

GEOLOGY OF BENTON COUNTY.

BY S. S. GORBY.

POSITION AND TOPOGRAPHY.

Benton County is situated in the north-western part of the State. It is bounded on the north by Newton and Jasper counties, on the east by White and Tippecanoe, on the south by Warren County, and on the west by the State of Illinois. It is the third county south from Lake Michigan. The area of the county is about 415 square miles, or sections of land, which for fertility and depth of soil can scarcely be equaled, and certainly not excelled by any county in the State. The soil is everywhere a rich, black loam, varying in depth from one foot six inches to eight or ten feet.

The surface is high and gently rolling, and has aptly been likened to the form of a turtle's back, from which the water flows in every direction. The highest point in the county is Gravel Hill on the Cincinnati, Indianapolis, St. Louis & Chicago Railroad, three and one-half miles north-west of Fowler, the central point of the county. Gravel Hill is 857 feet above ocean level, or 136 feet higher than the Union Depot at Indianapolis. North-west from Gravel Hill, on the line of the C., I., St. L. & C. R. R., the altitude of Earl Park is 814 feet, of Raub 731 feet, and the elevation at the State line, near the north-west corner of the county, is 702 feet, 19 feet lower than the Union Depot at Indianapolis. Kentland, Newton County, situated two miles north of the county line and six miles north of Earl Park, is 648 feet above the ocean. Mount Gilboa, in the north-eastern part of Benton County, is four miles west of the White County line and five miles south of the Jasper County line. The elevation at Gilboa is 815 feet, while Remington, seven miles north, in Jasper County, is only 735 feet above the sea. The lower portions of the county are along its eastern, southern and western borders, which vary in altitude from 700 to 765 feet above ocean level.

The county is eighteen miles wide from the north to the south line, and includes Congressional townships number 24, 25 and 26. Its length is 23 miles, including three sections, or the west half of range 6, all of

ranges 7, 8 and 9, and two sections on the east of range 10, making in all 414 sections, not one acre of which is necessarily waste land, as all the low-lying bogs, or so-called swamps, may readily be reclaimed by draining.

Three prominent ridges, extending in an easterly and westerly direction through the county, modify the direction of the surface drainage. Sand Ridge, running from the eastern boundary line of the county, which it crosses in the south-east quarter of section 9, township 26, range 6 west, two miles south of the Jasper County line, has a direction a little north of west, and passes over the boundary line into Newton County twelve miles west of the eastern boundary of Benton County. Blue Ridge crosses the eastern boundary of the county two miles south of Sand Ridge, pursues a westerly course, and crosses the western boundary of the county into the State of Illinois about three miles south of the Newton County line. About midway of the county from north to south, and just west of Pine Creek, four miles west of the White County line, a high ridge begins, which runs in a direction a little south of west, and passes over the boundary into Illinois about seven miles north of the southern boundary of Benton County. About a mile north of Fowler a high ridge begins, which runs in a westerly direction for two and one-half miles, when it gradually expands into a broad and gentle slope running away to the west, where it is finally lost in the rolling sea of fertile prairie. North of the last-named ridge about a mile is the highest point in the county, known as Gravel Hill. It is a high ridge of gravel and sand about three-fourths of a mile in length and 200 yards in width. Its direction is from east to west. The C., I., St. L. & C. R. R. crosses this ridge near its western extremity, and in the Railway Profile it is called the Summit. The track here is 111 feet higher than the Union Depot at Indianapolis, and it is the highest point on the line of road between Lafayette and Chicago. The cut through which the road passes is 25 feet deep.

DRAINAGE.

The northern part of the county is drained by Sugar Creek, the southern part by Mud Pine Creek, the eastern part by Pine Creek, and the western part by Mud Creek. Sugar Creek rises in the northern part of the county, in section 24, township 26, range 8, west, flows west until it crosses the C., I., St. L. & C. R. R., then flows south-westerly and crosses the boundary into Illinois, six miles south of the Newton County line. Pine Creek rises about five miles south of the Newton County line, in section 30, township 26, range 7, west, flows easterly to within three miles of the White County line, thence south, bearing west, and crosses the southern line of the county six miles west of the Tippecanoe County line. Mud Pine Creek rises at the south-west corner of the town of Fowler, flows southerly, bearing west, and enters Warren County nine miles east

of the Illinois State line. Mud Creek rises at Fowler, flows north-westerly, and empties into Sugar Creek one mile east of the Illinois line. A large ditch at the south-west of Fowler, which drains a large area of surface, empties the waters that are received at its northern extremity into Mud Creek, whence they flow away through Sugar Creek to the Iroquois River; while the waters collected at the southern end of the ditch flow into Pine Creek, and thence find their way to the Wabash. Mr. J. M. Blasdel, at Parish Grove, seven miles south-west of Fowler, has one acre of land on his farm that is drained by tributaries of the Wabash, the Vermillion and the Iroquois rivers respectively.

A well-made system of surface ditches has been constructed throughout a large portion of the county. These surface ditches give a suitable outlet to the underground tile drains that conduct the water from the adjoining lands. These ditches are being rapidly made wherever needed, and when they are properly made it is found that they are fully adapted to the purpose for which they were designed. They are made from four to eight feet deep, and from seven to twelve feet wide. In their construction large and powerful ditching machines are used that cut channels from two to three feet deep, and from five to seven feet wide, throwing the dirt from two to three feet away from the edge of the ditch. When once made, the expense of keeping the ditches in repair is inconsiderable, as they are kept clean by the currents of water flowing through them, which constantly wear them to greater depths and widths.

The tiles are placed from three to eight feet beneath the surface. The outlet tiles are put down from four to eight feet in the earth. Seven sizes of tile are in use, viz., 3-inch, 3½-inch, 4-inch, 6-inch, 7-inch, 8-inch and 10-inch, measured in the clear. Each tile is one foot in length. The larger sizes are used for outlets. There are four manufactories of tiles in Benton County, located, one at Fowler, one at Lochiel, one at Templeton and one at Oxford. They have the following combined daily capacity:

3-inch tiles	44,300
3½-inch tiles	14,000
4-inch tiles	32,500
5-inch tiles	28,800
6-inch tiles	20,600
7-inch tiles	10,000
8-inch tiles	11,000
10-inch tiles	7,200

But one of the factories makes 3½-inch tiles, and one of them makes none 7 nor 10 inches in diameter. The aggregate capacity per day of the four factories is 44,300 3-inch tiles, or 2,770 rods—nine miles—which will drain from 1,000 to 1,400 acres of land. Considering that a proper pro-

portion of outlet tiles are made, it is probable that the daily product of the tile factories in Benton County is sufficient to thoroughly drain 500 to 600 acres of land.

In making tiles the Fowler Steam Tile Works throw off about four inches of the top soil, then take one spade's depth (eighteen inches) of black loam and two spades' depth (thirth-six inches) of yellow clay, found just beneath, which, mixed properly, makes an excellent tile, which burns to a light red color. Lawson Brothers, at Oxford, use four feet of yellow clay, after throwing off eight inches of top soil. Lanum & St. Clair, at Templeton, throw off six inches of top soil, use fourteen inches of black loam and three feet of yellow clay. The factory at Lochiel uses about the same material as Lanum & St. Clair. Two kinds of mills are in use. The Auger mill is used by the Lochiel factory, and the Plunge mill by the factories at Fowler, Oxford and Templeton. No material difference is observed in the quality of the product of the different mills. The finished product from each factory seems to give entire satisfaction. The Fowler Steam Tile Works have two sheds for drying. In one they use steam and in the other air-dry. There seems to be no particular advantage in either method of drying. The other factories air-dry altogether.

The benefits of draining are very apparent. The drained swamps at once become easily tillable, and are the most productive lands in the county. The soil becomes loose, is easily cultivated, and responds generously to the labors of the husbandman. The older and higher lands are also greatly benefited by careful and thorough draining. An increase of twenty-five to seventy-five per cent. in the yield is accredited as the result of careful draining. Thoroughly drained lands more readily withstand the drouths, and the benefits derived during a wet season are incalculable. A few years more and all the lands in Benton County will be thoroughly drained.

SOIL AND PRODUCTS.

The soil of Benton County is everywhere a rich, black loam, composed largely of decayed vegetable matter, and, consequently, is very rich in those elements that go to build up the stock, blade and fruit of all cereals. The sub-soil in the central, northern and western portions of the county is a yellow clay, largely mixed with sand and vegetable mold. It is really a red loam, and when thrown to the surface, as is frequently done in ditching, and allowed to remain exposed for a year, it yields an enormous crop of corn. In the south-eastern part of the county, especially in the vicinity of Oxford, there is a much more compact soil, with a stiff, yellow clay sub-soil. The lands there are well adapted to the growth of wheat, and good yields are obtained. On account of the more compact

nature of the soil there, the roots of the cereals are not thrown out by the alternate freezing and thawing of the surface of the ground, as is the case in other portions of the county where there is more sand in the soil.

No county of land in the Union has so large a proportion of productive soil as Benton. The yield of corn, oats, grass and all the vegetables is simply enormous. In the short table below is given the yield of wheat, corn and oats in this county for the past five years. In the production of these crops it is equaled by but one county in the State—Tippecanoe.

<i>Year.</i>	<i>Wheat, bu.</i>	<i>Corn, bu.</i>	<i>Oats, bu.</i>
1879	71,161	3,315,387	399,192
1880	115,015	1,910,586	375,795
1881	95,910	2,447,343	515,093
1882	89,838	2,737,402	497,850
1883	36,394	1,917,345	804,829
1884	44,345	2,561,362	1,093,725

The value of the corn crop alone, in 1884, delivered at the elevators, was \$1,000,000. This is an enormous amount, considering that the entire population of the county is only about 12,000. More than 25,000 tons of hay were harvested in 1884, an average yield of nearly one and one-half tons per acre. The statistics above, are given merely to illustrate the productiveness of the soil, the soil that has been produced by the various geological changes of past ages.

The climate is not so well adapted to the growth of standard fruits, but all the small fruits may be obtained in great abundance and with comparative ease. The severe winter of 1884-5 destroyed many of the apple orchards, and created havoc among the peach trees. The citizens of the county should cultivate more of the small fruits, and depend upon other localities for the greater portion of other fruits.

TIMBER.

The timber area of the county originally consisted of a number of groves of limited extent. They comprised only about three per cent. of the area of the county. They dotted the surface of the wide-reaching prairie, and had the appearance of verdant islands lying placidly upon the bosom of some gently rolling sea. To the early settlers of the county they were like the oases among the eastern sands to the wandering tribes of the East. About them the first settlements in the county were made. Parish Grove is the largest in the county. It is situated in Parish Grove Township, seven miles south-west from Fowler. It was the summer home of the Kickapoo Indians, and derives its name from Parish, a prominent chief of that tribe. The representatives of the Kickapoos yet claim the grove as their property. The chief, Parish, lost his life here in 1830. The Indians built scaffolds in the trees upon which they slept.

Parish swung his hammock from a huge walnut, which the woodman's ax destroyed only six or seven years ago. The unfortunate chief was addicted to the use of the white man's distilled poison, and in attempting to climb to his perch while intoxicated, he fell from a dizzy height and broke his neck. He was buried in a small artificial mound upon the most prominent point of the ridge just west of the grove. From his grave is given a most magnificent view of landscape to the south, west and north. For twenty miles in each direction the wonderful panorama expands to the delighted eye. An excavation was made in the mound which brought to the surface some of the warrior's bones, but no relics of any kind were found. Denton's, or Walnut Grove, is in Gilboa Township, twelve miles north-east of Fowler; Sugar Grove, through which passes the boundary line between York and Parish Grove townships, is eleven miles north-west of Fowler, and Hickory Grove, in Center Township, is one mile west. West Hickory Grove is in the south-west corner of the county. There are oak groves along the eastern border of Pine Creek, and small oak groves along Mud Pine Creek near the line of Warren County. The timber in the oak groves is such as is usually seen growing contiguous to wide-reaching prairies, but the growth of Parish Grove consists of those species that form the dense forests of our rich bottom lands. Here, upon a high ridge, seven miles from any other timber, grew 700 acres of forest trees of gigantic size, and dense in their midst as are the forests of Africa. Linden trees of immense size, burr-oaks five or six feet in diameter, stately hackberries, monstrous elms and gigantic walnuts, that grew to be seven and one-half feet in diameter, and measured four feet across seventy feet from the ground. One giant among them measured seven feet three inches across the stump, and gave ninety feet of its immense length to be sawed into boards. Four, five and six feet were the common sizes of these forest monarchs. Five or six years ago a mill was set in the grove and the colossal forms of those magnificent trees were lowered by the ax, and now nothing remains of them but their desolate gigantic stumps and slowly decaying tops a hundred feet away. On the farm of J. M. Blasdel, which includes 130 acres of the grove, many dozen of those monstrous stumps were counted. On the adjoining farm of Mr. Henry Robertson, county commissioner, a number of those stately walnuts are yet standing, some of them exceeding four feet in diameter.

Almost every enterprising farmer in the county has set out groves of native forest trees upon his lands. These artificial groves cover ten, twenty, and sometimes even forty and eighty acres. Set out ten to forty years ago, the trees in many of them have grown to the diameter of a foot or more, and the beautiful parks, thus artificially formed, have the appearance of nature's original handiwork. It is difficult to estimate the value of these groves that are at once so beautiful and so useful.

COMMERCE.

It is well known that there are no navigable streams or canals in Benton County. The commercial highways of the county at present are embraced in its various railways. The Cincinnati, Indianapolis, St. Louis & Chicago Railroad enters the county at the south-east corner, and running in a north-west direction, passes out of the county at the north-west corner, thus running diagonally through the center of the county. The Chicago & Indiana Coal Railway runs due north and south through the county, and almost through the geographical center. It enters the coal fields of Warren and Fountain counties, and brings cheap fuel to the inhabitants of Benton. The Lake Erie & Western Railway runs east and west through the southern part of the county, about two miles north of the Warren County line. These thoroughfares furnish ample shipping facilities for all the business of the county. The many railroad stations give every convenience for the prompt shipment of stock—and Benton County is noted for its cattle and hogs—and all other articles of produce. As this is wholly an agricultural county, the present facilities for shipping are considered adequate to the wants of its citizens. Indianapolis, Chicago and St. Louis are its ready markets. Heavy shipments of stock and grain, however, are made to New York.

HISTORY, ETC.

The first settlements in Benton County were made probably in 1830 or 1831, on Pine Creek, in the eastern part of the county. Soon after this settlements were made at Parish Grove, and in the oak groves in the vicinity of the town of Oxford. Other settlements soon followed in the vicinity of the other groves of the county. The county organization was effected in 1840. Uniform prosperity has attended the various efforts of the citizens to build up their locality. The county seat was originally at Oxford, in the southern part of the county, but a few years ago it was moved to Fowler, the exact center of the county, where there is an elegant and commodious court-house, built at an expense of \$55,000. The jail is a magnificent structure, and would be a credit to any county in the State. It is built of handsomely dressed Indiana limestone, is located in tastefully ornamented grounds, and has more the appearance, from the outside, of an elegant private residence than of a jail. Besides Fowler and Oxford, there are Earl Park, Raub, Ambia, Talbot, Boswell, Chase, Templeton, Lochiel and Wadena—all thriving towns or villages.

GEOLOGY.

The strata of this county, as far as they have been revealed, are arranged as follows:

GENERAL SECTION.

Soil	10 ft. to	3 ft.
Alluvium	2 ft. to	10 ft.
Bowlder Drift	40 ft. to	250 ft.
Conglomerate sandstone		33 ft. 6 in.
St. Louis limestone		7 ft. 3 in.
Keokuk limestone and shales		73 ft.
Total		376 ft. 9 in.

It is difficult to present an accurate section of the strata of Benton County. That given above is made up of more than one hundred sections taken in different parts of the county. W. J. and L. Templeton, with others, bored to the depth of 500 feet on their farm, five miles southwest of Oxford, section 32, township 24, range 8, west, several years ago, with the hopes of finding coal. An accurate survey of the strata was made at the time, but, unfortunately, the papers were burned in a fire that destroyed Col. W. J. Templeton's office a few years later. From the gentlemen connected with the work the following section was obtained:

SECTION ON COL. TEMPLETON'S FARM.

Soil	2 ft.
Yellow clay	10 ft.
Blue clay	25 ft.
Gas—burned for weeks.	
Blue clay	90 ft.
Cemented gravel	25 ft.
Yellow clay and gravel	110 ft.
Black shale (?)	10 ft.
Clay and sand	100 ft.
Gray limestone	90 ft.
Shales and limestones	75 ft.
Total	537 ft.

The section above may not be wholly accurate. Col. W. J. Templeton, in giving it from memory, thought it probable that he was not altogether correct. No coal, however, was reached in the bore. The gas, which burned readily, continued to discharge from the well for several months. Three-fourths of a mile east of the Templeton well, on the farm of Mr. J. K. Adkinson, a well was bored and a gas vein struck several years ago. The gas still flows, and burns readily. At one time it continued to burn for a period of six months. In the Adkinson well the gas flows from a depth of forty feet. In several other wells in the same locality

gas has been found at depths of thirty-five to forty feet. On the farm of J. W. Swan, at Mount Nebo, section 20, township 26, range 7, west, gas was found in the blue clay at a depth of 61 feet. It flowed for half a day, and emitted such a strong odor that it drove the workmen entirely away from their work. In every instance in this county the gas has been found in the blue clay.

KEOKUK LIMESTONE.

There are two small quarries of this stone in Benton County. One on Pine Creek, on the farm of Mr. Stevenson, section 24, township 25, range 7, west, has furnished some very good material for foundation work. The quarry is exactly in the bed of the creek, and it is difficult to make a thorough examination of it on account of the water, which rises above the top of the strata. It is a buff-colored limestone on top, and changes to a light gray lower down. A few fragmentary fossils, characteristic of this group, were found here. The following section was obtained :

SECTION AT STEVENSON'S QUARRY.

Soil	2 ft.
Gravel	2 ft. 6 in.
Buff limestone—rotten	7 in.
Buff limestone	3 in.
Gray limestone and fossils	5 in.
Gray, cherty limestone	2 ft. 4 in.
Total	8 ft. 1 in.

On the farm of Mr. A. D. Raub, section 14, township 26, range 9, west, is located another quarry, with a little better exposure. It is on Sugar Creek, one mile north of Earl Park. The stone there is thinly bedded, gray in color, soft and shaly on top, but cherty and concretionary lower down. Like the quarries on Pine creek, this is in the bed of the creek, and the water prevents a thorough examination of the strata. There is here, however, an exposure of three and one-half feet above the water. This stone has been used to some extent for foundations for small buildings, but it does not weather well, and is too thin and shaly to be of much value. No effort has been made to burn it into lime, and an effort of that kind would hardly be remunerative. Below is given the section as far as exposed :

SECTION AT RAUB'S QUARRY.

Soil and gravel	4 ft.
Shaly limestone	2 ft. 6 in.
Gray limestone, chert	8 in.
Gray limestone, geodes, geodized shells	1 ft. 5 in.
Gray limestone, stems and plates of crinoids	2 ft.
Total	10 ft. 7 in.

ST. LOUIS LIMESTONE.

On Pine Creek, in section 28, township 26, range 7, west, Union Township, a quarry of stone was opened some years ago, which furnishes stone of a good quality for foundation work or bridge abutments. It is an evenly-bedded, light gray limestone, in ledges of three to four inches in thickness. It may be quarried in pieces of any size, and is an excellent flagging stone. It stands the weather well, and does not scale nor split on exposure to the frosts. The abutments of the Pine Creek bridge, one-half mile below the quarry, were made of this stone some years ago, and the rains and frosts have not marred nor injured them in the least. Among the fragments thrown out of the quarry were found an abundance of plates and spines of *Archæocidaris*, an *Actinocrinus*, plates of *Pentremites*, and two small crinoids on one fragment, too indistinct, however, to determine their species. This quarry, which is on the farm of Mr. Nutt, is, like the others, covered entirely by the waters of the creek. A kind of dam must be made and the water pumped out when the quarry is worked. As there is only very light local demand for the stone, the owner of the land gives it no attention. Whenever a farmer wants any of it for his own use he goes and quarries it himself, and that is the end of it. Below is given the

SECTION AT THE NUTT QUARRY.

Gravel, coarse	4 ft.
Gray limestone	3 in.
Gray limestone	2 in.
Gray limestone	3 in.
Gray limestone	4 in.
Gray limestone	3 in.
Gray limestone, 2-in. to 4-in. ledges.	6 ft. 6 in.
Total	11 ft. 9 in.

CONGLOMERATE SANDSTONE.

Mount Nebo, in Union Township, is eight miles north-east of Fowler. It is an elevated table-land or plateau, originally prairie, and forms part of the high land known as Blue Ridge. From Mount Nebo there is a gentle slope to the north, and a somewhat more rapid decline toward the south. There is also a slight decline to the east and west. From this point a splendid view of the country is obtainable for a distance of fifteen to twenty miles to the north and south, and of five to eight miles to the east and west. From the summit of Mount Nebo two miles to the south-east is the quarry of St. Louis limestone, on the farm of Mr. Nutt. The summit of Mount Nebo is about one hundred feet higher than the bed of

Pine Creek at the quarry. Mount Nebo, like every other portion of the county, has a great depth of Drift. Here, however, the Drift rests upon a stratum of sandstone, as yet not found in any other locality. In boring a well upon the farm of Mr. J. W. Swan, section 20, township 26, range 7, west, exactly at the summit, a stratum of sandstone was found thirty-three feet six inches in thickness. Near the top of the stratum it is soft, coarse, argillaceous, and of a dark yellow color, changing to a dark red, with traces of iron. Toward the bottom it is a fine-grained, compact stone of a dull gray color. The entire stratum is so soft that the workmen bored or drilled entirely through it in a little less than two days. There is no outcrop of this stone anywhere in the county, and here it seems to lie beneath but a limited area. It is probably a remnant of the great mass of conglomerate that once covered the entire county to the depth of many feet. From its summit may be measured the depth of the Drift in the deeply eroded valleys to the south, and in a measure, computed the strength of the force that swept from the surface hundreds of feet of solid rocks and ground them into the dust that now forms the clays and soils. Below is given the section of Mr. Swan's well:

SECTION NO. 1.

Soil	1 ft. 8 in.
Yellow clay	9 ft.
Blue clay	51 ft. 10 in.
Cavity from which flowed gas	10 in.
Blue clay	11 ft. 6 in.
Cemented gravel	1 ft.
Quicksand	6 ft.
Sandstone	33 ft. 6 in.
Gravel and water	8 in.
Limestone.	
Total	116 ft.

About one hundred and fifty yards south-west of the well of which the above survey is given Mr. Swan bored a second well. The surface there is probably thirty to forty feet lower than at No. 1. No sandstone nor other rock was struck in the second well. The following is the

SECTION OF WELL NO. 2.

Soil	2 ft.
Blue clay, unstratified	80 ft.
Water at	82 ft.

South-east of No. 1 about a half-mile Mr. Swan bored a third well, which is well down the slope of Mount Nebo. The survey of No. 3 is here given:

SECTION OF NO. 3.

Soil	2 ft.
Yellow clay	9 ft.
Stratified blue clay, sand veins	14 ft.
Quicksand	2 ft.
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Water at	27 ft.

On the south line of section 20, township 26, range 7, Mr. Swan bored a fourth well.

SECTION OF NO 4.

Soil	2 ft.
Yellow clay	7 ft.
Blue clay	10 ft.
Hardpan	2 ft.
Cemented gravel	10 ft.
Sand and gravel	3 ft.
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Water at	34 ft.

In Gilboa Township, two miles east of Mr. Swan's, a well was bored by Mr. Crane, of Earl Park. No sandstone was found, but it gave the following

SECTION.

Soil	2 ft.
Yellow clay	20 ft.
Blue clay, with veins of sand	136 ft.
Gray hardpan	15 ft.
Black shale	8 ft.
Water sand	1 ft. 6 in.
Blue shale	5 ft.
Cherty limestone	1 ft. 6 in.
Black shale	4 ft.
Blue shale	3 ft.
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Total	196 ft.

The above sections, obtained from points so near Mount Nebo, show clearly that the sandstone is confined to a very limited area. And, though it rests upon the St. Louis limestone, its general characters seem to indicate that it is conglomerate.

COAL.

There are no outcrops of coal in this county, and it is altogether improbable that there is any to be found beneath the surface. There are some of its citizens, however, sensible men, too, who firmly believe that coal may be found. Workmen who bored a well for Mr. Schlautenhofer, section 1, township 26, range 9, immediately upon the Newton County line, claimed that, at a depth of one hundred and four feet they struck a

four foot coal seam. They brought a black substance to the surface that was pronounced to be coal. They claimed at first that the coal seam was seven feet, but afterward found that its thickness was but four feet. From Mr. Schlautenhofer the following section was obtained :

SECTION AT MR. SCHLAUTENHOFER'S.

Soil	2 ft.
Blue clay with sand veins	68 ft.
Soapstone	34 ft.
Coal	4 ft.
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Water at	108 ft.

Considerable excitement was created by the announcement that coal was found here. To test the matter, Mr. Schlautenhofer was induced to bore another well, one hundred and twenty rods west of the first. The first bore was made for water, with no expectations nor thought of finding coal. The same workmen were employed. The following is the

SECTION OF NO. 2.

Soil	2 ft.
Yellow clay	6 ft.
Blue clay	60 ft.
Soapstone	36 ft.
Coal	4 ft.
Soapstone	15 ft.
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Total	123 ft.

It is a little remarkable that, although the second boring was on much lower ground than the first, coal should be reached at exactly the same depth—one hundred and four feet. The parties who did this work for Mr. Schlautenhofer were professional well borers, and got so much per foot for their labor. It is probable that they either willfully deceived Mr. Schlautenhofer or else they were mistaken themselves. They might have bored through a black bituminous shale, and mistaken it for coal. Other sections, taken in this immediate neighborhood, show clearly that no coal is to be found. Only a mile and one-half south, section 13, township 26, range 9, on the farm of Mr. Robert D. Miller, the following survey was obtained :

SECTION AT ROBERT D. MILLER'S.

Soil	3 ft.
Yellow clay	4 ft.
Hardpan	4 ft.
Black muck	5 ft.
Blue clay	25 ft.
Yellow clay	3 ft.
Gray limestone (St. Louis and Keokuk).	63 ft.
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Water at	107 ft.

Mr. Adam Roth's well, in section 7, township 26, range 8, west—his farm adjoining Mr. Schlautenhofer's—gave the following :

SECTION OF MR. ROTH'S WELL.

Soil	2 ft.
Yellow clay	4 ft.
Blue clay	44 ft.
Fine sand	2 ft.
Blue clay	57 ft.
Water at	109 ft.

No soapstone, nor any indications of coal, were found here nor at Mr. Miller's place. Two wells were bored on the farm of Mr. Antony Dehner, county commissioner, north-east quarter same section, township and range as Mr. Roth. The following is the

SECTION OF WELL NO. 1.

Soil	5 ft.
Yellow clay	4 ft.
Yellow quicksand	8 ft.
Blue clay	19 ft.
Gravel and water at	36 ft.

Well No. 2, is fifty yards south of No. 1.

SECTION OF WELL NO. 2.

Soil	4 ft.
Yellow clay	11 ft.
Gravel	5 ft.
Blue clay	55 ft.
Water at	75 ft.

Two miles north of Mr. Schlautenhofer's there is an outcrop of limestone on the farm of John McKee. The McKee farm is in Newton County. According to Prof. Collett, the stone at the McKee quarry is classed by Prof. James Hall, of New York, as Silurian. If so, and the strata are in place, it is highly improbable that coal should be found only two or three miles south. Also, it is only about three miles south-west to the quarry of Keokuk limestone on Mr. N. D. Raub's farm. With these facts stated, it is difficult to assume that there is coal underlying the farm of Mr. Schlautenhofer. It is well to state here that the water flowed to the height of five or six feet from well No. 1, on Mr. Schlautenhofer's farm, as long as the tubing remained in it.

On the farm of Mr. A. C. Boswell, section 9, township 25, range 9, west, it is claimed that coal was found in boring for water. The following is the section :

SECTION NO. 1.

Soil	5 ft.
Yellow clay	12 ft.
Gravel	6 in.
Blue clay	22 ft.
Coal	Trace.
Black slate	6 in.
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Water at	40 ft.

Well No. 2 was bored thirty feet south of No. 1.

SECTION OF NO. 2.

Soil	3 ft.
Yellow clay	12 ft.
Gravel	6 in.
Blue clay	25 ft.
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Total	40 ft. 6 in.

No other indications of coal exist in the county. An occasional slab may be found imbedded in the Drift, but the glaciers and sands and waters of time have completely obliterated all the strata of coal, if any ever existed in the county.

THE DRIFT.

The remarkable development of Drift in this county makes it of special and puzzling interest to the geologist. The speculations of the many eminent geological writers upon this subject have added little real knowledge as to the origin of this wonderful formation, or its subsequent modifications. The most intelligent and best-arranged theories yet advanced are still subject to many serious objections. It is to be hoped that the day will speedily dawn when the veil will be lifted, and the light of knowledge will illuminate the dark pages of its mysterious history. The Drift here consists of sand, gravel, cemented gravel, blue and yellow clay and boulders. Boulders of large size are found on the surface in every part of the county. In some localities they are widely scattered, and in others they lie about in great profusion. They consist of various forms of igneous and plutonic rocks, and vary in size from a few inches to eight or ten feet in diameter. They are more profusely found upon the lower ground, resting upon the blue clay, which, about the swamps and bogs, lies just underneath the soil. Along the various creeks of the county they are found in great numbers. Along the south side of Mud Creek they are in such great numbers and of such large size as to be a great obstacle to the farmers. They are being utilized, in the absence of other material, for house and barn foundations. Many of them can be readily

worked, and when once placed they are most durable and substantial. They are also broken and used as foundations for gravel roads, and for this purpose they are specially well adapted.

Gravel of good quality for making roads may be found in every part of the county. In many places these deposits lie just underneath the soil. There are but seven miles of gravel road in the county. The mud roads are almost impassable during a great part of the winter. The great inconvenience of such highways is a serious drawback to the county. If the roads are properly graded, and thoroughly drained, a proper depth of this gravel will make them equal to any roads in the State. Not less than eight inches should be used, and a depth of twelve or fourteen inches is much better. Broken bowlders placed upon the road-bed, and then covered with gravel, make a much more substantial and durable road.

Along the eastern border of Benton County was once a deep, eroded valley, now filled with the *debris* of ages, which is called Drift. Following nearly the course of Pine Creek to within three miles of the Warren County line, the gorge made an abrupt turn to the right, and crossed to the south-west corner of the county. Its greatest depth is not known, but on the farm of Col. Templeton, section 32, township 24, range 8, west, it was 262 feet beneath the present surface of the ground. The altitude of the surface is here about 705 feet. Mount Nebo is 795 feet above the ocean. The top of the conglomerate sandstone there is eighty-one feet beneath the surface. From the top of the sandstone at Nebo to the top of the shale in the Templeton bore is 271 feet. But this probably lacks hundreds of feet of being the true measure of erosion in this county. The sandstone at Mount Nebo is covered by eighty-one feet of Drift, a section of which was given from the well of Mr. J. W. Swan.

At Earl Park Mr. P. M. Crane bored a well which shows the exact character and depth of the Drift there.

SECTION OF WELL AT EARL PARK.

Soil	2 ft. 2 in.
Yellow clay and gravel.	16 ft.
Blue clay	40 ft.
"Liver sand," a packing, gray sand	20 ft.
Blue clay	12 ft.
Gray limestone	10 ft.
Blue limestone.	2 ft.
Water at	102 ft. 2 in.

At his elevator, at Fowler, Mr. O. Barnard bored a well which shows about the same Drift.

SECTION OF MR. BARNARD'S WELL.

Soil	3 ft.
Yellow clay	10 ft.
Blue clay	87 ft.
To solid limestone—no water	100 ft.

A well bored for Mr. A. D. Raub, at Earl Park, near his warehouse, gave the following:

SECTION OF MR. RAUB'S WELL.

Soil	2 ft.
Yellow clay	12 ft.
Blue clay	66 ft.
Gray limestone.	30 ft.
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Water at.	110 ft.

On Mr. Raub's farm, two miles east, and half mile north of Earl Park, gave the following

SECTION.

Soil	2 ft.
Yellow clay	14 ft.
Blue clay	34 ft.
"Marble"—gray limestone.	4 ft. 6 in.
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Water at.	54 ft. 6 in.

On the farm of Mrs. Sumner, at Sugar Grove, six miles south-west of Earl Park, Mr. P. M. Crane bored a well from which was obtained the following section.

SECTION OF MRS. SUMNER'S WELL.

Soil	1 ft. 6 in.
Yellow clay	10 ft.
Yellow quicksand.	4 ft.
Blue clay	26 ft.
Gray limestone.	6 ft.
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Water at.	47 ft. 6 in.

At the residence of Mr. Van Nata, one-half mile west of Fowler, section 17, township 25, range 8, west, the following section was obtained.

SECTION OF MR. VAN NATA'S WELL.

Soil	3 ft.
Yellow clay.	10 ft.
Blue clay	17 ft.
Gravel	1 ft.
Blue clay.	60 ft.
Limestone	2 ft.
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Water at.	93 ft.

On the north-east quarter of the same section, township and range, a well was bored for Mr. Fowler, and, although it reached the depth of 150 feet, no limestone was found. There is little if any difference between the altitude of the surface here and at Mr. Van Nata's residence.

SECTION OF MR. FOWLER'S WELL.

Soil	3 ft.
Yellow clay	10 ft.
Blue clay	87 ft.
Gravel and sand	50 ft.
Total	150 ft.

The two wells last mentioned were both bored under the superintendence of Mr. Van Nata. They are but two or three hundred yards apart. In the first, limestone was reached at a depth of ninety-one feet. In the other, gravel was found 100 feet below the surface. The total thickness of the gravel is more than fifty feet, as it was not passed through. A deep hole seems to have been scooped out here by the forces once in existence. Subsequently, the cavity was filled with gravel to about the level of the limestone, and then the blue clay was spread over all.

If the soil, clays, sand and gravel of this county were all removed, and the rocks laid bare, its surface configuration would be very much changed. West and north of the center of the county would appear a comparatively level tract of gray limestone. The surface of the rocks would be worn smooth, and occasionally great holes, or hollows, would be observed that were scooped out, worn or eroded before the deposition of the Drift began. Over this area there would be a slight but continued descent to the south until the neighborhood of Parish Grove was reached, when the descent would become more rapid into the deep valley that crosses the southern part of the county. North and east of Fowler the rocks would still be worn smooth on the surface, but they would be much higher, and the surface more uneven. At Mount Nebo and Mount Gilboa, too, perhaps, the St. Louis limestones would be seen, capped with a thick stratum of conglomerate sandstone. North-east of Earl Park, just over the line in Newton County, the tilted limestone in McKee's stone quarry would appear like quite a mountain. East and south of Fowler, for a distance of five or six miles, the uneven surface of gray Keokuk limestones would appear, and beyond this there would be an abrupt descent to the east and south into the deep valley eroded ages ago. The few outcrops of stone, and the numerous sections of accurate borings obtained in its survey, clearly indicate that the rock deposits of the county belong chiefly to the Sub-Carboniferous formation, and the above is probably a nearly accurate description of their position.

Clay, gravel and sand now cover the rocks, but the blue clay does not always rest primarily upon them. Sometimes a stratum of gravel or sand intervenes. However, with the exception of the immediate vicinity of the few rock exposures, the blue clay is not absent in any part of the county. The highest and lowest lands respectively have their stratum of blue clay of greater or less depth. Boulders of small size are common in

it. In the south-western part of the county they are quite numerous near or at the bottom of the stratum. They are frequently found in boring wells, but no scratched or striated ones have ever been brought to the surface so far as observations have gone. The blue clay does not always consist of a single stratum. It is often separated into several strata by intervening veins, or strata of sand or gravel. These vary from a few inches to several feet in thickness. The following sections show the character of the deposit as it appears in this county:

SECTION OF COL. TEMPLETON'S WELL AT TEMPLETON.

Black soil	5 ft.
Yellow clay and sand	8 ft.
Blue clay	42 ft.
Gravel	13 ft.
Blue clay	—
Water at	68 ft.

SECTION OF J. D. STENGLE'S WELL AT TEMPLETON.

Soil	5 ft.
Yellow clay	8 ft.
Blue clay	41 ft.
Hardpan	6 ft.
Water	20 ft.
Total	80 ft.

Here, after passing the hardpan, the rods dropped twenty feet through what appeared to be a subterranean lake. The water rose to within twenty feet of the surface.

In the south-west corner of Pine Township, seven miles north-east of Templeton, was obtained a

SECTION OF WARREN SHEET'S WELL.

Soil	4 ft.
Blue clay	20 ft.
Cemented gravel	60 ft.
Water sand	5 ft.
Gravel and water at	89 ft.

Two miles east of Templeton, section 22, township 24, range 7, west, at the well of W. J. Templeton, the following section was obtained:

SECTION OF W. J. TEMPLETON'S WELL.

Soil	2 ft.
Yellow clay	10 ft.
Blue clay with sand veins	75 ft.
Cemented gravel	20 ft.
Yellow clay and sand	70 ft.
Water at	177 ft.

Section of Pat. Bagley's well, three miles north of Ambia, one mile east of the State line:

SECTION.

Soil	4 ft.
Yellow clay	10 ft.
Blue clay	80 ft.
Fine, dry, white sand	20 ft.
Blue clay	46 ft.
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Water at	160 ft.

Section of well on the Dodge land in Illinois, three miles north of Ambia, one-half mile west of the State line:

SECTION.

Soil	3 ft.
Blue clay	42 ft.
Gravel	2 ft.
Blue clay	114 ft.
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Gravel and water at	161 ft.

In the well last described Mr. Charles Haver, who bored it, struck bowlders at a depth of 142 feet, and they were plentiful to the bottom of the stratum of blue clay, 19 feet lower.

Section of Mr. John Shilling's well, four miles north-east of Ambia:

SECTION.

Soil	3 ft.
Sand	25 ft.
Blue clay	50 ft.
Quicksand	16 ft.
Blue clay	20 ft.
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Water in gravel at	114 ft.

Mr. James Siddon's well, two miles north, one mile west of Talbot:

SECTION.

Soil	4 ft.
Fine sand	20 ft.
Blue clay	39 ft.
Hardpan	2 ft.
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Gravel and water at	65 ft.

Two miles north of Talbot was obtained a

SECTION OF DAVID SELF'S WELL.

Soil	4 ft.
Blue clay	44 ft.
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Gravel and water at	48 ft.

Three miles north of Boswell, on section 1, township 24, range 9, west, was obtained a section of Mr. A. K. Dills's well:

SECTION.	
Soil	3 ft.
Loose gravel	15 ft.
Blue clay	3 ft.
Cemented gravel	44 ft.
Water at	65 ft.

Section of Prof. J. P. Doyle's well, section 34, township 25, range 8, west:

SECTION.	
Black loam	2 ft.
Yellow clay	3 ft.
Blue clay	4 ft.
Coarse gravel and sand	1 ft. 6 in.
Water at	10 ft. 6 in.

Section of ditch through a slough on Prof. Doyle's farm:

SECTION.	
Black muck	2 ft. 6 in.
Blue clay	1 ft.
Coarse gravel	1 ft.
Total	4 ft. 6 in.

Section of Mr. Jonathan Howell's well, section 25, township 24, range 9, west, two miles south of Boswell, one mile north of the county line. Water was found in the gravel.

SECTION OF MR. HOWELL'S WELL.	
Soil	1 ft. 6 in.
Yellow clay	12 ft.
Blue clay	34 ft.
Quicksand	20 ft.
Gravel	66 ft.
Water at	133 ft. 6 in.

The two sections given below are both on the lot of Mr. Abe. Potter, at Boswell. They are only 40 feet apart.

SECTION OF WELL NO. 1.	
Soil	1 ft. 6 in.
Fine sand	12 ft.
Quicksand	17 ft.
Total	30 ft. 6 in.

SECTION OF NO. 2, 40 FEET WEST.	
Soil	1 ft. 6 in.
Yellow clay	15 ft.
Blue clay	23 ft.
Total	39 ft. 6 in.

Mr. Wm. Bennett, section 33, township 25, range 9, four miles east of the State line, bored a large number of wells on his lands, many of them nearly to the depth of the one described below. There was but little difference observed in the character of the clays, sand and gravel in them. The section here given is from the well at Mr. Bennett's residence. It is upon a high ridge.

SECTION OF MR. BENNETT'S WELL.

Soil	4 ft.
Yellow clay	16 ft.
Blue clay	27 ft.
Hard, gray clay	12 ft.
Green-gray clay.	7 ft.
Green and gray clay	74 ft.
Fine gravel	4 ft.
Green clay.	18 ft.
Coarse gravel.	8 ft.
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Water at.	170 ft.

In the railroad cut at Gravel Hill, on the C., I., St. L. & C. R. R., was obtained the following

SECTION.

Soil and sand	3 ft.
Coarse gravel	4 ft.
Gravel partially cemented	23 ft.
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Total.	30 ft.

It has been mentioned that the ridges of the county extend in an easterly and westerly direction. They are nearly parallel. The question arises: Are they of glacial origin?—are they moraines? It seems that the answer should be, in the strictest sense, they are not. They do not possess that heterogeneous mixing of elements—clays, gravel, sand and bowlders—asccribed to glacial moraines in an unmodified form. The ridge here consists of the same stratified deposits common to all parts of the county. The blue clay does not conform exactly to the surface of the rock deposits of the county, but it does nearly so. It lies upon them like a great sheet of fallen snow upon the surface of some undulating prairie, blown occasionally into great heaps by the drifting winds. In the ridges the blue clay is undisturbed; the gravel and sand deposits are undisturbed. The beds of gravel, sand and clay lie in their original position here, as they do in the long, wide reaches of lower land adjoining. It is not probable, strictly speaking, that the ridges here are glacial moraines. Glaciers did not assort their materials and spread them out in even layers. On the contrary, they plowed their way through every obstacle, and pushed everything before them, a confused and mingled mass. And though it

is quite evident that all the material of the Drift is of glacial origin, it is probably true that the topography of the county is due to a post-glacial agency.

No peat is found or worked in this county, but it is said that a substance resembling peat may be found in a swamp, or bog, on section 29, township 26, range 7, and also in a swamp in section 6, township 25, range 6. During the dry season of 1856 a fire occurred in both these places, which continued to burn for months. The fire extended over many acres, and burned holes to the depth of eight or ten feet in places. No effort has ever been made to procure any of this "peat" for use.

Some years ago a number of hickory logs, or trees rather, were found imbedded in the black muck of a swamp in section 28, township 25, range 7. They were about four feet below the surface. A number of hickory nuts were also found. This point is several miles from any hickory timber.

In digging a well on section 36, township 25, range 9, at the residence of Charles Boswell, a piece of wood, apparently a cedar root, was found in the blue clay sixteen feet below the surface. It is now in the possession of Mr. Henry Robertson, county commissioner.

There are several flowing wells in the county. One most worthy of note is that of Lawson Brothers, at their tile-works, Oxford. It was bored to a depth of fifty-two feet, and the water flows five or ten feet above the surface. There is a strong flow of water, which is not in the least affected by the weather. The water is strongly impregnated with iron and somewhat with sulphur.

ANTTIQUITIES.

There are no mounds or other earthworks in the county. The wide prairie was not a suitable place for a permanent home for Mound Builders. But few relics have ever been found in the county. Dr. J. S. May-ity has a fine stone maul, found in the Drift in the southern part of the county, and also a few arrow heads. Mr. Henry Robertson, of Parish Grove, has a few arrow heads picked up in that locality. In the neighborhood of Oxford a few arrow heads have been found.

THANKS.

For valuable information and assistance, thanks are due Dr. J. S. May-ity, Mr. John Lewis, editor of the *Era*, Mr. Eastburne, editor of the *Review*, and County Superintendent Johnston, at Fowler; Mr. A. B. Raub and P. M. Crane, at Earl Park; Mr. J. M. Blasdel, at Parish Grove; Mr. Charles Haver, at Templeton, and others,