | 486 | B | 1859 | —1373 |
| Byrd | 2232 | 347 | A | 1759 | —1412 |
| ? | 2136 | 434 | G | 1657 | —1223 |
| B. F. Benson | 2372 | 500± | H | 1661 | —1161± |
| Wm. Steckler No. 1 | 2286 | 400± | C | 1535 | —1135± |
| C. Manchette | 2017 | 440± | C | 1675 | —1235± |
| ? | 1853 | 434 | H | 1730 | —1296 |
| ? | 1816 | 360 | H | 1750 | —1390 |
| ? | 1963 | 485 | H | 1580 | —1095 |
| Sol Blue No. 2 | 5955 | 350± | C | 1725 | —1375± |

*See p. 15 for footnotes.*

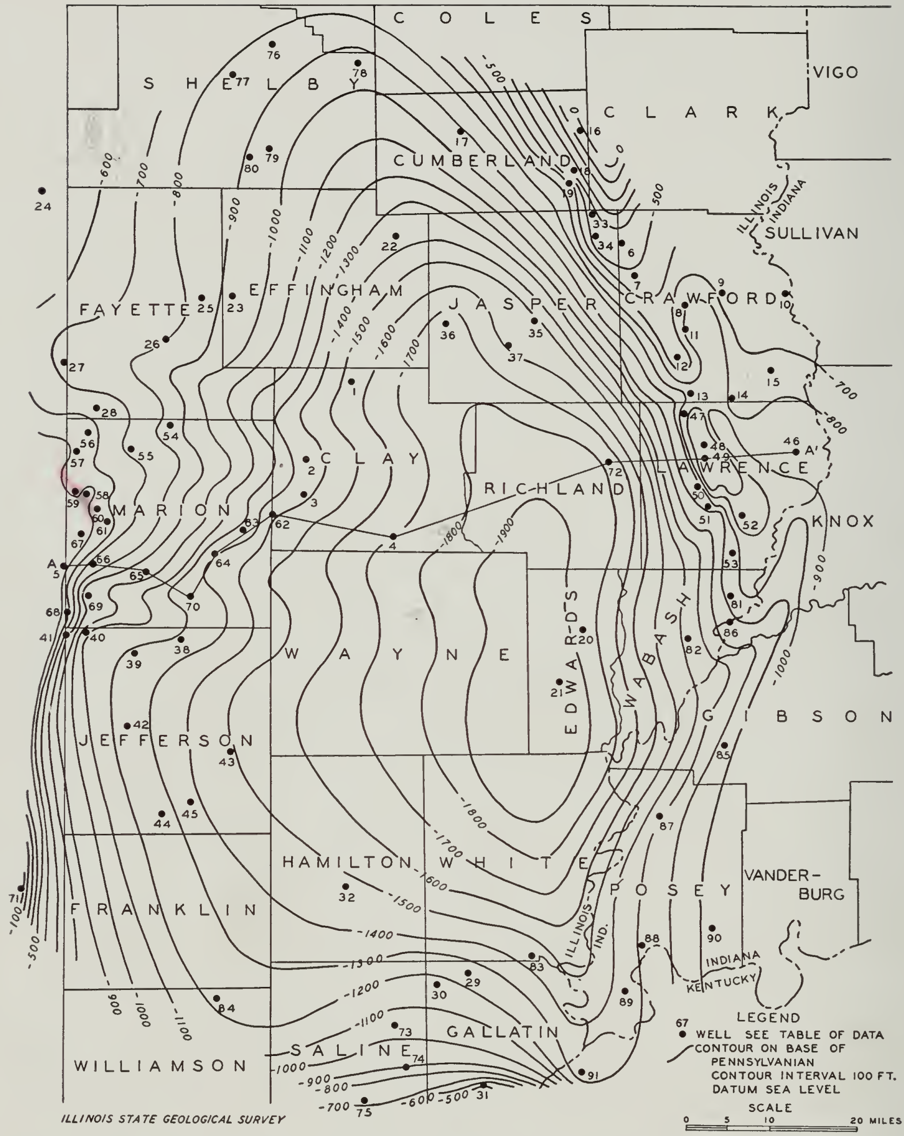


Fig. 2.—Central portion of Illinois Basin. Subsurface contour map on the base of the Pennsylvanian system, a surface of unconformity. Only those wells are shown in which the base of the Pennsylvanian can be recognized or estimated.

The Centralia-DuQuoin monocline is shown extending southward from southwest Marion County and the LaSalle anticline is conspicuous in the northeastern part of the map. Oil fields are located on both of these structures and are described in publications of the Illinois State Geological Survey.

The feature of most importance in connection with the present report is the anticlinal nose located in northern Marion County and Clay County, the axis of which apparently extends from a point about 6 miles north of the Sandoval oil field (around map No. 67, Fig. 2) eastward beyond Louisville, the county seat of Clay County. Although the details of this anticlinal nose are largely unknown, the available data seem to leave little doubt as to its existence in the approximate position shown.

**Cross-section.**—An east-west cross-section across the basin is shown in figure 3. This shows the relatively steep dips of the Centralia monocline on the west and the LaSalle anticline on the east, with the deeper part of the basin between. Because of lack of subsurface data, already noted for this area, the beds are shown with gentle even dips, but this is surely not the true condition. It is very likely that several folds exist in the path of this cross-section which could be shown if adequate subsurface data were available. The cross-section illustrates an interpretation of the general form of the basin and also some of the difficulties of correlation due to lack of data.

Present correlation of Chester formations shown in the cross-section suggest that post-Chester pre-Pennsylvanian warping may have been important. Data from future drilling should throw more light on this problem.

**Causes of local highs and lows in pre-Pennsylvanian unconformity.**—The irregularities of the unconformity at the base of the Pennsylvanian system, are the result of two factors, first deformation and erosion of the pre-Pennsylvanian strata previous to the deposition of the sediments that now lie above, and second, subsequent warping by diastrophic movement.

The major relief of the pre-Pennsylvanian unconformity, which is more than 2,000 feet between the center and edges of the basin, is undoubtedly due to diastrophism but local "highs" or "lows" having a relief of the order of

---

*Footnotes to Table 1, pp. 10-13:*

(*a*) Source of elevation:
- A—Determined by plane-table and alidade by State Geological Survey.
- B—Determined by telescopic handlevel by State Geological Survey.
- C—Estimated from U. S. Geological Survey topographic map.
- D—Estimated from Rolfe topographic map.
- E—Determined by aneroid.
- F—Well in or near oil field; elevation estimated from elevations of nearby wells determined by instrument.
- G—Instrumental elevation furnished by company.
- H—Elevation published by Indiana Geological Survey.

(*b*) Logs published:
- 5 Ill. State Geol. Survey Bull. 24, pp. 73-77.
- 9 Ill. State Geol. Survey Bull. 2, p. 62.
- 50 Ill. State Geol. Survey Bull. 24, pp. 123-129.
- 66 Ill. State Geol. Survey Bull. 24, pp. 77-81.
- 85 Subsurface strata of Indiana, p. 191.
- 86 Illinois Petroleum No. 12, pp. 13-15 (driller's log); depth of base Pennsylvanian according to unpublished sample study log by L. E. Workman and M. A. Blair.
- 87 Subsurface strata of Indiana, p. 653.
- 88 Subsurface strata of Indiana, p. 652.
- 89 Subsurface strata of Indiana, p. 652.
- 90 Subsurface strata of Indiana, p. 651.
- 91 Oil and Gas in Western Kentucky, pp. 441-450.

(*c*) Drilling January 17, 1936.

(*d*) Bottom of Pennsylvanian was not reached but its depth was estimated by correlation with other logs.

(*e*) Fishing for tools, January 21, 1936.

(*f*) Drilling January 15, 1936.

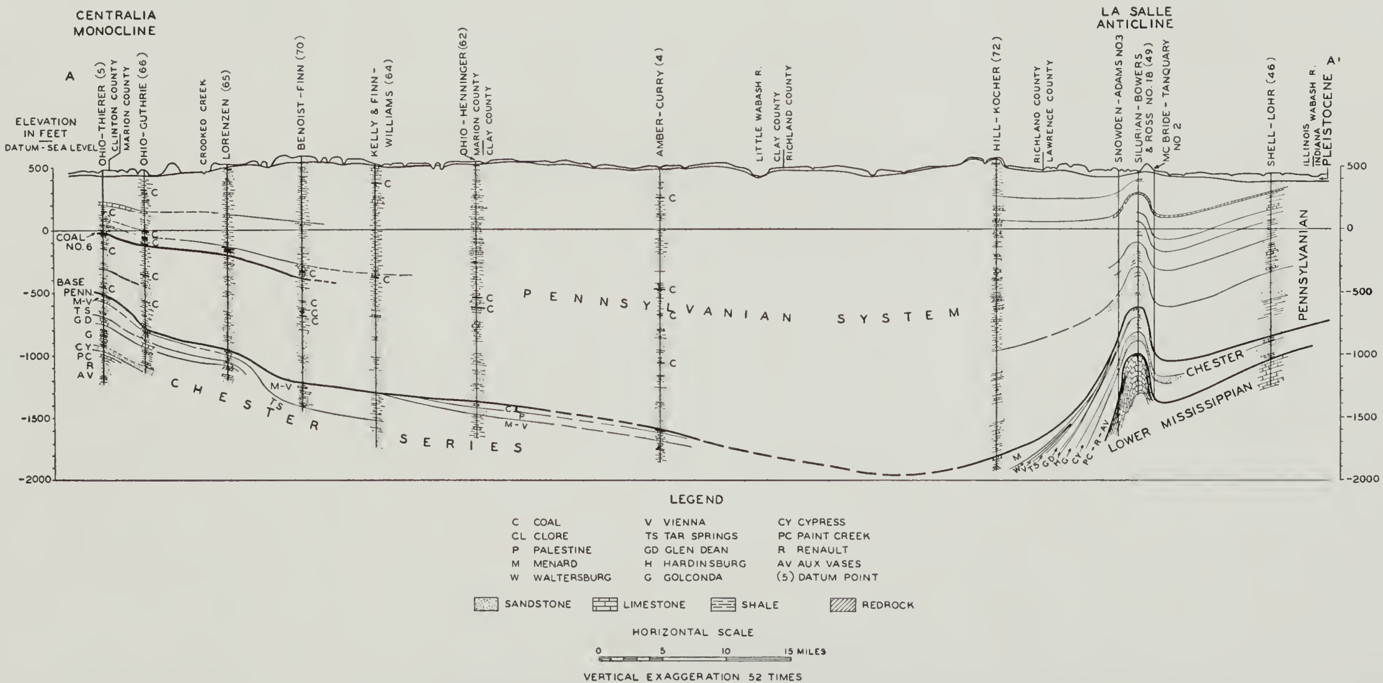


Fig. 3.—East-west cross-section A-A′ across the Illinois Basin. For location of wells, see figure 2.

100 or 200 feet may be due, at least in part, to pre-Pennsylvanian erosion. Available subsurface data are insufficient to determine the relative importance of these two factors in the formation of the local "highs" and "lows."

It is altogether likely that downwarping of the basin area took place during Pottsville time, perhaps continuing later in diminished degree. However, in areas where upwarping of the surface Pennsylvanian beds coincides in location with a "high" in the pre-Pennsylvanian surface, it seems reasonable to assume that this "high" is the result of structural disturbance later in age than the surface Pennsylvanian beds. Such a condition appears to exist in eastern Marion and western Clay counties—the area described in this report.

## SURFACE STRUCTURE

**Introduction.**—The structure of the upper Pennsylvanian beds in parts of western Clay and eastern Marion counties, and a generalized stratigraphic section of the outcropping beds is shown in figure 4. The stratigraphy and correlation of the outcropping beds is discussed below.

In using the structure contour map it should be noted that in large areas of the map there are no outcrops and the lack of knowledge of structure in these areas and the authors' interpretations are indicated by broken contour lines. Wherever the structural key horizon is not exposed, there is uncertainty as to the amount of the interval from the outcropping bed to the key bed, and in the same degree, uncertainty as to the elevation of the key bed. Where the distances between outcrops are great, as they are in that part of the area to the west of the line between ranges 3 and 4 E. (the vicinity of Kinmundy and westward), there is considerable doubt as to the correlation, and the interpretation of structure shown in this area is highly conjectural although based on careful consideration of the data now available.

Four areas of structural closure are shown (Figure 4). The north portion of another possible closure is shown in the west part of the area, but owing to lack of data, structural contours could not be drawn to the south. The four structural closures have been named the Louisville anticline, the Omega anticline, the Iola dome, and the Xenia dome.

**Louisville Anticline.**—The best defined structural feature in the area and perhaps the most favorable for oil and gas prospecting is the anticline which lies to the west of Louisville. This anticline has a closure of at least 30 feet, and covers an area of more than a township. It trends east-west in general but the western part also trends north-south. The northern flank of the anticline is well defined by outcrops along Crooked Creek and its tributaries whereas the south flank is defined only by a single test boring about six miles south of Crooked Creek (datum point 39). This portion of the Louisville anticline could be outlined by a number of shallow test borings

TABLE 2.—DATA TO ACCOMPANY STRUCTURE CONTOUR MAP (FIG. 4)

| Location County, T. and R., and section | Map No. | Surface elevation | Estimated interval to key horizon | Elevation horizon | Stratum exposed or name of well |
|---|---|---|---|---|---|
| Clay | | | | | |
| T. 5 N., R. 5 E. | | | | | |
| 25. | 1 | 467 | 0 | 467 | Omega limestone |
| T. 4 N., R. 5 E. | | | | | |
| 3. | 2 | 495 | —25 | 470 | Calcareous sandstone |
| 4. | 3 | 502 | —25 | 477 | Platy limestone. |
| 4. | 4 | 514 | —25 | 489 | Platy limestone |
| 5. | 5 | 539 | —40 | 499 | Slaty shale |
| 6. | 6 | 530 | —25 | 505 | Platy limestone |
| 6. | 7 | 533 | —25 | 508 | Platy limestone |
| 7. | 8 | 560 | —40 | 520 | Slaty shale |
| 9. | 9 | 496 | —25 | 471 | Calcareous sandstone |
| 9. | 10 | 506 | —40 | 466 | Slaty shale |
| 9. | 11 | 523 | —40 | 483 | Slaty shale |
| 10. | 12 | 486 | 0 | 486 | Omega limestone |
| 10. | 13 | 478 | 0 | 478 | Omega limestone |
| 10. | 14 | 499 | —25 | 474 | Calcareous sandstone |
| 11. | 15 | 483 | 0 | 483 | Omega limestone |
| 12. | 16 | 485 | 0 | 485 | Omega limestone |
| 12. | 17 | 488 | 0 | 488 | Omega limestone |
| 12. | 18 | 488 | 0 | 488 | Omega limestone |
| 12. | 19 | 466 | 0 | 466 | Omega limestone |
| 13. | 20 | 494 | —30 | 464 | Slaty shale |
| 13. | 21 | 511 | —30 | 481 | Slaty shale |
| 13. | 22 | 510 | —20 | 490 | Fresh-water limestone |
| 13. | 23 | 490 | 0 | 490 | Omega limestone |
| 13. | 24 | 489 | 0 | 489 | Omega limestone |
| 13. | 25 | 499 | —30 | 469 | Slaty shale |
| 14. | 26 | 513 | —30 | 483 | Slaty shale |
| 14. | 27 | 483 | 0 | 483 | Omega limestone |
| 14. | 28 | 525 | —35 | 490 | Slaty shale |
| 20. | 29 | 508 | —40 | 468 | Slaty shale |
| 27. | 30 | 534 | —50 | 484 | Harrell well |
| 32. | 31 | 500 | —40 | 460 | Slaty shale |
| T. 4 N., R. 6 E. | | | | | |
| 7. | 32 | 462 | 0 | 462 | Omega limestone |
| 17. | 33 | 469 | —40 | 429 | Slaty shale |
| 17. | 34 | 461 | —40 | 421 | Slaty shale |
| 19. | 35 | 485 | ? | 485— | Shale above Omega limestone |
| 20. | 36 | 467 | 0 | 467 | Omega limestone |
| 20. | 37 | 461 | 0 | 461 | Omega limestone |
| 23. | 38 | 439 | —25 | 414 | Calcareous sandstone |
| T. 3 N., R. 5 E. | | | | | |
| 12. | 39 | 514 | —73 (*a*) | 441 | Coal test near Dayton school |
| 14. | 40 | 506 | —25 | 481 | Calcareous sandstone |
| 15. | 41 | 541 | —84 ? | 457 | Anderson well |
| 23. | 42 | 544 | —57 | 487 | Old coal outcrop (*b*) |
| 29. | 43 | 510 | —57 | 453 | Limestone above slaty shale |
| 32. | 44 | 530 | —57 | 473 | Slaty shale |

TABLE 2.—Concluded.

| Location County, T. and R., and section | Map No. | Surface elevation | Estimated interval to key horizon | Elevation of key horizon | Stratum exposed or name of well |
|---|---|---|---|---|---|
| **Marion** | | | | | |
| T. 4 N., R. 4 E. | | | | | |
| 19 | 45 | 561 | —46 | 515 | Underclay |
| 26 | 46 | 544 | —40 | 504 | Limestone, slaty shale |
| 26 | 47 | 541 | —40 | 501 | Limestone, slaty shale |
| 32 | 48 | 521 | 0 ? | 521 | Coal, Omega ? horizon |
| T. 4 N., R. 3 E. | | | | | |
| 23 | 49 | 602 | —142 | 460 | Kinmundy shaft |
| 29 | 50 | 553 | —66 | 487 | Slaty shale, coal |
| 31 | 51 | 557 | —66 | 491 | Slaty shale, coal |
| 31 | 52 | 560 | —70 | 490 | Limestone |
| T. 4 N., R. 2 E. | | | | | |
| 26 | 53 | 511 | —66 | 445 | Coal |
| T. 3 N., R. 3 E. | | | | | |
| 10 | 54 | 560 | —66 | 494 | Coal |
| 10 | 55 | 560 | —66 | 494 | Coal |
| 13 | 56 | 533 | 22 | 555 | Ferruginous limestone |
| 24 | 57 | 528 | 22 | 550 | Ferruginous limestone |
| 24 | 58 | 524 | 0 | 524 | Omega limestone (*c*) |
| 26 | 59 | 519 | 22 | 541 | Ferruginous limestone |
| T. 3 N., R. 4 E. | | | | | |
| 1 | 60 | 506 | —40 | 466 | Slaty shale |
| 4 | 61 | 502 | 0 ? | 502 | Omega limestone ? |
| 4 | 62 | 504 | 0 | 504 | Omega limestone |
| 5 | 63 | 546 | 0 | 546 | Omega limestone |
| 5 | 64 | 508 | 35 | 543 | Ferruginous limestone |
| 5 | 65 | 504 | 35 | 539 | Ferruginous limestone |
| 6 | 66 | 557 | 0 ? | 557 | Black shale, Omega ? horizon |
| 9 | 67 | 527 | 0 | 527 | Omega limestone |
| 9 | 68 | 536 | 0 | 536 | Omega limestone |
| 18 | 69 | 535 | 22 | 557 | Ferruginous limestone |
| 18 | 70 | 527 | 22 | 549 | Ferruginous limestone |
| 18 | 71 | 536 | 22 | 558 | Ferruginous limestone |
| 19 | 72 | 494 | 0 | 494 | Omega limestone |
| 30 | 73 | 512 | 0 | 512 | Omega limestone |
| 30 | 74 | 512 | 0 | 512 | Omega limestone |

(*a*) Reported by the driller; depth to black slaty shale 16 feet; complete log not available.
(*b*) Geological Survey of Illinois, Vol. XI, p. 92, 1875. No outcrop now visible; elevation taken on flat swampy area.
(*c*) Interval to ferruginous limestone 22 feet.

and such test drilling seems desirable before choosing a location for a deep test.

**Omega Anticline.**—An anticline covering an area of about one township and trending north-northeast south-southwest is located in the west part of the area mapped. Its axis extends from a point about 3 miles east of Kinmundy southward, with a slight bend to the west, to the southern part of sec. 26, T. 3 N., R. 3 E. The anticline is named for the village of Omega located on its eastern flank. The eastern flank is well defined by two groups of outcrops, one north and northeast of Omega on Lost Fork and its tributaries, the other southwest of Omega on Bee Branch and tributaries. The western flank is poorly defined as there are no outcrops except in a small area on Dums Creek near Brubaker in sec. 10, T. 3 N., R. 3 E. The log of the Kinmundy shaft (Appendix log No. 6) shows 10 feet of black shale at a depth of 76 feet which is correlated as the black slaty shale which occurs widespread in the Crooked Creek area. Below the top of the black "slate" 66 feet (depth 142 feet), is a "limestone conglomerate," 1 foot thick which is correlated as the Omega limestone. This interval compares with that of 57 feet found 15 miles east-southeast in sec. 12, T. 3 N., R. 5 E. (datum point 39, Fig. 4). If this interpretation of the Kinmundy shaft log is correct there is a northwest dip from the crest of the Omega anticline of nearly 100 feet The scattered outcrops of black slate and coal west and south of Kinmundy are tentatively considered to be the same horizon. There is considerable uncertainty about the correlation of the coal at Brubaker and accordingly about the west dip shown for the Omega anticline. Structure test drilling should be done to determine whether or not such a dip actually exists before locating a deep test for oil and gas.

**Xenia and Iola Domes.**—Evidence was found for two minor closed domes, one to the north of Xenia centering about sec. 23, T. 3 N., R. 5 E., the other southwest of Iola centering in the nothern part of sec. 7, T. 4 N., R. 5 E. Both of these domes appear to be connected with the Omega anticline, the Xenia dome by an axis trending a little north of west and south of east, the Iola dome by an axis trending northeast-southwest.

## OIL AND GAS PROSPECTS

In order for a structure, as mapped on surface beds, to form a trap effective in the accumulation of oil and gas it must extend downward beneath the surface to the horizon of reservoir beds. It is therefore pertinent to inquire whether or not the anticlines and domes mapped in figure 4 probably extend sufficiently deep into the subsurface strata. Because few subsurface data are available this question cannot be answered definitely. The best that can be done pending further drilling is to compare these structures as to form and size with other structures in the region which are known to extend into the subsurface.

The Sandoval dome[1] about 10 miles west of the west edge of the territory mapped in figure 4 has been mapped on Herrin (No. 6) coal and on the top of the Benoist sand, about 950 feet stratigraphically lower. Although the pre-Pennsylvanian unconformity intervenes between these two horizons their structure is quite similar, the dips being steeper on the lower horizon. The

[1] Bell, A. H., Structure of Centralia and Sandoval oil fields: Illinois State Geol. Survey Illinois Petroleum No. 10, p. 9, 1927.

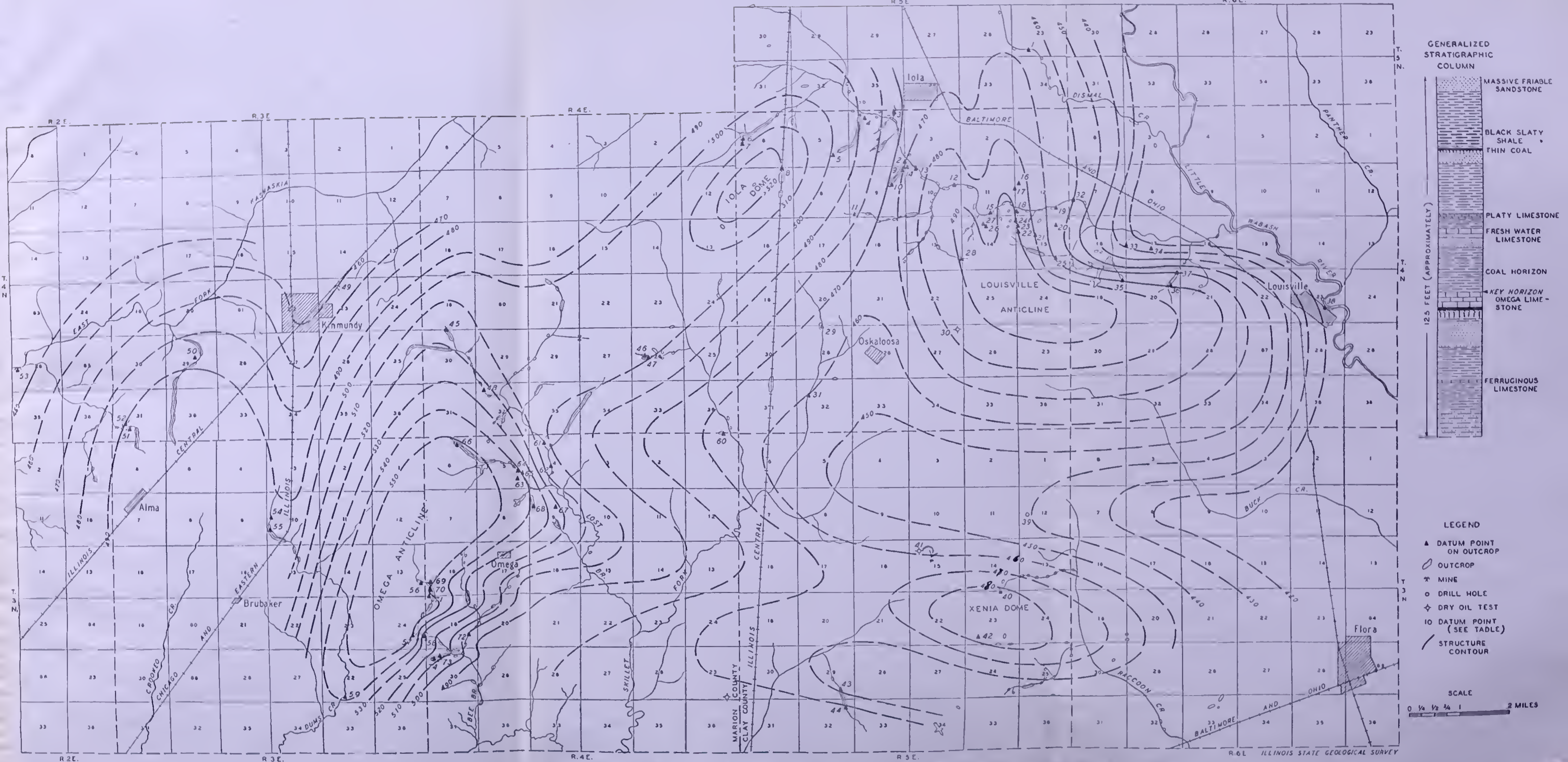


Fig. 4.—Structure contour map of parts of Clay and Marion counties, Illinois. Key horizon, top of Omega limestone; contour interval 10 feet; datum sea-level.

closure on No. 6 coal amounts to about 60 feet as compared with 30 feet or more on the Omega limestone for the Louisville anticline. Both structures trend approximately east and west. The steeper dips on the north flank of the Louisville anticline shown in figure 4 are about 50 feet per mile on the Omega limestone (although some local dips here are much steeper) as compared with a maximum of about 90 feet per mile for the Sandoval dome. It should be remembered, however, that the horizon of coal No. 6 is about 700 feet lower stratigraphically than the Omega limestone and that it is possible that on the Louisville anticline dips at the horizon of coal No. 6 are steeper than those of the beds exposed at the surface.

The maximum dips of the surface beds on the east flank of the Omega anticline as shown in figure 4 are about 70 or 80 feet per mile. (Here again some local dips are much steeper.) The trend of the axis of the Omega anticline is nearly parallel to that of the Centralia and DuQuoin monoclines (see figs. 2 and 3) which are pronounced structural features and which doubtless extend to great depth. From a consideration of these facts it appears probable that the Louisville and Omega anticlines extend downward into the pre-Pennsylvanian strata.

**Development.**—Few test wells for oil and gas have been drilled on or near the Louisville anticline, the only one of which a record is available being the J. H. Harrell well, sec. 27, T. 4 N., R. 5 E., Clay County, total depth 2,302 feet (datum point No. 30, Fig. 4, No. 2, Fig. 2). This well had a show of heavy oil from 2,140-2,152 feet in a sandstone tentatively correlated as Tar Springs. No deep well has been drilled on the Omega anticline. The log of the Harrell well is given in the Appendix, log No. 1.

**Possible Oil Producing Horizons.**—Within the area mapped in figure 4, structure contour map on Omega limestone, only three wells have been drilled below the base of the Pennsylvania system. One of these had a show of oil in a sandstone in the middle part of the Chester series, tentatively classified as the Tar Springs formation. No wells have yet reached the lower part of the Chester series in which occur the Stein and Benoist sands of the Sandoval field, the Carlyle sand of the Carlyle field, and the Kirkwood sand of the Lawrence County field, where these Lower Chester sandstones have been prolific producers. In the Lawrence County field, large yields of oil have also been obtained in somewhat more restricted areas from the McClosky "sand" in the Ste. Genevieve oolitic limestone of the Middle Mississippian series. All of these horizons as well as the Devonian-Silurian limestone ("Niagaran") and Kimmswick ("Trenton") limestone have possibilities of oil or gas production on the structures described herein.

Table 3 gives estimated depths to possible producing horizons for a location approximately on the Louisville anticline.

Table 3.—Estimated Depths to Pre-Pennsylvanian Horizons

| Horizon | Estimated depth at location of Harrell well (datum point 30) Sec. 27, T. 4 N., R. 5 E. | Remarks |
|---|---|---|
| Cypress formation.......... | 2480 | Kirkwood sand, productive in Lawrence County<br>Stein sand, formerly productive in Sandoval field, Marion County<br>Carlyle sand productive in Carlyle field, Clinton County |
| Yankeetown (?)............ | 2600 | Benoist sand productive in Sandoval field, Marion County<br>Tracy sand, productive in Lawrence County |
| Base Chester top Ste. Genevieve............... | 2700 | McClosky sand, porous zone in upper 80 feet of Ste. Genevieve oolitic limestone, productive in Lawrence County field. |
| Top Devonian-Silurian limestone ("Niagaran")....... | 4150 | Productive in Martinsville field, Clark County and Siosi field, Vigo County, Indiana |
| Top Kimmswick-Plattin ("Trenton")............. | 5550 | Productive in Dupo field, St. Clair County, and Westfield and Martinsville pools, Clark County |
| St. Peter sandstone......... | 6350 | No oil or gas production in Illinois or adjacent states. Approximately correlated with "Wilcox" sand of Oklahoma and Kansas |

The St. Peter sandstone lies below the so-called "Trenton" which includes the Kimmswick, Plattin, and Joachim formations of southwestern Illinois and southeastern Missouri. Its approximate correlation with the "Wilcox" sand of Oklahoma and Kansas have led many to believe that it has favorable prospects of oil production in Illinois and other states east of Mississippi River. No shows of oil, however, have been reported thus far from the St. Peter in Illinois. In the northern part of Illinois this formation contains fresh water. At the two places in the Southeastern Illinois field where it has been drilled the St. Peter contained salt water, in Clark County about 45,000 parts per million of dissolved solids, in Lawrence County about 175,000 p.p.m. Both of these tests were located in areas of oil production from higher horizons. Aside from the foregoing, there is little on which to base an opinion as to the oil prospects of the St. Peter in the Illinois basin area.

The Iola and Xenia domes appear to be structures of considerably smaller closure and areal extent than the Louisville and Omega anticlines. However, it is believed that they deserve consideration in a program for testing the area discussed, particularly if either the Louisville or Omega anticline should prove productive.

**Recommendations.**—Because of their location in the Illinois basin area, and the presence of several possible producing formations which produce oil to the east and to the west, it is believed that the Louisville and Omega anticlines have possibilities for oil or gas production. However, since the available data are far from complete, it is not possible at present to choose any one location which deserves testing in preference to many other possible locations on these structures. In view of this situation it is believed that the wisest procedure would be either to make a number of shallow tests to some recognizable key bed, in order to outline the structure in greater detail than is now possible, and to discover any structural closures that may be present[2] or to use some geophysical method, as for example the seismograph, in order to supplement geologic studies. Test borings for structure could be made either by a small churn drill or a diamond drill. In either case the samples or cores should be studied by a geologist. The State Geological Survey is ready to cooperate with anyone who drills either structure tests or oil tests, by making a geologic study of sample cuttings and driller's logs, by correlating the new data with that already in hand, and by making whatever recommendations can be made for further testing.

[2] The advantages of structure test drilling in Illinois are discussed in Moulton, G. F., "Proper Testing for Oil Structures in Illinois and Some Areas Deserving Such Testing"; Illinois State Geological Survey Report of Investigations No. 6.

## CHAPTER IV

## DESCRIPTION OF OUTCROPPING BEDS

J. Marvin Weller

### KEY BEDS

The glacial drift is comparatively thin throughout much of northwestern Clay and northeastern Marion counties and small outcrops are abundant in certain well dissected areas, particularly upon the south side of Crooked Creek in Clay County and along Lost Fork and Bee Branch and their tributaries in Marion County. The outcropping strata constitute a section over 100 feet thick consisting mainly of shale but with thinner beds of limestone, sandstone, clay, and coal. This section varies greatly in lithological character from place to place, and most of its members may change abruptly in thickness or disappear within short distances. Two of the beds, however, are quite persistent and constant in lithology. These are the Omega limestone in the lower part and the thick black slaty shale in the upper part of the section. They are the two principal key horizons upon which the accompanying structural contour map (Fig. 4) is based. Besides these beds two others have been utilized for structural control where elevations cannot be obtained upon either of the more persistent beds. These subordinate key beds are the ferruginous limestone below the Omega limestone and the fresh-water and platy limestones which occur between the Omega limestone and the black slaty shale.

### STRATIGRAPHIC INTERVALS

Because most of the rock outcrops are confined to the beds and immediate banks of the streams, there are comparatively few localities where the intervals between the key horizons can be accurately determined. The only place where the Omega limestone and black slaty shale outcrop in close proximity is in the NE. 1/4 of the NW. 1/4 sec. 14, T. 4 N., R. 5 E. (map Nos. 26, 27, Fig. 4). There the top of the shale lies 30 feet above the top of the limestone. These same two beds, however, have both been penetrated in the shaft of the old Kinmundy coal mine (map No. 49, Fig. 4), located just northeast of town, and in the Dayton School well, in the NW. 1/4 of the SW. 1/4 sec. 12, T. 3 N., R. 5 E. (map No. 39, Fig. 4). At these places this interval is 66 and 57 feet respectively.

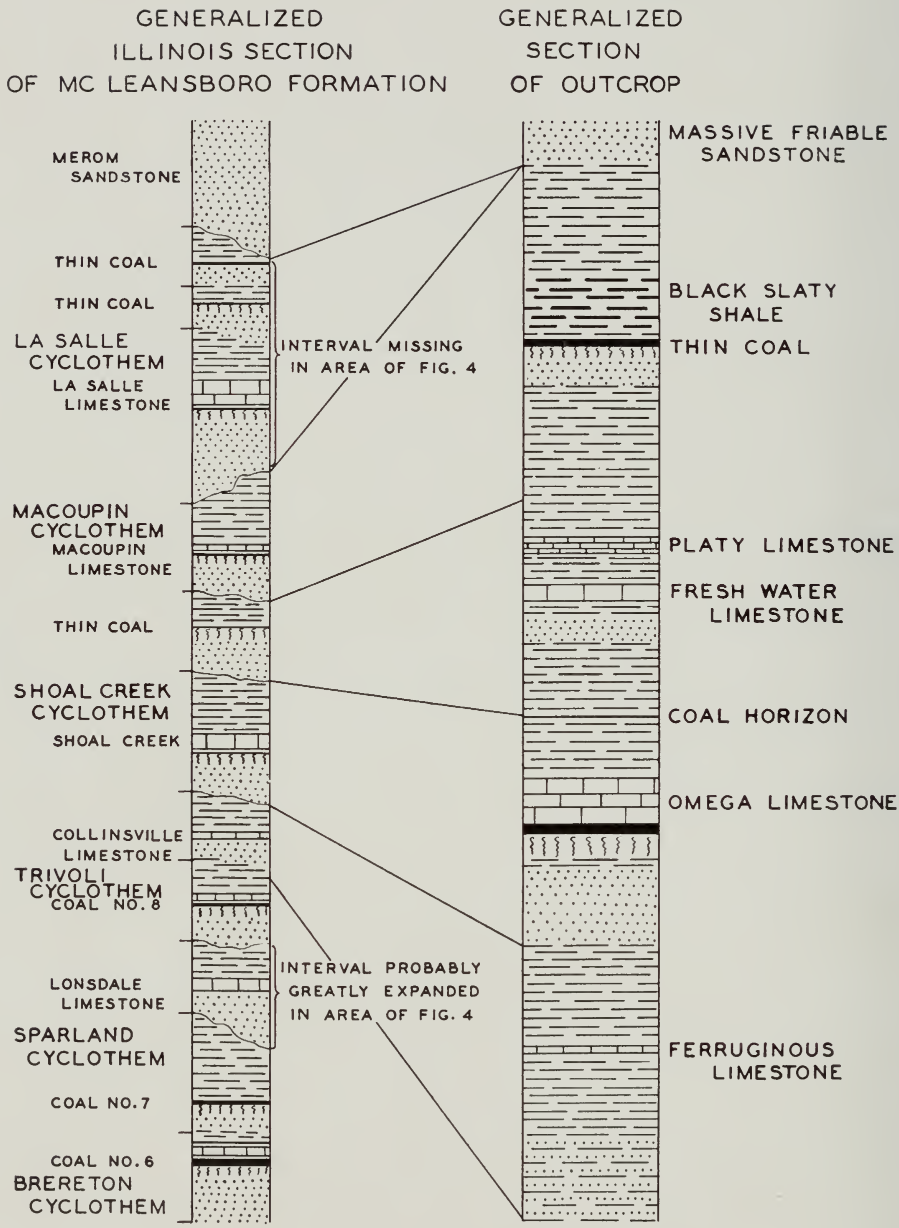


Fig. 5.—Correlation of outcropping beds with the general stratigraphic section of the McLeansboro strata in Illinois.

Near the center of the east line of the SE. 1/4 sec. 24, T. 3 N., R. 3 E. (map No. 58, Fig. 43, the top of the ferruginous limestone lies 22 feet below the top of the Omega limestone. In the center of the SE. 1/4 of sec. 5, T. 3 N., R. 4 E. (map Nos. 63 and 64, Fig. 4), the difference in elevation of these horizons is 38 feet but because of the probable dip of the strata between the two outcrops the actual interval is believed to be somewhat less.

The top of the fresh-water limestone occurs 25 feet above the top of the Omega limestone near the west line of the NW. 1/4 sec. 13, T. 4 N., R. 5 E. (map Nos. 22 and 23, Fig. 4), and an approximately similar interval separates the Omega from the top of the platy limestone in the NW. corner of sec. 10 and adjacent part of sec. 9 (map Nos. 9 and 13, Fig. 4) of the same township.

The top of the platy limestone lies 14 feet below the top of the black slaty shale near the center of the S. 1/2 sec. 13, T. 4 N., R. 5 E., but in the NE. 1/4 sec. 9 (map Nos. 9 and 10, Fig. 4) of the same township, this interval has increased to about 30 feet.

## BEDS BELOW OMEGA LIMESTONE

Beds below the Omega limestone are exposed in Clay County principally along Crooked Creek in secs. 10, 11, and 12, T. 4 N., R. 5 E. Throughout these sections the limestone is generally immediately underlain by a coal bed which attains a maximum thickness of nearly one foot but appears to be locally absent as in the SE. 1/4, SW. 1/4 sec. 11 (map No. 15, Fig. 4) and the SW. 1/4, SW. 1/4 sec. 12 (map No. 18, Fig. 4). Underclay below the coal is comparatively thin and poorly developed and grades downward into irregularly laminated greenish-gray shale. This in turn grades downward into sandy beds which attain a maximum observed thickness of about 15 feet. They may consist of very sandy shale or shaly to thin-bedded fine-grained micaceous sandstone. In the SE. 1/4 SE. 1/4 sec. 11, several feet of gray silty shale with large oval ironstone concretions outcrops beneath the level of the sandstone. These are the oldest beds exposed in Clay County. A similar section consisting of coal, underclay, thin-bedded sandstone and gray shale underlies the Omega limestone in Marion County in the NW. 1/4 sec. 9, T. 3 N., R. 4 E. (near map No. 68, Fig. 4). Sandstone apparently belonging below the Omega limestone is well exposed and rises nearly to prairie level in the NE. 1/4 of the adjoining sec. 8.

Southwest of Omega in Marion County the strata below the Omega limestone are exposed along the west fork of Bee Branch in secs. 13 and 24, T. 3 N., R. 3 E., and secs. 18 and 19, T. 3 N., R. 4 E. Here the coal is very thin or absent and the Omega limestone closely overlies a medium light gray, soft underclay. The ferruginous limestone is well exposed in the SW. 1/4 sec. 18 (map No. 69, Fig. 4), where it is very fossiliferous (Fig. 6). The strata between this member and the Omega limestone, however, are not completely exposed in this vicinity. The lack of outcrops of this part of the section suggests that it consists mainly of shale. The ferruginous limestone may occur below drainage along Crooked Creek and is probably present below the strata mentioned as occurring in the NW. 1/4 sec. 9, one mile northeast of

Fig. 6.—Ferruginous limestone in the bed of the west fork of Bee Branch, NW. 1/4 SW. 1/4 sec. 18, T. 3 N., R. 4 E. (map No. 69, Fig. 4).

Omega. Evidence indicates that the interval between the Omega and ferruginous limestones increases in those areas where sandstone forms an important part of the intervening strata.

Where best developed along the west fork of Bee Branch, the ferruginous limestone consists of less than one foot of dark gray, very impure, fine-grained limestone which weathers to a deep brownish-red color. It is locally very fossiliferous and contains numerous large pelecypods and gastropods. The isolated outcrop on Dums Branch in the SW. 1/4 sec. 26, T. 3 N., R. 3 E. (map No. 59, Fig. 4), resembles this bed as exposed on Bee Branch but is somewhat more impure. In the NW. 1/4 SE. 1/4 sec. 9, T. 3 N., R. 4 E., the ferruginous limestone is only 2 to 4 inches thick, very conglomeratic and only sparingly fossiliferous, and it shows a similar development at several outcrops (map Nos. 64 and 65, Fig. 4) on the southwest side of the creek which flows through sec. 5 of this same township. The ferruginous limestone is correlated with the Collinsville limestone of the Illinois general stratigraphic section (Fig. 5).

On the west fork of Bee Branch the ferruginous limestone is underlain by 10 feet or more of gray silty shale, the lower part of which contains *Estheria*. Below this occurs a questionable, poorly developed underclay and very sandy, gray to brownish shale, with impure flattened ironstone concretions.

In the SE. 1/4 sec. 5, T. 3 N., R. 4 E. (map No. 64, Fig. 4), the ferruginous limestone is underlain by about a foot of sandy shale, below which occurs a small thickness of thin-bedded, fine-grained, more or less calcarous sandstone. Up-stream to the west the ferruginous limestone rises in the banks which are composed of greenish-gray to gray sandy shale and it may be traced nearly to the road lying near the west line of this section. West of this road and mainly in sec. 6 are more or less continuous outcrops of sandy shale and shaly sandstone which continue upward nearly to the level of the prairie. Near the upper part of this sequence in NW. 1/4 NE. 1/4 sec. 6 (map No. 66, Fig. 4) occurs a poor exposure of coaly shale with associated calcareous siltstone containing *Spirorbis* and wide flattened stem impressions which somewhat resembles the platy limestone described below, although it does not exhibit the characteristic platy structure of this latter bed.

The relations of the beds exposed in sec. 6 to those observed in sec. 5 are uncertain. The lower part of this stratigraphic section seems to occur definitely below the ferruginous limestone but this stratum has not been recognized higher in the section and the coaly shale is unlike any bed known in this area below the Omega limestone. There is a possibility that the Omega and ferruginous limestones have been cut out along an unconformity and that the coaly shale represents a horizon younger than the Omega limestone. Evidence bearing on the existence of such an unconformity is presented below.

## OMEGA LIMESTONE

The Omega limestone is a light gray, hard, dense, generally fine-grained, pure limestone, which is commonly 4 to 9 feet thick. It outcrops along Crooked Creek from the NW. corner of sec. 10, T. 4 N., R. 5 E. (map No. 13, Fig. 4) to the SW. 1/4 sec. 7, T. 4 N., R. 6 E. (map No. 32, Fig. 4), attaining a thickness of 4 to 5 feet except locally where it may disappear entirely as in part of the SW. 1/4 SW. 1/4 sec. 12, T. 4 N., R. 5 E., or thicken to as much as 13 feet as in the SW. 1/4 SE. 1/4 sec. 11 (map No. 15, Fig. 4) of the same township where it becomes quite silty and contains fairly abundant, well preserved fossils. On Dismal Creek in the SW. 1/4 sec. 25, T. 5 N., R. 5 E. (map No. 1, Fig. 4), this bed attains a thickness of nearly 10 feet of light gray, fairly pure, quite fossiliferous limestone. In the NW. 1/4 sec. 9, T. 3 N., R. 4 E. (map No. 68, Fig. 4) (Marion County), it is 5 to 6 feet thick. The main upper part is hard, gray, massive limestone but the basal bed, less than one foot thick, is dull bluish-gray and impure and contains many small fossil fragments, mainly crinoid stems, which gives it a granular

Fig. 7.—Solution-pitted upper surface of the Omega limestone above the quarry in the NE. ¼ NW. ¼ sec. 30, T. 3 N., R. 4 E. (near map No. 73, Fig. 4).

and crystalline structure. In the NW. 1/4 sec. 30 (map Nos. 73 and 74, Fig. 4) of the same township where it has been extensively quarried for local uses, the Omega consists of 6 to 7 feet of light gray, hard, massive limestone, the upper part of which contains abundant fusulinids (Fig. 7).

Limestone conglomerate which may contain marine fossils is closely associated with the Omega limestone near the NW. corner sec. 13, T. 4 N., R. 5 E. (map No. 23, Fig. 4) and in the SW. 1/4 sec. 19, T. 3 N., R. 4 E. (map No. 58, Fig. 4). The conglomerate consists mainly of gray limestone pebbles up to 3 or 4 inches in diameter, although most of them are much smaller. The pebbles appear to have been derived from the Omega limestone and some of them are brownish on the outside as though they had been weathered before reconsolidation. The matrix of the conglomerate is also limestone but appears to be less pure than the pebbles and may be quite sandy. It is developed to a maximum observed thickness of about 10 feet. At the first locality mentioned above both conglomerate and Omega limestone occur at the same elevation separated by only 6 feet of covered slope. At the second locality conglomerate overlies Omega limestone in the road south of the creek. On the north side of the creek and also in the road only conglomerate is present at about the same elevation, and down stream to the east, conglomerate occurs at lower levels. It is believed that this conglomerate marks an unconformity and is much younger than the Omega limestone which it appears to cut out locally. Similar material has been observed much higher than the Omega limestone and is described in a later paragraph.

The outcrops of Omega limestone that extend eastward along the hillsides from the quarries in the NW. 1/4 sec. 30, T. 3 N., R. 4 E. (map Nos. 73 and 74, Fig. 4), end abruptly in the NW. 1/4 NE. 1/4 of this section, and a short distance farther massive sandstone occurs on the hill slopes at about the same level. Likewise the outcrops of Omega limestone which occur along the east fork of Bee Branch in the SE. 1/4 of sec. 19 of the same township, cease abruptly near the south line of this section and no outcrops of the Omega limestone are known to occur farther south or east in Marion County. It is believed that the Omega limestone has been cut out here by an unconformity.

In the NW. 1/4 sec. 9 and the S. 1/2 sec. 4, T. 3 N., R. 4 E., the Omega limestone is dipping to the northeast. In the NW. 1/4 sec. 4, (map No. 61, Fig. 4) an outcrop of limestone irregularly overlain by massive sandstone is present just above water level in the east bank of Lost Fork. This limestone occurs at about the proper elevation if the dip previously mentioned continues this far north. The limestone, however, although massive, does not otherwise resemble the Omega; it is much more impure, contains very abundant small crinoid stem segments as well as some larger fossils, and its brownish-gray color is altered to deep brownish-red by weathering. If this is the Omega limestone, the outcrops occurring farther up Lost Fork must overlie this latter member. If it is not the Omega limestone, which appears possible, it may be the ferruginous limestone, although it resembles this only in its weathered color. In the latter case the massive sandstone occurring in this vicinity overlies an unconformity that has cut out the Omega limestone and the outcrops in the SW. 1/4 sec. 29, SE. 1/4 sec. 30 and NW. 1/4 sec. 32, T. 4 N., R. 4 E., which resemble no others observed in this vicinity, probably belong beneath the ferruginous limestone and would therefore be the oldest beds exposed within this area, perhaps extending down to coal No. 8 of the Illinois general stratigraphic section. The occurrence of an *Estheria*-bearing horizon seen near the NW. and SE. corners of sec. 32, the center of the N. 1/2 sec. 28 and the center of the E. 1/2 sec. 21, somewhat similar to that occurring beneath the ferruginous limestone on the west fork of Bee Branch, suggest that this interpretation may be correct. However, in the interpretation of structure given in figure 4, the outcropping strata in secs. 28, 29, 30, and 31, T. 4 N., R. 4 E., are all assumed to be above the Omega.

Abundant large blocks of Omega limestone occur in the glacial drift in the breaks of the prairie east and southeast of Kinmundy and are evidence that this bed is present immediately below the drift not far to the north. No actual exposures of the Omega are known in Marion County, however, north of T. 3 N., R. 4 E.

The Omega limestone is believed to be equivalent to the Shoal Creek limestone of the Illinois general stratigraphic section (Fig. 5).

## BEDS OVERLYING OMEGA LIMESTONE

Although beds younger than the Omega limestone occur in northeastern Marion County, the sequence is known only from the exposures in the vicinity of Crooked Creek in northwestern Clay County. In the south bank of Dismal Creek in the SE. 1/4 NW. 1/4 sec. 5, T. 4 N., R. 6 E., a coal horizon consisting of 1/4 inch of smutty material and overlying a poorly developed underclay about 6 inches thick occurs about 10 or more feet above the Omega limestone, from which it is separated by finely sandy shale with impure ironstone concretions (Fig. 5). Blocks of massive, fine-grained, hard sandstone 4 feet thick have tumbled down the slope from a position 6 feet or more above the coal horizon. In the NE. 1/4 sec. 20 of the same township 15 feet of gray shale, sandy above and silty below, with large ironstone concretions overlies the Omega limestone and similar shale occurs in the NE. 1/4 of the adjoining sec. 19 (map No. 35, Fig. 4), although the limestone is not exposed.

Sandstone probably equivalent to that mentioned above outcrops at several places on the south side of Crooked Creek and the southwest side of Little Wabash River between the Baltimore and Ohio Railroad and Louisville in secs. 14, 15, 16, and 23, T. 4 N., R. 6 E. It varies from 2 to 4 feet in thickness and is massive, fine-grained, hard, and very calcareous. At the mouth of Crooked Creek, a thin smutty coal horizon, probably identical with that observed on Dismal Creek in sec. 5, occurs in a silty to sandy shale succession 10 feet below this bed. Shale and underclay, in part mottled reddish, overlie the calcareous sandstone in secs. 15 and 16.

The same calcareous sandstone outcrops in the bed of a small ravine at the road crossing in the N. center of sec. 19, T. 4 N., R. 6 E., and descends to the north at a rate about equal to the gradient of the hollow. In the road a locally developed coal horizon above 4 feet of mottled reddish underclay occurs some 6 feet above the sandstone. The coal horizon is succeeded above by drab to gray or brownish-gray silty shale containing an irregular discontinuous limestone bed in its lower part. This limestone is hard, crystalline, brownish-gray to medium dark gray, somewhat impure and ferruginous and contains marine fossils. Near the center of the W. ½ SE. ¼ sec. 18 to the north this limestone has been observed about 20 feet below the black slaty shale described below. It is possible that the 6-inch coal exposed in the west bank of the Little Wabash River south of the bridge at Louisville is equivalent to the coal horizon mentioned above.

A composite stratigraphic section built up from the outcrops described above indicates that the interval between the top of the black slaty shale and the top of the Omega limestone is about 55 feet in this vicinity.

Fig. 8.—Calcareous sandstone that lies between the platy fresh-water and Omega limestones, NW. corner sec. 10, T. 4 N., R. 5 E. The thicker sandstone ledge in the middle grades locally into impure limestone with *Spirorbis* and small thin shelled non-marine pelecypods (near map No. 9, Fig. 4).

Because the fresh-water and platy limestones are absent from the section described above, it is difficult if not impossible to correlate these beds with those which occur to the west. Near the NW. corner of sec. 10, T. 4 N., R. 5 E. (map No. 9, Fig. 4), a calcareous sandstone occurs at about this same position in the sequence. This bed is described later in connection with its possible equivalence to the fresh-water limestone.

A thin coal horizon is exposed in the NE. ¼ NW. ¼ sec. 4, T. 4 N., R. 5 E., some distance below the fresh-water limestone and may be the continuation of that occurring beneath the calcareous sandstone on Dismal Creek and at the mouth of Crooked Creek. A somewhat similar coal horizon is exposed at several places along the creek which flows east across the S. ½ sec. 13, T. 3 N., R. 5 E. It probably underlies platy limestone outcropping in the creek bed near the west line of this section. A fairly good coal horizon is present 5 feet or more below the fresh-water limestone in a tributary on the north side of Crooked Creek in the NE. 1/4 sec. 4, T. 4 N., R. 5 W. (map No. 3, Fig. 4). A thin coal smut is also exposed in the road cut on the line between sections 22 and 23, T. 5 N.. R. 5 E. just south of Dismal Creek (north of the edge of the area shown in Fig. 4) and may represent the same horizon but other outcrops which might substantiate this conclusion are lacking.

There are few, if any, exposures of the beds intervening between the platy and fresh-water limestones and the Omega limestone in sections 10, 11, 12, and 13, T. 4. N., R. 5 E., and it is probable, therefore, that this part of the stratigraphic section consists almost wholly of shale.

In sections 31 and 32, T. 5 N., R. 5 E., and sec. 6 to the south there are extensive exposures of more or less sandy shale and shaly to thin-bedded sandstone that underlie the platy limestone and it is probable that this part of the section has thickened considerably.

No strata equivalent to those described above have been definitely recognized in northeastern Marion County.

## FRESH-WATER LIMESTONES

Fresh-water limestone occurring in the midst of the sequence between the Omega limestone below and the black slaty shale above outcrops at numerous places along the small tributaries of Crooked Creek in secs. 4, 6, 9, 13, 14, and 15, T. 4 N., R. 5 E., and in sec. 14, T. 3 N., R. 5 E. Similar rock is exposed a short distance west of the area shown in figure 4 in the south bank of the East Fork of Kaskaskia River in the SE. 1/4 NE. 1/4 sec. 6, T. 3 N., R. 2 E. The fresh-water limestone occurs in one to several, thin, more or less lenticular beds and varies greatly in lithology. The most persistent type is quite silty and impure and consists of thin and even laminae that weather to platy fragments. It attains a maximum thickness of about 15 inches and is of medium gray color where fresh but upon exposure bleaches nearly white. Marine fossils are absent from this bed although *Spirorbis*, ostracods, small thin shelled pelecypods and more or less carbonized plant stem impressions are more or less abundant locally. This platy limestone is the uppermost bed of the fresh-water sequence and may be observed in the center W. 1/2 sec. 6 (map Nos. 6 and 7, Fig. 4). NE. 1/4 NW. 1/4 sec. 4 (map No. 4, Fig. 4), NE.1/4 NE. 1/4 sec. 9 (near map No. 9, Fig. 4), central part of sec. 15, NE. 1/4 SW. 1/4 sec. 13, all in T. 4 N., R. 5 E., and SW. 1/4 sec. 13, T. 3 N., R. 5 E.

In the NE. 1/4 sec. 4, T. 4 N., R. 5 E. (map No. 3, Fig. 4), the typical platy type of limestone is absent and the fresh-water limestone is light gray, lithographic in texture, and breaks with a conchoidal fracture. In the NE. 1/4 SW. 1/4 sec. 13 of the same township hard, dense, fine-grained, somewhat earthy fresh-water limestone that is medium light gray when fresh but weathers to yellowish-brown, appears to occur a short distance beneath a bed of the typical platy limestone (Fig. 9). Similar material without the overlying platy bed is exposed just north of the road near the northwest corner of this same section (map No. 22, Fig. 4) and also in another small ravine a short distance to the west. In the northeast corner of section 9 of the same township (map No. 9, Fig. 4) more or less calcareous sandstone in two beds separated by 2½ feet of clay or shale and attaining a total thickness of about 17 feet occurs three or four feet below platy fresh-water limestone. The shale or clay separating the two beds of sandstone contains many small calcareous nodules, particularly concentrated in the lower part where

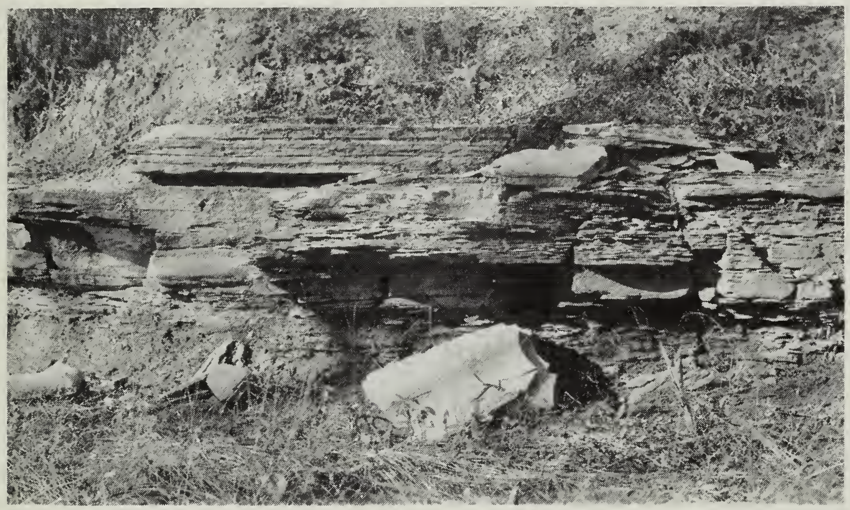

Fig. 9.—Platy, fresh-water limestone, NE. ¼ SW. ¼ sec. 13, T. 4 N., R. 5 E.

they attain maximum diameters of 3 to 4 inches. The upper part of the underlying sandstone is very calcareous, locally contains limestone nodules similar to those occurring in the softer beds above, and at a few places imperceptibly grades into what appears to be fairly pure limestone with *Spirorbis* and small thin shelled pelecypods. This association suggests that the calcareous sandstone may be equivalent to the yellowish-brown weathering limestone in sec. 13 described above. It is also possible that very calcareous sandstone without fossils or limestone nodules occurring one foot below platy limestone near the center W. ½ sec. 6 of the same township may be equivalent to this bed. If there actually is such a sandy calcareous member more or less persistent throughout this area, it is likewise possible that the calcareous sandstone previously described in sec. 19, T. 4 N., R. 6 E., and at various places on Crooked Creek and Little Wabash River as far southeast as Louisville may be the continuation of this same bed as it occurs at approximately the same position in the stratigraphic section even though the platy limestone is undeveloped there.

Conglomerate consisting of gray limestone pebbles or nodules in a calcareous, more or less sandy and ferruginous matrix occurs at numerous places in northeastern Marion and northwestern Clay counties. In the SW. 1/4 NE. 1/4 sec. 4, T. 4 N., R. 5 E., a thin bed of such material occurs 4 feet above fresh-water limestone. In south central sec. 18 and north central sec. 19, T. 4 N., R. 6 E., thin beds of conglomerate occur at one or more horizons between the thin lenticular marine limestone which overlies a coal horizon, and the thick black slaty shale. Near the NW. corner of sec. 13, T. 4 N., R. 5 E., and the SW. corner of sec. 19, T. 3 N., R. 4 E., limestone conglomerate is closely associated with the Omega limestone as previously mentioned. In the SE. 1/4 SE. 1/4 sec. 18 of the latter township, it overlies thin-bedded sandstone which might be at a lower elevation than the Omega limestone were it present here. Well cemented conglomerate occurs by the roadside near the center W. line NW. 1/4 sec. 27, T. 4 N., R. 4 E., not far below the level of the prairie. Three and one-half feet of limestone conglomerate outcrops in the N. 1/2 NW. 1/4 sec. 5, T. 3 N., R. 4 E., unassociated with other exposures, and similar material occurs near the center sec. 15, T. 4 N., R. 5 E.

The significance of the limestone conglomerate is not known. It certainly occurs at different places at various intervals between the Omega limestone and the black slaty shale and may even be present locally below the level of the Omega limestone. At some places it strongly suggests an unconformable deposit occurring locally on an irregular surface of erosion and possibly wherever found may be of approximately contemporaneous age but at some places it appears to be an integral part of a perfectly conformable sequence. At those localities where the conglomerate is closely associated with the Omega limestone it is likely to include marine fossils and may be composed largely of pebbles derived from the Omega, but elsewhere it may consist of more or less reworked calcareous nodules similar to those present between the two sandstones near the northeast corner of sec. 9, T. 4 N., R. 5 E.

Although very erratically developed, fresh-water limestones appear to be sporadically present at a comparable horizon throughout a wide area in central and southeastern Illinois. Besides in Clay and Marion counties they have also been observed in Jasper, Richland, Edwards, White, and Jefferson counties.

## BEDS OVERLYING THE FRESH-WATER LIMESTONES

The beds intervening between the fresh-water limestones and the black slaty shale are exposed with a fair degree of completeness only in the NE. ¼ sec. 9 (Fig. 10) and the SW. ¼ sec. 13, T. 4 N., R. 5 E. At the latter locality this interval is much reduced and consists mainly of shale that includes a dark *Estheria*-bearing layer in the lower part, and a thin nodular limestone layer with marine fossils less than one foot below the black shale.

Fig. 10.—Black slaty shale and underlying beds in SE. ¼ NE. ¼ sec. 9, T. 4 N., R. 5 E. The following section is exposed here:

| | |
|---|---|
| 8. Black slaty shale........ | 1′6″ |
| 7. Softer black shale....... | 1′ |
| 6. Black slaty shale........ | 1′ |
| 5. Dark gray, fine grained limestone lens.......... | 6″ |
| 4. Dark gray calcareous shale .................. | 8″ |
| 3. Shaly coal............... | ¼″ |
| 2. Poorly developed underclay .................. | 3″ |
| 1. Fine grained sandstone.. | 1′6″ |

No. 1 contains root impressions and Nos. 4 and 5 contain marine fossils. A large oval concretion of limestone similar to No. 5 has fallen from the cavity above the hammer to the water's edge.

At the SW. corner of sec. 10 of this same township, a thin, dark gray earthy limestone with marine fossils closely underlies the thick black slaty shale. Two and one-half feet lower occurs another bed of black slaty shale more than one foot thick and coaly in its lower part with brackish-water fossils. Downstream to the northeast there appears below the limestone a lens of fine-grained calcareous sandstone that thickens to the northeast and cuts out the lower black shale. These beds appear to be equivalent to those exposed in sec. 13 but below them occurs gray, silty to sandy shale with large oval, more or less septarian limestone concretions which may reach a thickness of nearly 20 feet. This shale is unrepresented at the other locality.

In the NE. 1/4 sec. 9, T. 4 N., R. 5 E. (map No. 10, Fig. 4), a thin coaly streak and poorly developed underclay a few inches thick underlies the thick slaty shale. Locally an inch of dark argillaceous limestone intervenes between the shale and coal horizon. Beneath the underclay is 3 to 4 feet of thin-bedded calcareous sandstone overlying about 20 feet of shale, sandy above with oval septarian concretions, and silty below with a few rather continuous thin bands of clay-ironstone. A small covered interval separates the lower part of this shale from the platy limestone that has previously been mentioned as occurring at this locality.

The sandstone of the last section, although thin, is probably the basal sandstone of the Macoupin cyclothem that is widespread throughout this part of the State and locally attains a considerable thickness and may become very massive. The sandstone extensively exposed north and northeast of Xenia is believed to be this same member in thicker development. Likewise the sandstone outcropping at many places in secs. 21, 30, 32, 33, and 34, T. 4 N., R. 4 E., and which becomes very massive in part of this area is also considered to be the continuation of this bed to the west. Sandstone present in sec. 29, T. 4 N., R. 3 E., is probably this same bed; it here contains a few marine fossils in a restricted very calcareous zone near the top.

Elsewhere in this part of the State the Macoupin sandstone is known to rest unconformably upon and locally to cut out a considerable thickness of underlying beds. It is probable that similar unconformable relations also exist in northwestern Clay and northeastern Marion counties although the evidence here is not conclusive. It is possible that the sandy shale overlying the Omega limestone in the NW. 1/4 sec. 30, T. 3 N., R. 4 E. (map No. 74, Fig. 4), is a representation of the lower part of this member and it is probable that much of the sandstone that outcrops extensively, to the almost complete exclusion of other types of rock, south and east of this locality in Marion County is this same bed.

The limestone, coal, and underclay that normally intervene between the black slaty shale of the Macoupin cyclothem and the sandstone described above are very erratically developed in this area. Two to three inches of coal over 2½ feet of underclay occurs in the SE. 1/4 sec. 18, T. 4 N., R. 6 E. Both of these members are absent in sec. 13, T. 4 N., R. 5 E. A thin zone of very shaly coal without underclay is present at the SW. corner of sec. 10, T. 4 N., R. 5 E., and several thin bands of coal totalling not more than 3 inches occur without underclay in the SE. 1/4 sec. 5 in the same township (map No. 5, Fig. 4). A discontinuous smut streak without underclay is exposed in the NE. 1/4 NE. 1/4 sec. 32, T. 3 N., R. 5 E. (map No. 44, Fig. 4). Underclay outcropping in SE. 1/4 SW. 1/4 sec. 19, T. 4 N., R. 4 E. (map

No. 45, Fig. 4), probably belongs at this horizon. Coal 8 inches thick above 6 inches or more of underclay occurs near center W. line sec. 10, T. 3 N., R. 3 E. (map No. 54, Fig. 4). The coal has thickened to 14 inches in sec. 29, T. 4 N., R. 3 E. (map No. 50, Fig. 4) and overlies a foot or more of underclay. The coal apparently continues thickening westward and has been mined in a very small way near the SE. corner SW. 1/4 sec. 31 of the same township and near the center of sec. 1, T. 3 N., R. 2 E.

Limestone, largely dark colored and very argillaceous occurs irregularly in thin lenses between the coal or its horizon and the overlying thick black slaty shale. It is best developed locally in the SW. 1/4 of sec. 29, T. 4 N., R. 3 E., where it reaches a maximum thickness of 9 inches but pinches out entirely within 10 feet and in the W. 1/2 sec. 26, T. 4 N., R. 4 E. (map Nos. 46 and 47, Fig. 4), where it is one foot thick. Similar limestone lenses of less thickness have been observed in the SW. corner sec. 10, T. 4 N., R. 5 E., in the NE. 1/4 sec. 32, T. 3 N., R. 5 E., the SE. 1/4 sec. 36, T. 4 N., R. 4 E. (map No. 60, Fig. 4), SW. 1/4 sec. 31, T. 4 N., R. 3 E. (map No. 52, Fig. 4), and near the center W. line sec. 26, T. 4 N., R. 2 E. (map No. 53, Fig. 4). This limestone was apparently encountered in the cut of the Illinois Central Railroad on the N. line sec. 7, T. 4 N., R. 5 E. (map No. 8, Fig. 4), as loose fragments occur upon the bank and it is reported to have been seen in the NW. 1/4 sec. 10, T. 3 N., R. 3 E., and in the SW. 1/4 sec. 23, T. 3 N., R. 5 E. (map No. 42, Fig. 4), at which latter locality it is said to overlie 6 inches of coal.[1]

## BLACK SLATY SHALE

The black slaty shale of the Macoupin cyclothem is one of the most widespread and persistent strata of the Pennsylvanian succession exposed in central Illinois. Its outcrops south of Crooked Creek in Clay County between sec. 21, T. 4 N., R. 6 E., and sec. 5, T. 4 N., R. 5 E., are too numerous to list; the locations of the more important outcrops are indicated as datum points on the accompanying structural contour map (Fig. 4, Table 2). To the north it has been observed in the west bank of Little Wabash River near center E. line NE. 1/4 sec. 30, T. 5 N., R. 6 E., and is reported to have been encountered in a shallow well some distance to the northwest, probably at a somewhat higher elevation. Throughout this area the black slaty shale reaches the extraordinary thickness of from 4 to 7 feet. It is a black, highly carbonaceous, well laminated shale that weathers into thin more or less elastic flakes or sheets. It is practically unfossiliferous except for conodonts and at many places contains large oval concretions up to several feet in diameter of very hard, fine-grained, dark gray, argillaceous and carbonaceous limestone.

[1] Worthen, A. H., Geological Survey of Illinois, vol. VI, 1875, p. 92.

In the NE. 1/4 sec. 32, T. 3 N., R. 5 E. (near map No. 44, Fig. 4), the slaty shale is 2 feet thick and it attains a similar thickness in the SE. 1/4 sec. 36, T. 4 N., R. 4 E. (map No. 60, Fig. 4). In the W. 1/2 sec. 26 of the same township (map Nos. 46 and 47, Fig. 4) this bed is about 3 feet thick. The black slaty shale was excavated in the cut on the Illinois Central Railroad on the N. line NE. 1/4 sec. 7, T. 4 N., R. 5 E. (map No. 8, Fig. 4) and fragments occur on the bank but its thickness here is not known. This member is entirely absent above the coal near the center of the W. line sec. 10, T. 3 N., R. 3 E. (map No. 55, Fig. 4). In sec. 29, T. 4 N., R. 3 E. (near map No. 50, Fig. 4), the slaty shale varies in short distances from nothing to 1½ feet thick and in general is undeveloped where the limestone lenses are present above the coal. One and one-half feet of black slaty shale overlies the coal in SW. 1/4 sec. 31, of the same township (map No. 51, Fig. 4).

There may be some question regarding the correctness of the correlation of the thick slaty shale and associated beds along Crooked Creek with the coal and slaty shale southwest of Kinmundy and the coal without slaty shale northeast of Brubaker. However, the evidence furnished by the outcrops, not only of the area under particular consideration but also of several adjacent counties, makes it appear that this correlation is most probable.

## BEDS OVERLYING BLACK SLATY SHALE

Limestone to a maximum thickness of 5 feet which is rather massive, fine-grained, somewhat argillaceous, gray when fresh but weathering to light buff color, locally overlies the black slaty shale in the SE. 1/4 sec. 29 and NE. 1/4 sec. 32, T. 3 N., R. 5 E. (map Nos. 43 and 44, Fig. 4), and the W. 1/2 sec. 26, T. 4 N., R. 4 E. (near map No. 47, Fig. 4). Elsewhere the slaty member is overlain by a considerable thickness of shale which is gray and slightly silty southwest of Kinmundy and south of Crooked Creek in secs. 17 and 18, T. 4 N., R. 6 E. At the latter locality marine fossils are sparingly present to a height of 20 feet above the black slaty shale. Twenty-five feet of shale at this position is exposed in the railroad cuts in sec. 7, T. 4 N., R. 5 E., the upper half becomes increasingly sandy above and similar material is present in another railroad cut in sec. 31 to the south.

## MASSIVE FRIABLE SANDSTONE

The youngest Pennsylvanian rock of Clay and Marion counties is more or less massive, very soft and friable sandstone which is brownish where weathered and is commonly coarser grained than the other sandstones of the region. It is well exposed in the road-cuts near the top of Oak Mound in the SE.1/4 sec. 23, and NE. 1/4 sec. 26, T. 3 N., R. 5 E., and by the roadside in NE. 1/4 sec. 13, T. 4 N., R. 4 E. Possibly the soft massive sandstone in the railroad cut near the N. line of sec. 31, T. 4 N., R. 5 E., occurs at this same horizon. It is also probable that this sandstone occurs elsewhere in some of the higher portions of this area as for example the SW. 1/4 sec. 5 and NW. 1/4 sec. 8, T. 4 N., R. 5 E., but because of its softness it is rarely exposed except in road-cuts.

This friable sandstone is believed to be equivalent to the Merom sandstone of the Wabash valley which, so far as known, is the youngest Pennsylvanian bed present in Illinois. The Merom sandstone is unconformable with the older beds below it, and if the correlation suggested above is correct, several cyclothems normally present above the Macoupin have been entirely removed from this region by pre-Merom erosion.

## GENERAL OBSERVATIONS

The Pennsylvanian section is much thicker in southern Illinois than in the western and eastern parts of the State. This thickening is the result not only of the southward thickening of individual members of the succession but also of the introduction of numerous additional members not present on the other flanks of the basin. In southern Illinois where these additional members are, in general, best developed they commonly form parts of more or less well characterized cyclothems. As they are traced northward these cyclothems, which are not present between the more widespread cyclothems of western and eastern Illinois, gradually lose their identity and pass into more or less complex successions of rudimentary members that are extremely difficult to recognize and correlate. Because the central part of the Illinois Basin was depressed much more during Pennsylvanian time than were its flanks, such successions continue as tongue-like extensions much farther north in the central part of the State than they do either to the west or east.

The complex succession of beds, including fresh-water limestones and probably several coal horizons, which intervenes between the Omega limestone and black slaty shale in Clay and Marion counties apparently represents a series of beds, such as those described above, which rapidly expands and integrates to the south. It is likely that other comparable intervals occur in the unexposed lower part of the Pennsylvanian strata of this area which produce thickening of the section eastward from Sandoval and Centralia and make the identification and correlation of the members penetrated by the deep wells of the area impossible from the records that are available.

# APPENDIX I

## WELL LOGS

Logs Nos. 1, 2, and 4 are driller's logs of the deeper wells and Log No. 6 is the log of a mine shaft in the area shown in figure 4. Logs Nos. 3 and 5 are sample study logs of wells outside of but near the area shown in figure 4, included however within the area of figure 2. Other logs referred to in this report are in the files of the State Geological Survey, and copies of them may be borrowed upon application to the Chief, State Geological Survey, Urbana, Illinois.

The logs given are as follows:

| Log. No. | Company and well | Map No. (Fig. 2) | Map No. (Fig. 4) |
|---|---|---|---|
| 1 | Benedum Trees and Grayson J. H. Harrell well No. 1 | 2 | 30 |
| 2 | Benedum Trees Anderson well No. 1 | 3 | 41 |
| 3 | Amber Oil and Gas Co. Curry well No. 1 | 4 | ... |
| 4 | Ohio Oil Co. H. B. Henninger well No. 1 | 62 | (*a*) |
| 5 | Benoist and Finn Finn well No. 1 | 70 | ... |
| 6 | Kinmundy shaft | ... | 49 |

(*a*) On map but unnumbered because it did not furnish a datum point.

1. Benedum Trees and Grayson, J. H. Harrell well No. 1, NE. corner sec. 27, T. 4 N., R. 5 E., Clay County

Driller's log

Elevation ~~534~~ 537.7 feet

534 ok.

Map. No. 2, Fig. 2
Map No. 30, Fig. 4

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Pleistocene system | | |
| Soil, dark, soft | 24 | 24 |
| Pennsylvanian system | | |
| Lime, light, hard (fresh-water limestone?) | 4 | 28 |
| Shale, light, soft | 22 | 50 |
| Lime, light, hard (Omega limestone?) | 3 | 53 |
| Slate, light, soft | 77 | 130 |
| Sand, broken, soft | 30 | 160 |
| Slate, dark, medium | 5 | 165 |
| Sand, broken, light, medium | 155 | 320 |
| Slate, dark, soft | 80 | 400 |
| Sand, broken, medium | 10 | 410 |
| Slate, dark, soft | 20 | 430 |
| Sand, broken, light, medium | 40 | 470 |
| Slate, dark, soft | 30 | 500 |
| Sand, broken, light, medium | 50 | 550 |
| Slate, light, medium; 1 bailer water per hour at 580 | 30 | 580 |
| Sand, light, medium | 10 | 590 |
| Lime, light, hard | 30 | 620 |
| Slate, dark, medium | 115 | 735 |
| Sand, broken, light, medium; hole full water | 15 | 750 |
| Sand, light, medium | 45 | 795 |
| Slate, dark, soft | 50 | 845 |
| Sand, broken, light, medium | 30 | 875 |
| Slate, dark, soft | 75 | 950 |
| Lime, light, hard | 10 | 960 |
| Slate, dark, soft | 40 | 1000 |
| Coal, black, soft | 2 | 1002 |
| Lime, light, hard | 8 | 1010 |
| Slate, dark, soft | 12 | 1022 |
| Slate, light, medium | 63 | 1085 |
| Coal, black, soft | 4 | 1089 |
| Slate, light, soft | 96 | 1185 |
| Slate, dark, medium | 185 | 1370 |
| Slate, light, medium | 15 | 1385 |
| Slate, dark, soft | 65 | 1450 |
| Shale, light, medium | 10 | 1460 |
| Slate, dark, soft | 65 | 1525 |
| Sand, light, medium; 1 bailer water at 1535, 2 bailers at 1553, hole full at 1560-1700, 3 bailers at 1735, hole filled up, 500 feet in 30 minutes at 1800 | 175 | 1700 |
| Lime, light, hard | 15 | 1715 |
| Water, sand, light, medium | 20 | 1735 |
| Lime, broken, dark, medium | 40 | 1775 |
| Slate, dark, soft | 15 | 1790 |
| Sand, brown, soft | 5 | 1795 |
| Sand, water, light, soft | 10 | 1805 |
| Sand, light, hard | 25 | 1830 |
| Sand, water, light, soft | 50 | 1880 |
| Sand, pebbles, light, hard; and lime, sandy, very nice looking | 20 | 1900 |

| | Thickness Feet | Depth Feet |
|---|---|---|
| Mississippian system | | |
| Chester series | | |
| Lime, gritty, light, hard | 10 | 1910 |
| Slate, dark, soft | 6 | 1916 |
| Lime, sandy, light, hard | 24 | 1940 |
| Slate, and shells, light, medium | 14 | 1954 |
| Slate, dark, soft | 14 | 1968 |
| Lime, light, hard | 7 | 1975 |
| Slate, dark, soft | 15 | 1990 |
| Lime, light, firm | 30 | 2020 |
| Slate, light, soft | 5 | 2025 |
| Slate, light, medium | 15 | 2040 |
| Slate, light, soft | 20 | 2060 |
| Lime, light, hard | 6 | 2066 |
| Slate, dark, soft | 6 | 2072 |
| Lime, light, medium | 2 | 2074 |
| Slate, dark, soft | 36 | 2110 |
| Lime, light, hard | 12 | 2122 |
| Slate, light, soft | 13 | 2135 |
| Sand, water, light, medium; show of black oil at 2145-2152. Hole filled up with water at 2152 and started caving. Underreamed 6⅝, 1945-2202 | 17 | 2152 |
| Sand, light, hard | 20 | 2172 |
| Slate and shells, dark, soft | 27 | 2199 |
| Lime, light, hard | 10 | 2209 |
| Slate and shells, dark, soft | 39 | 2248 |
| Lime, light, hard | 5 | 2253 |
| Slate, red, soft | 1 | 2254 |
| Slate, light, soft | 162 | 2270 |
| Slate, red, light, soft | 5 | 2275 |
| Slate, light, soft | 7 | 2282 |
| Lime, light, hard | 6 | 2288 |
| Slate, dark, soft | 9 | 2297 |
| Lime, light, medium | 5 | 2302 |
| Abandoned. 16″—24; 12½″—435; 10″—1022; 8¼″—1707; 6⅝″—1942; 6⅝″ underreamed to 2302. | | |

2. Benedum Trees, Anderson well No. 1, SE. ¼ NW. ¼ sec. 15, T. 3 N., R. 5 E.
Driller's log

Elevation 541 feet

Map No. 3, Fig. 2
Map No. 41, Fig. 4

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Pleistocene system | | |
| Soil, yellow, soft; water at 26 feet | 27 | 27 |
| Pennsylvanian system | | |
| Coal, black soft (*a*) | 3 | 30 |
| Slate, dark, soft | 15 | 45 |
| Slate, light, medium | 95 | 140 |
| Sand, light, medium | 45 | 185 |
| Slate, light, soft | 10 | 195 |
| Lime, light, hard | 15 | 210 |
| Broken sand, light, soft | 60 | 270 |
| Slate, blue, soft | 90 | 360 |
| Lime, light, hard | 3 | 363 |
| Slate, dark, soft | 27 | 390 |
| Lime, gritty, brown, hard | 8 | 398 |
| Slate, dark, soft | 32 | 430 |
| Lime, dark, hard | 12 | 442 |
| Slate, dark, soft | 8 | 450 |
| Lime, sandy, light, medium | 20 | 470 |
| Slate, dark, soft | 68 | 538 |
| Sand, light, medium | 6 | 544 |
| Slate, light, soft; 10 bailers water at 575 | 6 | 550 |
| Slate, dark, soft | 10 | 560 |
| Sandy shale, light, medium | 70 | 630 |
| Slate, dark, medium | 30 | 660 |
| Lime, light, hard | 6 | 666 |
| Slate, dark, soft | 10 | 676 |
| Slate, light, soft | 19 | 795 |
| Sand, light, soft; water | 20 | 815 |
| Slate, light, soft | 23 | 838 |
| Sand, light, soft | 20 | 858 |
| Lime, light, hard | 6 | 864 |
| Slate, light, soft | 136 | 1000 |
| Lime, dark, hard | 15 | 1015 |
| Slate, light, medium | 5 | 1020 |
| Lime, light, hard | 5 | 1025 |
| Coal, black, soft | 4 | 1029 |
| Slate, dark, soft | 3 | 1032 |
| Lime, light, firm | 8 | 1040 |
| Lime, gritty, light, firm | 20 | 1060 |
| Slate, dark, medium | 15 | 1075 |
| Coal, black, soft | 6 | 1081 |
| Slate, light, soft | 5 | 1086 |
| Slate, dark, soft | 14 | 1100 |
| Sand, light, medium | 10 | 1110 |
| Lime, light, hard | 13 | 1123 |
| Slate, dark, soft | 30 | 1153 |
| Lime, light, medium | 7 | 1160 |

(*a*) Probably the black slaty shale. Depth to Omega limestone horizon calculated by adding the interval of 57 feet (found at the Dayton school well, map No. 39, Fig. 4, two miles east-northeast) to 27 feet, or a total of 84 feet (Table 2). It is assumed that the Omega limestone either is absent or was not recorded by the driller.

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Slate, dark, soft | 15 | 1175 |
| Sand, broken, medium | 65 | 1240 |
| Slate, light, soft | 3 | 1243 |
| Lime, sandy, light, medium; water at 1263 | 20 | 1263 |
| Sand, light, soft; hole full | 82 | 1345 |
| Slate, dark, soft | 10 | 1355 |
| Slate, light, soft | 10 | 1365 |
| Lime, sandy, light, hard; water at 1375 | 6 | 1371 |
| Sand, light, medium | 29 | 1400 |
| Slate, light, medium | 15 | 1415 |
| Slate, dark, soft | 25 | 1440 |
| Lime, light, hard | 10 | 1450 |
| Slate, light, medium | 10 | 1460 |
| Slate, dark, soft | 15 | 1475 |
| Slate, light, soft | 10 | 1485 |
| Slate, dark, soft | 10 | 1495 |
| Sand, light, medium | 10 | 1505 |
| Slate, dark, soft | 15 | 1520 |
| Sand, broken, light, medium | 15 | 1535 |
| Sand, light, soft | 15 | 1550 |
| Slate, dark, soft | 25 | 1575 |
| Slate, light, soft | 10 | 1585 |
| Lime, light, medium | 20 | 1605 |
| Sand, light, soft; similar to water sand | 8 | 1613 |
| Sand, light, medium | 25 | 1638 |
| Slate, dark, soft | 2 | 1640 |
| Lime, light, hard | 4 | 1644 |
| Slate, dark, soft | 16 | 1660 |
| Sand, broken, light, medium | 52 | 1712 |
| Sand, light, soft; water | 30 | 1742 |
| Lime, light, hard | 18 | 1760 |
| Sand, light, medium | 24 | 1784 |
| Lime, sandy, light, hard | 16 | 1800 |
| Coal, black, soft | 2 | 1802 |
| Lime, light, medium | 3 | 1805 |
| Slate, dark, soft | 60 | 1865 |
| Lime, light, hard | 10 | 1875 |
| Sand, light, soft | 15 | 1890 |
| Lime, gritty, light, hard | 15 | 1905 |
| Sand, light, medium | 25 | 1930 |
| Mississippian system | | |
| Chester series | | |
| Slate, light, medium | 15 | 1945 |
| Lime, light, hard | 20 | 1965 |
| Lime, pebbles, light, medium | 8 | 1973 |
| Slate, dark, soft | 7 | 1980 |
| Lime, light, hard | 25 | 2005 |
| Slate, light, soft | 10 | 2015 |
| Lime, light, hard | 5 | 2020 |
| Slate, light, medium | 7 | 2027 |
| Slate, dark, soft | 13 | 2040 |
| Sand, dark, medium | 6 | 2046 |
| Slate, dark, soft | 10 | 2056 |
| Sand, light, medium | 4 | 2060 |
| Slate, dark, soft; water | 10 | 2070 |
| Sand, light, soft | 6 | 2076 |

3. Amber Oil and Gas Company, Curry well No. 1, [NE SW SE] ~~NW. ¼ SW.~~ ¼ sec. [8] ~~16~~, T. 2 N., R. 7 E., Clay County

Compiled from driller's log and sample study by L. E. Workman (*a*)

Elevation 431 feet

Map No. 4, Fig. 2

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Pleistocene system | | |
| Soil and glacial till | 20 | 20 |
| Pennsylvanian system | | |
| "Shale" | 25 | 45 |
| Sandstone, light gray, very fine; "fresh water" | 63 | 108 |
| Sandstone, calcareous, light gray, very fine, compact | 12 | 120 |
| "Sandstone; fresh water" | 25 | 145 |
| Shale, sandy, gray; "set 12½-inch casing at 150 feet" | 7 | 152 |
| Coal; fireclay; sandstone, very fine | 2 | 154 |
| "Shale" | 17 | 171 |
| Sandstone, calcareous, light gray, very fine, coarse at base, porous; "fresh water to ground level" | 77 | 248 |
| Shale, black, brittle; "reset 12½-inch casing at 251 feet" | 3 | 251 |
| Coal; fireclay; grades down to marl, light gray, sandy at base | 19 | 270 |
| Sandstone, calcareous, light gray, very fine | 12 | 282 |
| Sandstone, argillaceous, grading to shale, sandy, gray | 34 | 316 |
| Shale, gray, partly sandy | 68 | 384 |
| Limestone, light brown, coarse, fossiliferous | 4 | 388 |
| Shale, silty, gray | 27 | 415 |
| Sandstone, calcareous, light gray, very fine | 5 | 420 |
| Shale, silty, light to dark gray | 75 | 495 |
| Sandstone, calcareous, light brown, compact; shale, calcareous, dark gray | 15 | 510 |
| Shale, silty, dark gray, tough | 45 | 555 |
| Siltstone, gray, grading to sandstone, very fine | 45 | 600 |
| Limestone, buff, fossiliferous; shale, black, fossiliferous, at top | 8 | 608 |
| Bone coal | 2 | 610 |
| Fireclay; sandstone, carbonaceous, very fine | 6 | 616 |
| "Shale, light" | 100 | 716 |
| Sandstone, calcareous, fine, porous; "salt water to about 175 feet from top of casing" | 57 | 773 |
| Same; with shale, gray and black, at top; "salt water to about top of casing" | 24 | 797 |
| Limestone, buff and light gray, fossiliferous; "set 10-inch casing at 800 feet" | 10 | 807 |
| "Shale, light to gray and black" | 183 | 990 |
| "Limestone" | 5 | 995 |
| "Sandstone; about four bailers water per hour" | 10 | 1005 |
| "Limestone, dark gray, flinty" | 7 | 1012 |
| Shale, carbonaceous, black, brittle; coal | 7 | 1019 |
| "Shale, gray to black" | 61 | 1080 |
| Shale, silty, gray, containing siderite concretions; grades to siltstone | 90 | 1170 |
| Shale, green and gray, smooth, weak (red rock horizon) | 34 | 1204 |
| Coal | 2 | 1206 |
| Shale, silty, brownish-gray, tough | 26 | 1232 |
| Sandstone, shaly, light gray, fine; "dry" | 4 | 1236 |

(*a*) Quotations are from driller's log.

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Shale, silty, dark gray, tough | 39 | 1275 |
| Sandstone, calcareous, light gray, fine, coaly; below 1295 feet struck "heavy flow of salt water to within 175 feet from top" | 50 | 1325 |
| Shale, gray, weak; limestone, buff | 5 | 1330 |
| Shale, dark and light gray; "set 8¼-inch casing at 1338 feet" | 9 | 1339 |
| Shale, silty, gray, tough, siderite concretions | 52 | 1391 |
| Sandstone, calcareous, light gray, very fine, "dry to 1432 feet, salt water below" | 72 | 1463 |
| Sandstone, as above; and shale, silty, dark gray | 37 | 1500 |
| Sandstone, buff, very fine to medium | 58 | 1558 |
| Same; interbedded with siltstone and shale, dark gray | 17 | 1575 |
| Shale, dark gray | 11 | 1586 |
| Sandstone, buff, very fine | 12 | 1598 |
| Coal; shale, dark gray; sandstone, very fine, carbonaceous, compact | 5 | 1603 |
| Sandstone, light gray, very fine | 6 | 1609 |
| Coal; sandstone, light gray, very fine, compact to loose; shale | 9 | 1618 |
| Sandstone, buff, fine, porous; "salt water" | 94 | 1712 |
| "Red shale; coal band" | 2 | 1714 |
| Sandstone, buff, fine to medium, porous | 33 | 1747 |
| Siltstone, grading to shale, dark gray, tough | 44 | 1791 |
| Sandstone, buff, fine, porous, partly calcareous | 134 | 1925 |
| Shale, dark gray, smooth, tough; siltstone below | 48 | 1973 |
| Sandstone, calcareous, light gray, compact; "set 6⅝-inch casing at 1978 feet" | 14 | 1987 |
| Sandstone, buff, fine, grading to coarse downward, porous; "salt water" | 147 | 2134 |
| Mississippian system | | |
| Chester series | | |
| Clore formation | | |
| Shale, calcareous, greenish to pinkish-gray | 3 | 2137 |
| Shale, dark bluish-gray; sandstone, calcareous, very fine, compact | 23 | 2160 |
| Palestine sandstone | | |
| Sandstone, calcareous, light buff, very fine; "dry" | 24 | 2184 |
| Siltstone, calcareous, light gray, tough; shale, dark gray | 11 | 2195 |
| Shale, bluish-gray, tough; siltstone | 6 | 2201 |
| Sandstone, calcareous, light gray, very fine, compact | 11 | 2212 |
| Sandstone, as above, grading to siltstone and shale, dark gray | 15 | 2227 |
| Menard formation | | |
| Limestone, gray; shale, dark gray | 8 | 2235 |
| Shale, dark gray; few limestone beds | 58 | 2293 |
| Shale, dark gray; thin siltstone and limestone beds; "set 5 3/16-inch casing at 2323 feet" | 108 | 2401 |

4. Ohio Oil Company, H. B. Henninger well No. 1, SW. corner SE. ¼ SE. ¼ sec. 25, T. 3 N., R. 4 E., Marion County, Illinois

Driller's log

Elevation 522 feet

Map No. 62, Fig. 2

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Pleistocene system | | |
| Clay | 19 | 19 |
| Pennsylvanian system | | |
| Lime | 2 | 21 |
| Slate | 35 | 56 |
| Sand rock | 84 | 140 |
| Shale | 120 | 260 |
| Lime | 10 | 270 |
| Slate | 180 | 350 |
| Sand rock | 3 | 353 |
| Slate | 92 | 445 |
| Sand rock | 2 | 447 |
| Salt water | ... | .... |
| Slate | ... | 489 |
| Lime | 26 | 515 |
| Slate | 25 | 540 |
| Lime | 2 | 542 |
| Slate | 65 | 605 |
| Lime | 5 | 610 |
| Slate | 20 | 630 |
| Lime | 18 | 648 |
| Shale | 27 | 675 |
| Lime | 35 | 710 |
| Shale, brown | 15 | 725 |
| Sandy lime | 25 | 750 |
| Shale, light | 40 | 790 |
| Lime | 6 | 796 |
| Sand rock | 39 | 835 |
| Shale, black | 70 | 905 |
| Lime | 8 | 913 |
| Slate | 107 | 1020 |
| Lime | 30 | 1050 |
| Coal No. 6 | 6 | 1056 |
| Lime | 44 | 1100 |
| Shale | 45 | 1145 |
| Part coal | 5 | 1150 |
| Sandy lime | 20 | 1170 |
| Sand lime | 70 | 1240 |
| Salt sand | 30 | 1270 |
| Lime | 25 | 1295 |
| Slate | 10 | 1305 |
| Slate and lime | 135 | 1440 |
| Salt sand | 60 | 1500 |
| Sand | 40 | 1540 |
| Slate | 55 | 1595 |
| Lime shale | 20 | 1615 |
| Slate | 15 | 1630 |
| Salt sand | 40 | 1670 |
| Slate | 20 | 1690 |
| Shale, black | 10 | 1700 |
| Salt sand | 95 | 1795 |
| Slate | 45 | 1840 |
| Salt sand | 61 | 1901 |
| Hard sand | 9 | 1910 |

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Mississippian system | | |
| Chester series | | |
| Shale | 10 | 1920 |
| Lime | 5 | 1925 |
| Shale | 10 | 1935 |
| Slate | 17 | 1952 |
| Sand | 73 | 2025 |
| Lime | 10 | 2035 |
| Slate | 59 | 2094 |
| Sand shale | 3 | 2097 |
| Lime | 23 | 2120 |
| Slate | 93 | 2213 |

5. Benoist and Finn, Finn well No. 1, SE. ¼ NE. ¼ sec. 16, T. 1 N., R. 3 E., Marion County

Compiled by L. E. Workman from driller's log and sample studies of Pennsylvanian by G. H. Cady and of Chester by M. A. Blair

Elevation 581 feet

Map No. 70, Fig. 2

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Pleistocene system | | |
| Loess and clay | 10 | 10 |
| Sand, yellow, fine | 5 | 15 |
| Glacial till | 10 | 25 |
| Sand, yellow, fine, clayey | 4 | 29 |
| Pennsylvanian system | | |
| Shale, very silty, gray | 26 | 55 |
| Sandstone, light gray, fine | 40 | 95 |
| Siltstone, light gray | 25 | 120 |
| "Coal" | 1 | 121 |
| Shale, silty, light gray | 4 | 125 |
| Sandstone, light gray, fine | 37 | 162 |
| Shale, silty, light gray | 8 | 170 |
| Shale, dark gray, hard | 5 | 175 |
| Shale, light gray, slip-fractured | 10 | 185 |
| Shale, gray, slaty | 10 | 195 |
| Sandstone, calcareous, fine; clay, weak, "clod"; coal | 5 | 200 |
| Shale, light gray | 15 | 215 |
| Shale, gray, slaty | 18 | 233 |
| "Sandstone" | 22 | 255 |
| "Shale" | 9 | 264 |
| Limestone, light and dark gray | 4 | 268 |
| Coal and fireclay | 2 | 270 |
| Fireclay | 5 | 275 |
| Shale, light gray, ironstone concretions | 40 | 315 |
| Shale, dark gray, hard | 5 | 320 |
| "Shale" | 6 | 326 |
| Limestone, sandy, coarse; bone coal | 4 | 330 |
| Shale, light gray, hard | 30 | 360 |
| Sandstone, calcareous, light gray; limestone, light brown; coal | 5 | 365 |
| Shale, light to dark gray, some greenish at 380-395 | 92 | 457 |
| Limestone, fossiliferous; siltstone, light gray | 6 | 463 |

5. Benoist and Finn, Finn well No. 1—*continued*

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Shale, light to dark gray | 77 | 540 |
| Limestone, white, fine; shale, dark gray, at base | 13 | 553 |
| "Coal" | 2 | 555 |
| Shale, black, hard | 5 | 560 |
| Shale, light gray | 100 | 660 |
| Sandstone, light gray, fine, calcareous at base | 45 | 705 |
| Sandstone, light gray, medium to coarse | 20 | 725 |
| Shale, dark gray, hard | 10 | 735 |
| Shale, light gray | 10 | 745 |
| Sandstone, calcareous, light gray, fine | 10 | 755 |
| Shale, light gray | 125 | 880 |
| Shale, reddish brown; "red rock" | 5 | 885 |
| Limestone, buff, white, and green; shale, red, green, and gray; little coal | 4 | 889 |
| Shale, dark gray to black; sandstone, calcareous, gray | 11 | 900 |
| Shale, gray and green; limestone, sandy | 4 | 904 |
| Coal | 5 | 909 |
| Fireclay | 5 | 914 |
| Limestone, light buff to cream, fine | 9 | 923 |
| Shale, gray | 12 | 935 |
| Shale, sandy, light gray, hard | 8 | 943 |
| Sandstone, light gray, fine, compact | 17 | 960 |
| Shale, black, hard; little coal | 5 | 965 |
| Fireclay; sandstone, gray, fine, calcareous | 12 | 977 |
| Limestone, gray, white, and brown, *Fusilina* | 3 | 980 |
| Coal | 7 | 987 |
| Fireclay | 3 | 990 |
| Limestone, white, fine, "sandy" | 3 | 993 |
| Shale, light to dark gray, hard | 52 | 1045 |
| Sandstone, gray, compact, finely laminated, carbonaceous partings | 58 | 1103 |
| "Shale" | 12 | 1115 |
| Sandstone, as above, grading down to loose | 31 | 1146 |
| Siltstone, gray | 4 | 1150 |
| Shale, black; limestone, brown and black, fossiliferous; little coal | 5 | 1155 |
| Siltstone, light gray | 5 | 1160 |
| Sandstone, gray, fine | 5 | 1165 |
| Shale, black | 5 | 1170 |
| Sandstone, gray, fine | 40 | 1210 |
| Shale, dark gray to black, brownish below | 15 | 1225 |
| Shale, light gray, soft, slip-fractured | 5 | 1230 |
| Same; and bone coal | 5 | 1235 |
| Shale, black, hard, carbonaceous | 10 | 1245 |
| Shale, carbonaceous, slip-fractured | 5 | 1250 |
| Sandstone, gray, fine | 5 | 1255 |
| Shale, black, light gray at top | 13 | 1268 |
| Coal | 2 | 1270 |
| Fireclay, slip-fractured | 5 | 1275 |
| Siltstone, gray and brownish; calcareous below | 5 | 1280 |
| Limestone, gray, white, and greenish, dense fossiliferous | 3 | 1283 |
| Sandstone, calcareous, dark gray to black, dense | 12 | 1295 |
| Shale, black; coal | 5 | 1300 |
| Sandstone, fine; fireclay, slip-fractured, at top | 10 | 1310 |
| Sandstone, fine, interbedded with shale, dark, hard | 33 | 1343 |
| Clay, light and dark gray, slip-fractured | 12 | 1355 |
| Sandstone, gray and reddish | 5 | 1360 |
| Siltstone, dark gray to black, grading down to shale | 8 | 1368 |
| Sandstone, white, fine | 37 | 1405 |
| Shale, gray; clay, slip-fractured | 5 | 1410 |
| Clay, slip-fractured; little limestone, brown, coarse | 5 | 1415 |

5. Benoist and Finn, Finn well No. 1—*concluded*

| | Thickness *Feet* | Depth *Feet* |
|---|---|---|
| Shale, calcareous, dark gray, micaceous | 5 | 1420 |
| Sandstone, white, fine | 25 | 1445 |
| Siltstone, gray | 5 | 1450 |
| Sandstone, white, fine, clean | 55 | 1505 |
| Sandstone, white, very fine | 30 | 1535 |
| Sandstone, white, fine | 15 | 1550 |
| "Slate" | 5 | 1555 |
| Sandstone, brownish to white, fine | 57 | 1612 |
| Shale, dark gray, carbonaceous, slip-fractured | 13 | 1625 |
| Shale, silty, dark gray, interbedded with sandstone, grading to sandstone | 60 | 1685 |
| Sandstone, light gray, very fine to fine, "water" | 145 | 1830 |
| Mississippian system | | |
| Chester series | | |
| Clore formation | | |
| Shale, silty, light greenish-gray to red rock at base | 18 | 1848 |
| Palestine formation | | |
| Shale, dark greenish-gray; interbedded with siltstone and sandstone, very fine | 27 | 1875 |
| Menard formation | | |
| Shale, dark gray | 10 | 1885 |
| Limestone, dark gray, very fine to coarse; interbedded with shale, dark gray | 45 | 1930 |
| Shale, dark gray to green; thin beds limestone and sandstone | 60 | 1990 |
| Limestone, sandy, gray; shale, sandy, gray | 25 | 2015 |
| Tar Springs sandstone | | |
| Sandstone, calcareous, light gray, very fine, compact; shale at base | 25 | 2040 |
| Sandstone, greenish-gray, very fine, compact; shale, red and green | 10 | 2050 |
| Sandstone, gray, very fine, "hole full of water, still in sandstone at bottom" | 6 | 2056 |

6. Kinmundy shaft, NE. ¼ NW. ¼ sec. 23, T. 4 N., R. 3 E., Marion County (*a*)

Map No. 49, Fig. 4

Elevation 602 feet

| | Thickness *Feet* | Thickness *Inches* | Depth *Feet* | Depth *Inches* |
|---|---|---|---|---|
| Soil and clay | 12 | .. | 12 | .. |
| Sandstone | 46 | .. | 58 | .. |
| Gray "slate" | 18 | .. | 76 | .. |
| Black "slate" | 10 | .. | 86 | .. |
| Sand shale | 19 | .. | 105 | .. |
| "Slate and soapstone" | 4 | .. | 109 | .. |
| Sand shale | 9 | .. | 118 | .. |
| Gray "slate" | 2 | .. | 120 | .. |
| Sandstone, hard | 1 | .. | 121 | .. |
| Gray "slate" | 7 | .. | 128 | .. |
| Sand rock, hard | 4 | .. | 132 | .. |
| "Slate" | 5 | .. | 137 | .. |

(*a*) This log was compiled from two original logs, both labeled "Kinmundy shaft." One of these logs was published in Illinois State Geological Survey Cooperative Mining Series Bulletin 11, 1922, pp. 128-129. However the other log gives greater detail in the upper part of the section which is important for correlation with outcropping beds and is therefore substituted down to depth 143 feet in the above compilation. It is possible that one log is for the hoisting shaft and the other for the air shaft. The "limestone conglomerate" from depth 142 feet to 143 feet in one log may be the same bed as the pebbly limestone from 146 feet 5 inches to 147 feet 9 inches in the other.

6. Kinmundy shaft—*continued*

| | Thickness | | Depth | |
|---|---|---|---|---|
| | *Feet* | *Inches* | *Feet* | *Inches* |
| Sand rock, hard | 2 | .. | 139 | .. |
| Gray "slate" | 3 | .. | 142 | .. |
| Limestone conglomerate | 1 | .. | 143 | .. |
| * * * * * * | | | | |
| Limestone, pebbly | 1 | 4 | 147 | 9 |
| "Slate," black | 9 | 7 | 157 | 4 |
| Coal | 1 | 2 | 158 | 6 |
| Fireclay | 7 | .. | 165 | 6 |
| Shale, gray | 19 | 7 | 185 | 1 |
| "Slate," black | 11 | .. | 196 | 1 |
| Coal | 1 | 6 | 197 | 7 |
| Fireclay | 2 | .. | 199 | 7 |
| Shale | 37 | 10 | 237 | 5 |
| "Slate," black | 5 | .. | 242 | 5 |
| Limestone, bituminous | 2 | .. | 244 | 5 |
| Coal | .. | 6 | 244 | 11 |
| Limestone and black shale | 6 | .. | 250 | 11 |
| Coal | .. | 2 | 251 | 1 |
| Clay shale | 5 | 6 | 256 | 7 |
| Shale, gray and black with bands of lime | 51 | .. | 307 | 7 |
| "Slate," black | 1 | 5 | 309 | 1 |
| Coal | 1 | .. | 310 | .. |
| Fireclay | 1 | 6 | 311 | 6 |
| Limestone | 3 | .. | 314 | 6 |
| Shale, gray | 15 | 9 | 330 | 3 |
| "Slate," black | 3 | .. | 333 | 3 |
| Coal | 2 | .. | 333 | 5 |
| Fireclay | 2 | 10 | 336 | 3 |
| Shale and sandstone | 65 | 6 | 401 | 9 |
| Coal | .. | 4 | 402 | 1 |
| Fireclay | 4 | .. | 406 | 1 |
| Limestone | 3 | .. | 409 | 1 |
| Shale | 71 | .. | 480 | 1 |
| Limestone | 9 | 10 | 492 | .. |
| Shale, bituminous, and 2 inches coal | 2 | .. | 494 | .. |
| Shale, pebbly | 5 | .. | 499 | .. |
| Sandstone and shale | 76 | .. | 575 | .. |
| Limestone, pebbly | 1 | 6 | 576 | .. |
| Shale, bituminous, and ½ inch coal | 2 | 6 | 579 | .. |
| Fireclay | 5 | .. | 584 | .. |
| Sandstone and shale | 69 | .. | 653 | .. |
| Shale, black | .. | 10 | 653 | 10 |
| Coal | .. | 7 | 654 | 5 |
| Fireclay | 2 | .. | 656 | 5 |
| Limestone, sandstone and fireclay | 8 | 6 | 664 | 11 |
| Shale, blue | 14 | 2 | 689 | 1 |
| Limestone | 21 | 6 | 710 | 7 |
| Fireclay | 2 | .. | 712 | 7 |
| Shale, green | 1 | 6 | 714 | 1 |
| Limestone, pebbly | 6 | .. | 720 | 1 |
| Sandstone and shale | 84 | 2 | 804 | 3 |
| Coal No. 7 | 2 | .. | 806 | 3 |
| Fireclay | 11 | .. | 817 | 3 |
| Sandstone and shale | 30 | .. | 847 | 3 |
| Coal } No. 6 | 2 | 2 | 849 | 3 |
| Shale, black } No. 6 | 3 | .. | 852 | 5 |
| Hard rock, gray limestone } No. 6 | 4 | .. | 856 | 5 |
| Coal } No. 6 | 4 | 2 | 860 | 7 |