GEOLOGY OF TIPPECANOE COUNTY.

S. S. GORBY.

GENERAL DESCRIPTION AND HISTORY.

Tippecanoe County is situated in the west-central part of the State and is bounded on the north by White and Carroll, on the east by Carroll and Clinton, on the south by Montgomery, and on the west by Fountain, Warren and Benton counties. It is separated from the boundary line of the State of Illinois by the three counties last named. The county is twenty-one miles wide, east and west, and its length is twenty-four miles. Its entire area is 504 square miles. About one-half the surface consists of broad, fertile and nearly level plains. The balance consists of gently-rolling uplands, steep hillsides or rich alluvial bottoms. Occasional swamps or bogs are seen with deep, lacustral deposits.

The earliest settlements in the county were made by the French on the Wabash River, at the Indian town of Ouiatenon, which occupied the beautiful and fertile region on the south bank of the Wabash, known as the Wea Plains. This town contained an Indian population of more than 500. For many years it was the chief town in all the Northwest Territory. It was the point of general rendezvous for many of the principal tribes of the great Northwest. The French settlement in this place consisted of forty or fifty wooden houses. The Indians lived in wooden houses, wigwams and tents. The extensive tract of land, Wea Plains, contains sixty-five or seventy sections of the most beautiful and productive lands in the county. This land was thoroughly cultivated by the natives for many years. The rich soil produced abundant yields of their native maize or corn. The entire town and all the crops were destroyed by an expedition directed by General George Rogers Clark, in 1791. General Charles Scott and Colonel Wilkinson had immediate command of the expedition. The French who were merely traders and mechanics, never attempted to settle here again. The Indians long attempted to maintain their right to these beautiful lands, and it was not until after the disastrous battle of Tippecanoe that they finally yielded to the decree of force.

The Indians also had a populous village at Prophet's Town, near the mouth of Burnett's Creek, in the northeastern part of the county. This

was the home of Law-le-was-i-kaw, the Shawnee prophet, half-brother of Tecumseh, the famous Shawnee chief. Near the latter village occurred the famous battle of Tippecanoe, which was fought on the 7th of November, 1811. The Indians were under the command of the Shawnee prophet. His forces were made up of warriors from the Shawnees, Pottawatomies, Miamis, Sacs, Winnebagoes, Kickapoos, Chippewas, Ottowas and Wyandots. General Harrison's force, consisting of about 900 men, was encamped upon the narrow ridge separating Burnett's Creek on the north from a deep, impenetrable swamp or morass on the south. The ridge is about a mile in length and it runs to a point at its southwestern extremity. Its general direction is northeast and southwest. The whites were encamped at its southwestern extremity. The Indians were encamped upon the high ground lying between the swamp and the Wabash River. The Wabash river is one mile south of the battle ground. Tippecanoe River is two miles east. The impassable swamp lay between the hostile forces. The bluffs of Burnett's Creek are high and precipitous on the north. They are formed of great masses of piled-up gravel, cemented together with carbonate of lime and iron. About one-half mile below the western limit of the ridge upon which the Americans were encamped, and on the opposite side of the creek, is an immense mass of conglomerate, high and picturesque, which overlooked the camp of the Americans and all the region beyond. This rock has been worn into caves and grooves and arches by the eroding forces of past years. It is said that the Indian prophet stood upon this eminence to give the signal for attack on the morning of November 7th, 1811. The attack was begun just before the break of day. By wading up Burnett's Creek the Indians reached the camp of the Americans. The surprise was almost complete, and the issue of the battle for a long time doubtful. The Indians were finally compelled to flee, and the dissolution of the great Northwestern Confederacy was complete. The white despoiler retained the land and the Indian pursued his way toward the setting sun. The loss was nearly equal on both sides, the Americans having 37 killed and 154 wounded; the Indians having 38 killed and 160 wounded. Many relics of the great battle have been found in the vicinity. An occasional rusted rifle barrel is yet picked up in the swamp just south of the battle ground. This swamp has recently been drained and is now yielding excellent crops. A neat iron fence, which was built by the State, encloses the scene of the battle, but the graves of the heroes who fell there are sunken and neglected—unmarked by any suitable monument.

The earliest English settlements in the county were made about the year 1815, or a little later. Patrick Henry Weaver, the oldest settler now living, was one of the earliest settlers on the Wea Plains. He moved to the county in 1823, and it has been his continuous residence ever since. There were but thirteen families in the county when Mr. Weaver first set-

tled there. The population of the county has since increased to 40,000.

Lafayette was settled in 1825; Dayton, in the eastern part of the county, was settled in 1829, and Romney, in the southern part of the county, in 1832. Lafayette at the present time claims a population of about 25,000. It has an excellent city government, and many substantial and beautiful public buildings. The new court house, built of Indiana limestone, at an expense of about $500,000, is one of the finest buildings of the kind in the State. It is a credit to the county, an ornament to the city, and will be a permanent advertisement of the beauty and durability of the Indiana building stone.

The public schools of the city, under the able management of Prof. Merrill, City Superintendent, afford excellent and unsurpassed facilities for the education of the rising generation. The school buildings are elegant and commodious, and are so situated as to be easily accessible to all who may wish to attend them. The enrollment of pupils is large in proportion to the population of the city and the total enumeration for school purposes.

Many fine churches adorn the city. In fact, it may be called the "City of Churches" as well as the "Star City," as there are no less than twenty-nine commodious buildings controlled and occupied by the various church organizations of the city. Thirteen newspapers are published in the city, devoted to news, politics, agriculture, temperance and religion.

Purdue University is located here. This excellent institution is under the management of the State. It affords ample facilities for students in the classical and scientific departments. Special attention is here given to the mechanical and agricultural arts. In this respect there is not a similar institution in the State. In these departments, as in all others, Purdue ranks with the very best institutions in the Union. Exceptionally good facilities are here afforded for the study of geology. A large library of rare books, and an extensive cabinet of fossils and minerals, together with an excellent corps of teachers, enable the students to rapidly acquire a knowledge of geolgical formations, and the characteristic fossils of the various periods and groups. Nearly two hundred acres of land are devoted to scientific, experimental farming. All observations are carefully recorded, and valuable discoveries are immediately published. The University buildings are located about a mile west of the city, upon high and beautifully ornamented grounds. Dormitories and boarding houses afford ready accommodations for students. Under the able management of President James H. Smart, the attendance of students is rapidly increasing. The enrollment at this time is larger than ever before attained.

Tippecanoe County was organized in 1826, ten years after the admission of the State into the Union. It has steadily increased in population and wealth. It is noted for the intelligence and energy of its citizens. Many men famous in the politics and literature of the United States

have resided here. Besides the city and towns already mentioned, there are many other thriving towns and villages. Battle Ground, on the site of the battle of Tippecanoe; Colburn and Buck Creek, in the north-eastern part of the county; Dayton, in the eastern part; Montmorenci, in the north-western part; West Point, in the south-western part; Clark's Hill, Stockwell and Culvers, in the southeastern part, and Corwin and Romney, in the southern part of the county, are all thriving towns. Chauncey, on the Wabash River opposite Lafayette, possesses an intelligent population of about 2,000. The corporation line extends west to Purdue University.

TOPOGRAPHY AND DRAINAGE.

The county was originally a nearly level plain, broken occasionally by low ridges that traversed the county from east to west. One of these ridges extended from the bluffs of the Wabash River, a little north of Lafayette, to the Warren County line on the west, a distance of about ten miles. It is almost parallel with the Wabash River, which pursues a nearly west course from Lafayette to the county line on the west. The mean distance of this ridge from the river is about two miles. This is a sand and clay ridge principally. But few bowlders were observed in it, and but little coarse gravel. Another ridge, parallel with this, crosses the county about five miles south. It is known as the High Gap Ridge. It is largely composed of sand, gravel and bowlders. It extends from Culver Station on the Cincinnati, Indianapolis, St. Louis & Chicago Railroad to the Fountain County line. Another ridge lies five miles south of High Gap Ridge. It lies almost wholly in Jackson Township, in the south-western corner of the county. This is a sand, gravel and clay ridge. Near its western extremity is a high and prominent mound, known as Shawnee Mound. The numerous creeks of the county have cut through these ridges in many places, but at no point could a complete section of them be taken. The creek bluffs have generally rounded and gentle slopes, that are easily susceptible of cultivation.

The Wabash River enters the county at the north-east corner and flows southwesterly to Lafayette, near the center of the county; thence it flows westerly to within two and one-half miles of the Warren County line, where it again changes to the south-west, and pursues that direction until it crosses the western boundary of Tippecanoe County, ten miles north of the southern limit of the county. The river is navigable here for steamboats of light draft during the whole of the year. During easy or fair stages of water boats of large capacity can run. Owing, however, to the variable stages of water, only boats drawing little water are employed upon the river at this point.

Pine Creek, in the north-western part of the county, rises in Section 31, Township 24, north, Range 5, west, Shelby Township, north of the L., E. & W. R. R. It flows south-westerly and empties into Big Pine Creek in Warren County.

Big Indian Creek rises in Wabash Township, two miles north-east of Porter Station on the Lake Erie & Western Railroad, and flows south-westerly to the Wabash River, which it enters two and one-half miles east of the Warren County line. Little Indian Creek rises north of Montmorenci on the L., E. & W. R. R., and flows south; it empties into Indian Creek.

The several branches of Burnett's Creek rise near the White County line, and drain Tippecanoe Township. They pursue a tortuous course, flowing first southerly, thence north-easterly, again southerly, and finally a south-west course to the Wabash River.

Tippecanoe River crosses the northern boundary of the county about four miles west of the Carroll County line. It flows a southerly course, and discharges its water into the Wabash River.

Sugar Creek rises in Carroll County, flows west, crosses the Tippecanoe County line three miles south of the north-east corner of the county, and empties its water into the Wabash River nearly opposite the mouth of the Tippecanoe River.

Buck Creek rises in Carroll County, flows west, crosses the Tippecanoe County line two miles south of Sugar Creek, and discharges its water into the Wabash opposite the town of Battle Ground. Washington Township, in the north-east corner of the county, is drained by Sugar and Buck creeks.

Wild Cat Creek and its many tributaries drain Fairfield Township in the central and Perry and Sheffield townships in the eastern part of the county. Wild Cat Creek rises in the north-western part of Clinton County, flows westerly, emptying its waters into the Wabash River four miles above Lafayette. It crosses the Tippecanoe County line eight miles north of the southern boundary of the county. The North Fork, which has several branches, rises in Carroll County, flows south-westerly, and unites with Wild Cat Creek four miles north-east of Lafayette. Middle Fork rises in Clinton County, flows west, and empties into Wild Cat Creek five miles east of Lafayette. Laramie Creek rises in the extreme south-eastern part of the county. It flows north-westerly, then north-easterly, and discharges into Wild Cat Creek two and one-half miles west of the Clinton County line. It drains Laramie Township in the south-east corner of the county.

Wea Creek rises in the southern part of the county. The East Fork drains the western part of Laramie Township, and the West Fork drains Randolph Township, the central one the southern tier of townships. Wea Creek flows north-westerly, and discharges into the Wabash River

four miles west of Lafayette. Little Wea Creek rises in the south-western corner of the county, in Jackson Township, flows north-easterly, then north-westerly, and unites with Wea Creek about three miles south-west of Lafayette.

The two branches of Flint Creek drain Wayne, Union and Jackson townships. The South Fork rises in the northern part of Jackson Township, flows north until it unites with the North Fork near West Point, and then pursues a north-westerly course to the Wabash River. The North Fork rises in Union Township, flows northerly, then westerly to its junction with the South Fork near West Point.

Many other small streams add to the surface configuration and drainage of the county. Many beautiful springs of clear, cold water abound in the county. These keep the numerous creeks flowing the entire year. The never-failing, crystal currents add a great convenience to the stock raiser.

The natural drainage of the county is almost perfect. The creeks have cut channels in the Drift from ten to two hundred feet in depth. In many instances wide, alluvial bottoms have been formed. The soil of these bottoms is of great fertility and productiveness. The creek bluffs are of sand, gravel or clay, and have been worn into beautifully rounded contours, or gently sloping descents. In the southern, eastern and northern parts of the county, ditching and tiling is resorted to in order to thoroughly perfect the drainage. On the Wea Plains and the gravel terrace west of Purdue University, the great gravel deposits underlying the soil furnish the most complete and thorough drainage. The most copious rains sink at once into the soil and out of sight. These lands, on this account, are not affected by the periodical wet seasons, and their capacity to resist extreme drouths is equally as great.

In the eastern part of the county, in the neighborhood of Dayton, many low sand mounds were observed. They usually consist wholly of fine, clean, yellow or white sand, but in some instances they consist partly of fine or somewhat coarse gravel, which makes excellent roads. Mounds of the same character were noticed in Jackson Township, in the south-west part of the county. Shawnee Mound, a mound of historical interest, is a large mound of this character. It covers many acres, and has frequently been mistaken for the work of the Mound Builders. Careful examination, however, has revealed that it is of Nature's handiwork, built by the Master Builder during the great period in the history of the earth that geologists have denominated the Glacial Epoch. It is but a more elevated portion of one of the high ridges already described.

In Shelby Township, on Indian Creek, near its junction with the Wabash River, are two large mounds, known as "The Indian Creek Mounds." These are located in the creek bottom, on the west side of the creek, near the bluffs. It has been supposed that these, too, were of artificial origin, but a thorough examination shows that they were originally

a part of the west bluff of the creek. The bluffs of the creek here consist principally of layers coarse and fine gravel, compactly cemented together by carbonate of lime and carbonate of iron, forming a rough conglomerate. The mounds are of the same material, stratified in the same manner, and are situated in what was anciently an acute angle of the creek bluff. At a time when the water flowed to the tops of the bluffs, and over the bluffs above the mounds, it cut a new channel to the right of them, and also one between them, which were worn deeper and deeper, and widening at the same time, finally cut away all connection between them and the adjoining bluff, and at last left them to remain as monuments of what has been, and with a beautiful tract of fertile bottom land around them.

The low alluvial bottom lands of the Wabash River, which form the first terrace above the river channel, vary in width from a few yards, as at Lafayette, to perhaps a mile, as may be observed opposite Black Rock in Warren County. West of Lafayette, on the south side of the river, is a second terrace, elevated forty to eighty feet above the first, which runs back two to five miles from the river. This nearly level tract, known as Wea Plains, was originally all prairie land, and, as before remarked, is a great mass of gravel, 125 to 200 feet in depth. North of the river, opposite Wea Plains, is a gravel terrace of a corresponding hight to that of the plains, but here it is really a third terrace, as there is a lower terrace from twenty to thirty feet in hight lying between the river bottom and the level of the higher terrace. This second terrace is very distinct, three or four miles below Lafayette, but rises higher and higher as it approaches the city till it finally merges into the higher or third terrace. The low river bottom also narrows rapidly near the city, and nearly opposite Lafayette the first, second and third terraces are almost wholly lost in the river bluffs, which here approach nearly to the river. The second terrace varies in width from a few yards at some points to perhaps a mile in other places. Above Lafayette the low bottoms of the Wabash River vary but little from what was observed below the city. The same varying width was noticed, and the hight above low-water mark is about the same, ranging from ten to twenty feet, probably. These bottoms are all subject to overflow during extremely high water.

Low-water mark of the Wabash River at Lafayette is 504 feet above ocean level. The reservoir on the bluff, east of the city, is 226 feet above low-water mark of the Wabash. The altitude of the reservoir, therefore, is 730 feet above the sea. About 750 feet is probably near the general altitude of the county. It was anciently a nearly level plain, with a few rolling ridges and mounds to break the otherwise uniform appearance of the surface. The erosion of the deep river and creek valleys and channels has modified the appearance of this ancient plain to a material extent, but the general altitude of the entire area is not greatly altered. Shawnee Mound, High Gap Ridge, the high bluffs of Cedar Hollow, about five

miles north of Lafayette, and the high lands between Wild Cat Creek and Buck Creek, and between the latter and Sugar Creek, rise to the hight of a little more than 800 feet. These are probably the highest points of the county.

WATER.

This is one of the best watered counties in the State. The rivers and creeks furnish an abundance of water for mechanical and agricultural purposes, and the many excellent springs and wells furnish an inexhaustible supply for agricultural, domestic and medicinal purposes. Springs of clear, cold, sparkling water are plentiful in nearly every part of the county, and never-failing wells may usually be obtained by digging or boring from fifteen to forty feet. On Wea Plains, however, and on the high terrace on the opposite side of the river, near Purdue University, wells have to be sunk a hundred feet or more to insure a constant supply of pure water. In the northern and north-eastern parts of the county a sure supply of water is obtained at a depth of twenty-five to eighty feet.

The canal was abandoned several years ago as a way of commerce, and it has lately fallen almost wholly into disuse as a motive power for machinery; but it seems that motives of economy should prompt its preservation, for it is certainly a cheap and reliable power for the movement of machinery. Many dams have been constructed on the various creeks, and suitable power thus acquired for the manufacture of lumber and flour. The new "Roller Process" of manufacturing flour has almost entirely superseded the old buhr stone process, and the loss of business has caused the abandonment of many country mills that one day were excellent paying property.

For domestic purposes the water of this county can scarcely be excelled. It is remarkably free from diatomaceous organisms, and other forms of microscopic organic life calculated to produce malarial or typho-malarial poisons. In the western and south-western parts of the county the water is strongly impregnated with salts of lime, and at Montmorenci and on Indian Creek the water carries a large per cent. of salts of iron. Mr. Godman, a leading citizen of Montmorenci, has a well on his premises which supplies water strongly impregnated with sulphur and iron. Some of the springs and wells in the western part of the county contain water which is strongly magnetic. A knife blade, or other steel instrument, immersed in the water will soon acquire the property of lifting a needle or other small iron or steel substances. Many of these springs and wells have local reputations on account of their medicinal properties. Their waters are usually cathartic in their effects. The spring at the Battle Ground is quite widely known. It has long been a favorite resort for invalids who seek a pleasant retreat and mild chalybeate water. The

ground over which the water flows is deeply colored by a deposit of oxide of iron, precipitated by the water. The temperature of the water is 53° to 54° F. It has a strong taste of iron. There are many springs of the same character along Burnett's Creek, and along Tippecanoe River. In fact, these iron springs abound all over the county. Whenever the water deposits that red, ocherous sediment it may be known that the sparkling liquid is carrying iron, and perhaps other salts.

The artesian well at Lafayette has a reputation not confined to the limits of this State. The water of this well precipitates a white sediment upon the surface over which it flows, and is known, therefore, as "white sulphur water." A complete analysis of this water was made by Charles M. Wetherill, Ph. D., M. D., several years ago. From the published report of that analysis the following copious extracts are taken:

"Physical Character.—The artesian water is of an extreme limpidity when taken freshly from the well. The deposit upon the pebbles over which it flows is *white*, entitling it to the name of *white sulphur water*. Standing in imperfectly closed vessels, a similar bluish white deposit takes place. Under certain conditions, the deposit contains black flakes of sulphuret of iron. The smell of the water is strongly of sulphuretted hydrogen, so as to be perceived at a distance (with the wind) of two squares from the well. The taste is similar to that of the celebrated Blue Lick water, though less strong. It is pleasantly brackish, resembling in taste the liquor from oysters freshly opened." The temperature of the water when first taken from the well is 55° to 56° Fahrenheit. The density of the water is 1.00523. The following table gives the "composition of the white sulphur water of the Lafayette artesian well, water of March 25, 1858, as determined by Dr. Wetherill. Temperature, 55°–56° F. Density, 1.00523."

GASEOUS CONTENTS.

	In 1,000 grammes. Grammes.	Cub. Centim.	In a wine pint. Cub. Inches.
Sulphuretted hydrogen	0.0093	6.3594	0.1841
" " of water of Apr. 8.	0.0145	9.9154	0.2870
Carbonic acid	0.0997	52.683	1.5253
Nitrogen		21.280	0.6160

SOLID INGREDIENTS.

	In 1,000 parts by weight.	Grains in a wine pint.
Residue by pure water	992.75	7,274.446
Evaporation, solid ingredients	7.25	53.124
Total	1,000.00	7,327.570*

*This is the weight of a wine pint of the artesian water; the weight of the same measure of pure water being 7,291.11 grains.

INGREDIENTS BY ANALYSIS.

	In 1,000 parts by weight.	Grains in a wine pint.
Carbonate of lime	0.2052	1.503
Carbonate of magnesia	0.0069	0.050
Peroxide iron with alumina.		
Phosphate of lime, fluoride of.	0.0085†	0.052
Calcium, and a faint trace of manganese		
Silica	0.0080	0.058
Sulphate of lime	0.9555	7.002
Chloride of calcium	0.0635	0.465
Chloride of magnesium.	0.5059	3.707
Chloride of iodium	5.5402	40.596
Traces of iodine and organic matter		
Bromine doubtful		
Total	7.2937	53.443

By comparison, Dr. Wetherill found that the water of the Lafayette artesian well contained "as much carbonate of lime as the White Sulphur Springs of Virginia; as much sulphate of lime as the same springs, and as the Sharon Sulphur and the Avon Lower Springs of New York; as much chloride of magnesium as the Blue Lick Spring of Kentucky, and more iron and less silica than the same spring. One and a half pints of the Lafayette artesian water contains as much common salt as one pint of the Blue Lick water."

This water is recommended as a beverage and for baths in nearly all cases of derangement in the secretory organs. Diseases that have become chronic are generally cured by a continued use of this water. For drinking purposes the water is free to all. Private parties have established baths at a moderate price. For pulmonary troubles the water is not recommended.

The following accurate survey, by Mr. Wm. S. McKay, who superintended the work, shows correctly the succession of strata encountered in boring the well:

Clay	3 ft.
Clay and gravel	9 ft. 6 in.
Gravel and pebbles.	1 ft. 6 in.
Fine gravel and sand.	13 ft.
Quicksand	1 ft.
Gravel, clay and pebbles	2 ft. 6 in.
Dark gray clay	72 ft.
Sand and gravel	4 ft.
Clay and pebbles.	1 ft. 3 in.
Sand and gravel	7 ft. 3 in.
Clay	6 in.

†Equivalent to carbonate of the protoxide of iron 0.0061 per mille.

Sand and gravel	3 ft.	
Clay and pebbles	6 ft. 6 in.	
Gravel and pebbles	5 ft.	
Bowlders	40 ft.	
To shale		170 ft.
Blue shale	2 ft.	
Gray shale	18 ft.	
Blue shale	1 ft. 6 in.	
Gray shale	7 ft.	
Total shale		28 ft. 6 in.
Limestone, coralline—Devonian		11 ft. 6 in.
Gray limestone with spar—Upper Silurian		20 ft.
Total depth of well		230 ft.

This well is located in the valley of the Wabash River, and the surface at the well is fifty or sixty feet above low-water mark, or about 180 feet lower than the top of the bluffs east of the city. The total depth of the well, therefore, is about 410 feet, measured from the level of the surrounding country. In making the well the eroding forces of nature, ages ago, did material service in removing 180 feet, or more, of the overlying deposits. Indeed, the tools of the workmen only penetrated to a depth of 60 feet beneath the level of the ancient valley of erosion.

COMMERCE AND MANUFACTURES.

The Wabash River is only navigable at its ordinary stages for boats drawing little water. Formerly a large business was done, principally with the South, through the medium of flat-boats and barges. This method of business was soon supplemented by the building of the Wabash Canal. This opened a direct freight line to the East, and at once gave a great impetus to the grain and stock trade. But the interest of business demanded faster freights, and the building of railroads through every part of the State has forever superseded the old canal as a means of transit. Lafayette, the capital of the county, is one of the important railroad centers of the State. The following lines of railroad now pass through the city, viz: The C., I., St. L. & C. R. R., which passes from south-east to north-west through the county; the Lake Erie & Western Railroad, which crosses the county from east to west; the Wabash, St. Louis & Pacific, which runs north-east and south-west through the county, and the Louisville, New Albany & Chicago Railroad, which runs north and south through the county. Besides, the T., C. & St. L. Railway crosses the south-eastern part of the county, running north-east and south-west, crossing the C., I., St. L. & C. R. R. at Clark's Hill. These thoroughfares give ample accommodation for the transaction of all the business of the

county. They give direct communication with Chicago, St. Louis, Louisville, Indianapolis, Cincinnati and the cities of the East. For the prompt transaction of all kinds of business no city in the State is better situated than is Lafayette.

All the important manufacturing interests of the county are situated at Lafayette. The following table of statistics, taken from the United States Census Report of 1880, gives complete information as to the extent of the manufacturing interests of the city:

TABLE OF MANUFACTURES.

Boots and shoes	$212,000
Bread and other baked products	153,000
Carriages and wagons	59,000
Cars, railroads, streets and repairs	214,000
Clothing, men's	132,000
Coffee and spices, roasted and ground	33,000
Cooperage	154,084
Flouring and grist-mill products	490,139
Foundry and machine-shop products	58,000
Furniture	20,650
Distilled liquors	122,000
Malt liquors	132,840
Lumber, planed	40,000
Lumber, sawed	46,500
Marble and stone work	21,800
Printing and publishing	266,500
Pumps, not including steam-pumps	74,856
Saddlery and harness	50,500
Tinware, copperware and sheet-iron ware	55,274
Tobacco, cigars and cigarettes	42,450

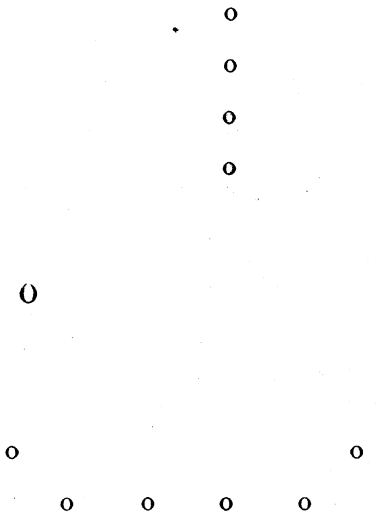
While no great specialty is made in any particular line of manufactures, it will be seen that the aggregate amount of manufactured goods is such as to entitle the city of Lafayette to respectful consideration as a manufacturing city. The excellent shipping facilities, healthful climate, generous soil and genial people, together with the cheapness of living, offer splendid inducements to those who seek locations for the establishment of factories.

ARCHÆOLOGY.

Evidences of the Mound Builders are quite numerous in this county. Drills, spear-heads, arrow-heads, stone axes, scrapers, pestles, mortars, gorgets, pottery, copper bracelets, copper beads and many other relics have been found in different parts of the county. Purdue University has a choice collection of stone implements, gathered from different localities in the county. The Lafayette High School collection contains a number of very fine specimens. Besides, many private collectors have fine cabinets

of archæological specimens. Among them may be mentioned Mr. A. J. Godman and Prof. W. M. Rank, at Lafayette; Mr. Rowe and Mr. Godman, at Montmorenci; Mr. Meigs, at Romney; Mr. Fiddler, near Culver's Station; Mr. M. E. Sherry, at West Point, and many others. No tumuli were observed, except in the northeast part of the county. In the neighborhood of Battle Ground, and on Pretty Prairie, north of Battle Ground, mounds are quite numerous. South of the Wabash River, in the neighborhood of Buck Creek Station, there are several mounds. There is an elliptical mound on the farm of Mr. Allen Stanfield, in Washington Township, about twelve feet in hight. Its longest diameter is about forty feet, and the transverse diameter about thirty feet. Two other mounds on the same farm are circular, or nearly so, and about twenty feet in diameter and seven or eight feet in hight.

On the farm of Major VanNata, two miles east of Battle Ground, and just at the edge of Pretty Prairie, is an interesting series of mounds. They are located near the mouth of the Tippecanoe River, and just west of the bluffs of that stream. They overlook the valleys of the Wabash and Tippecanoe rivers, and command a view of the country for miles in every direction. The diagram given below correctly illustrate the relative positions of these mounds:



The four mounds in a line on the north are about one-half mile north of the line of six running east and west. The four mounds on the north are about 50 or 60 yards apart. The one on the extreme north is elliptical 60x40 feet, and about five feet high. The others in the same line are 50x30 feet, and three to four feet high. The lone mound on the west is a very large mound. It is circular, about 60 feet in diameter, and at

the present time about 15 feet high. This mound was opened some years ago, and a large number of stone and copper implements taken out of it, including pipes, axes, arrow-heads, copper bracelets, copper beads, rings, and, among other rare specimens, a copper vessel resembling a pitcher. The most valuable of the relics, however, have been scattered around and lost. It is to be deplored that our citizens generally take so little care of valuable relics when they find them. Many of the most valuable specimens are carelessly or wantonly broken, or thoughtlessly thrown into some refuse heap about the premises, and finally lost. All these things, from the diminutive arrow-head to the massive stone ax, or highly ornamented pipe, should be carefully preserved, and if not valued at home sold or donated to some public collection where they *will* be carefully preserved for future comparison and scientific study. Four of the six mounds on the south are in a straight line, while the two at the extreme ends are projected a little north, giving the series a crescent shape. They are all circular in form, and, beginning on the east, the first is 30 feet in diameter and 4 feet high; the second 40 feet in diameter and 5 feet high; the third 45 feet in diameter and 5 feet high; the fourth 50 feet in diameter and 5 feet high; and the sixth 30 feet in diameter and 4 feet high. From the center of Mound No. 1 to the center of No. 2 is 47 yards; No. 2 to No. 3, 39 yards; No. 3 to No. 4, 65 yards; No. 4 to No. 5, 44 yards, and from No. 5 to No. 6 is 47 yards. This series of six mounds is directly along the bluff of the Tippecanoe River, just at the junction of that stream with the Wabash. It is probable that a large mound once occupied a position on the east to correspond with the position of the large, lone mound on the west, but, if so, it was situated immediately upon the bluff of the river, and has been entirely obliterated by the crumbling away of the bluff.

There are many mounds scattered over the surface of Pretty Prairie. Sometimes they are in groups, and others are isolated. Skeletons of the American Indians are frequently found in them near the surface. In one or two instances stone vaults were discovered at the bottom of the mounds, near the original surface of the ground, and these contained skeletons, undoubtedly of the Mound Builders. These bones, when brought to the surface, disintegrate rapidly, and soon crumble away. Bones of the Indians are frequently ploughed out by farmers in cultivating their land. This people usually buried their dead upon some high knoll or ridge of land, and scarcely ever deposited the bodies to the depth of more than two or three feet. The bones of this race are usually found in a very good state of preservation.

A few years ago Mr. M. E. Sherry, residing on the Wabash River, near West Point, in collecting some gravel from the bluffs of that stream, found a nest of Mound Builders' relics, consisting of axes, scrapers, flint implements, discoidal stones, etc. A few poorly-preserved skeletons were

also found. These were taken from the gravel about six or seven feet below the surface. They were not found in a mound, but in the extremity of a ridge running down toward the river.

Many localities might be mentioned where relics are found in great numbers, but nothing has as yet been observed in this county to throw any new light upon the history of the wonderful people known as the Mound Builders. It is thought by many that they were a people wholly distinct from the savages of recent times; that they practiced agriculture and the arts; that they were peaceable, industrious and attached to their domestic pursuits, and that they were, to some extent, civilized. It is thought, too, that, like the Chinese, their country was invaded by a race of savages, fierce and relentless as the Tartars of the East; that the Mound Builders were totally annihilated or driven forever from their homes by their bloodthirsty foes, and that the remnant of them wandered to the South and South-west, where they founded new villages, cities and empires. But it seems to me that this assumption rests upon intangible proof.

The implements found in Tippecanoe County, as well as those found in all other localities of this State and the entire West, consist largely of such weapons as were used in the prosecution of war or the pursuit of game. I have opened and thoroughly examined some twenty-five of the mounds erected by this people, and the result of my examinations could lead to but one conclusion, and that is, that the Mound Builders were not only a war-like people, but that they were bloodthirsty savages and cannibals. I have found in Dearborn and Ohio counties, in this State, in Boone County, Kentucky, and Hamilton County, Ohio, in what are known as "kitchen mounds," or "habitation mounds," many fragments of the bones of various animals, which had been slaughtered for food, and among them large numbers of human bones, split and fractured, as were the animal remains, and all highly calcined. The evidence in these cases just as strongly indicates that the human beings were slain and eaten for food as it does that the animals were used for the same purpose. It seems to me that the most reasonable conclusion in regard to this people is that they were *Indians*—the ancestors of our present race of savages. If it, indeed, is true that they were more enlightened, more civilized anciently than now, then the conclusion will be that the American Indian is but the degenerated son of a noble sire—a prodigal son, as it were. It is true that in the manufacture of their stone weapons, their ornaments and pipes, they exhibited a considerable degree of skill, but this proves little concerning their civilization, for we read in authentic history that many of the most barbarous and savage nations of ancient times were the most skillful in the manufacture of various kinds of armor and the implements of war.

GEOLOGY.

In this county there is a range of geological formations from the Devonian, in the northeast corner of the county, to the Conglomerate of the Lower Coal-Measures along the western boundary. Near Porter Station, on the Lake Erie and Western Railroad, six miles west of Lafayette, is an exposure of limestone belonging to the Keokuk group, and on Flint Creek, near West Point, there are exposures of the St. Louis and Chester groups. There are no other exposures of Paleozoic rocks in the county. In boring the artesian well at Lafayette, the first rock reached was Devonian shale. The bore terminated in the Niagara rocks. Vast erosions ages ago were followed by immense depositions of sand, gravel, bowlders and clay over the surface of the entire county. The greatest depth of the Drift in this county, so far as positively known, is three hundred and fifty feet, but it is probable that accurate measurements in some other localities would give a depth exceeding that by one hundred feet. Running east and west along the northern line of the county, and extending across the southern part of Benton County, there was once a deep valley, furrowed out to a depth of one hundred and fifty to two hundred feet below the present level of the Wabash bottoms. At the time that the eroding forces were operating along this line, a great basin was also scooped out in the central part of Tippecanoe County. The greatest depth of this great basin is not known, but at Lafayette, which is very nearly in the exact geographical center of the county, the boring in the artesian well shows that the depth at that point was one hundred and twenty feet below low-water mark. The western rim of this basin was only two or three miles west of Lafayette, as evidenced by the appearance of the Keokuk limestones at the surface at Porter Station. The western rim, from this point, followed a south-west direction toward Black Rock, on the Warren County line. At Black Rock the St. Louis limestones and great masses of Conglomerate sandstones formed an effectual barrier against the further advance of flowing water or glacial ice. The limestones, shales and sandstones of Flint Creek also presented an insurmountable point to the eroding forces, and so the southern rim of the basin may be traced easterly from Black Rock along the course of Flint Creek for a distance of several miles. In the low bottoms of the Wabash River, opposite Black Rock, the St. Louis limestone lies just under the soil, at a depth of from six inches to three feet. The river bed at this point is solid rock, and at low-water there is but two to three feet of water in the channel here. The stream is easily forded. The bottom of the ancient basin at Lafayette is at least one hundred feet lower than the river bed at this point, and fully three hundred feet below the summit of Black Rock. The conclusion arrived at here is that for long ages the Conglomerates and sandstones of this region effectually barred the further advance of

the great streams of water and ice that flowed from the north and east, and that the forces that finally carved out the valley of the Wabash through Warren and Fountain counties, came into existence long periods after. It is probable that if the great covering of Drift was removed from the northern half of Indiana, an immense system of great river channels and scooped-out basins would be revealed that would put to shame the shallow streams and puny lakes that are seen on the surface of same region to-day. Subsequent to the period of erosion, and immediately following, came the deposition of the Drift. It must be true that when the process of erosion was actually going on, the surface of the underlying rocks was in immediate contact with grinding influences above it. It follows, then, that upon the dissolution of the eroding forces, the bowlders, gravel, sand and finer particles, brought by the same agencies that were still at work breaking down strata, and disintegrating and dissolving the fragments in other localities, were gradually laid down upon the worn irregular surface of the rocks beneath. Ages elapsed while this process of disintegrating, dissolving and erasing of strata in one locality, and the sorting and distributing of particles and building up of strata in another locality, was going on. Matter is never lost nor annihilated. The great masses of rock that were broken into fragments, ground into particles and worn into atoms invisible to the naked eye, were distributed over wide areas and deposited as bowlders, gravel, sand or clay.

A general section of the strata of this county can only be given as approximately correct. The known depth of the Quaternary varies from one foot to three hundred and fifty feet. It may exceed four hundred and fifty feet in places. A bore started in the Devonian shales, near the top of the stratum, in the north-eastern part of the county, reached the depth of one hundred and nineteen feet. The stratum was reached at the depth of eight feet below the surface, but when the work was stopped, at the depth of one hundred and nineteen feet, the drill had not passed through the shale. Twenty-eight feet six inches of Devonian shale was passed through in boring the artesian well at Lafayette, which, from its color and other characteristics, seems to belong to a different part of the series from that found near Buck Creek Station, in the north-eastern part of the county. As the great erosions at Lafayette carried away nearly the whole of this series, leaving only a few feet at the bottom of the system, and the bore at Buck Creek was begun near the top of the group, it is probable that the sum of the two measurements of shale approximates the total thickness of that group in this county. The total thickness may somewhat exceed, but will scarcely fall short of, the figures given in the general section. No rocks of the Knobstone group are exposed in this county; neither have any of the members of that group been struck at any point in boring. The inference is that that group is wholly wanting here, and that the Keokuk beds rest primarily upon the Devonian shales in this county.

GENERAL SECTION.

QUATERNARY.

Soil	1 ft. to 8 ft.	
Alluvium	2 ft. to 20 ft.	
Drift—Clay, sand, gravel and bowlders	10 ft. to 350 ft.	
Total Quaternary		378 ft.

LOWER COAL-MEASURES.

Conglomerate		60 ft.

SUB-CARBONIFEROUS.

Chester group	10 ft.	
St. Louis group	60 ft.	
Keokuk group	20 ft.	
Total Sub-Carboniferous		90 ft.

DEVONIAN.

Hamilton group—Black shale	139 ft. 6 in.	
Corniferous limestone	11 ft. 6 in.	
Total		151 ft.

UPPER SILURIAN.

Niagara group		20 ft.
Total		699 ft.

UPPER SILURIAN.

No outcrop of these rocks occurs in the county, but the bore of the artesian well at Lafayette evidently terminated in the Niagara rocks of this formation. Minute corals and bryozoans brought to surface during the progress of the work clearly indicated that rocks of the Niagara group had been reached. These little fossils, many small, beautiful crystals of lime, and the general character of the stone, all evidenced the fact that the Niagara rocks had been reached. It is from this group that the highly prized water of the artesian well perpetually flows. Speculation as to the source of the water that flows from this well is idle. The torn and tilted condition of the Niagara rock at Delphi, at Kentland, and many other points, indicates that a vast upheaval occurred at the close of the Niagara period. The uniform dip of the newer rocks is not continued throughout the Niagara. The strata of this group are broken and upheaved in many places. The pearl-white waters of the Lafayette well may find their way to the top of the group through vertical seams in the broken rocks from a depth hundreds of feet below the termination of the bore in the well.

DEVONIAN FORMATION.

The exposure of Devonian rocks in this county is limited to the black shale, variously referred to by geologists as "Delphi black shale," "New Albany black shale," etc., and generally recognized as equivalent to the Genesee shale of New York. There is an outcrop of this shale near Buck Creek Station, on the W., St. L. & P. R. R., in Washington Township. The exposure may be seen in the bed of Sugar Creek, upon the farm of Mr. L. T. Blood, section 23, township 24, north, range 3, west. There is an exposure of fifty or sixty yards along the bed of the creek. The water has cut a channel in the shale here to the depth of four or five feet. The exposed rock is a black, hard slate, with a regular, even line of cleavage, and, when first broken from the mass, has a smooth, glossy surface. It is somewhat bituminous, and contains traces of petroleum. It has been known to burn quite freely. On account of its strong resemblance to coal in color, and its burning so readily, Mr. Blood was induced to make a bore here, under the belief that coal would surely be found. At the depth of eighteen feet the workmen found a stratum of what they supposed to be coal, two and one-half inches thick. No other evidences of coal were found. No gas was observed to escape from the well at any time. Mr. Blood kindly furnishes the following section:

SECTION OF MR. BLOOD'S WELL.

Soil	8 ft.
Black slate—shale	18 ft.
"Coal"	0 ft. 2½ in.
Black slate	17 ft.
"Soap stone"—gray shale	30 ft.
Black slate	35 ft.
"Soap stone"—gray shale	11 ft.
Total	119 ft. 2½ in.

Several hours' careful searching failed to reveal any fossils in the exposed rocks.

Mr. Blood's experiments were valuable to science, revealing as they did the great thickness of the shales at this point, but they were wholly futile, from a financial standpoint, and it may be added that any similar exenditure of time and money anywhere in Tippecanoe County, with a view of obtaining coal, will always give the same unsatisfactory results. There is not a possibility of finding coal, nor a probability of finding petroleum. It may be that gas will be found in paying quantities.

In boring the Lafayette well a stratum of limestone was found, eleven feet, six inches in thickness, which is what geologists in this State usually call Corniferous limestone. There is no outcrop of this stone in the county, and this is the only bore in the county that reaches it. Mr.

McKay, in his report on the well, calls it Coralline limestone. It is, indeed, a great mass of corals, somewhat silicified, composed largely of the genus *Favosites*. At the Falls of the Ohio, at Logansport and many other places in Indiana, this rock is exposed at the surface. It is found at a depth of 198 feet 6 inches in the Lafayette well—or at the hight of 386 feet above ocean level. The same rock appears at the surface at Logansport 588 feet above the level of the sea. Its south-westerly dip from Logansport to Lafayette is at the rate of eight or nine feet to the mile.

KEOKUK BEDS.

These rocks are exposed on Indian Creek in Wabash Township, at the crossing of the Lake Erie & Western Railroad. They appear at the surface at no other point in the county. The outcrop may be observed about one mile east of Porter Station. There is a ledge of buff limestone on the top of the series, varying along the line of exposure from one foot to two and one-half feet in thickness. This buff-colored stone is usually found capping the outcrops in the counties west and north of Tippecanoe. Underlying the buff-colored ledge is a layer of gray, cherty stone, containing geodes, with an average thickness of about eight inches. Under the last is a layer about twelve inches in thickness that is highly ferruginous. This ledge is porous, spongy and more tenacious than the layers above it. Below this for three or four feet the stone is in thin layers. It is gray in color, soft, shaly, and contains more or less chert. Near the bottom of the exposure it is in thicker layers, gray in color, crystalline in structure, and better adapted to economic purposes. None of it, however, is of much value for building purposes. It cracks and scales off in weathering, and is, therefore, only adapted to use in rough foundation work, where it can be placed beneath the surface. It makes poor lime, on account of the great amount of silica in it; but it makes the best of metal for public roads. It is extensively used for the latter purpose, and, fortunately, it occurs in a part of the county where gravel suitable for that purpose is very scarce. No fossils were found in it, with the exception of a few crinoid stems and a few geodized shells, probably those of a *Spirifer*. The following section was obtained:

SECTION OF THE EXPOSED KEOKUK BEDS ON INDIAN CREEK.

Soil and clay	2 ft.	0 in.
Buff limestone	1 ft.	8 in.
Gray, cherty limestone		8 in.
Ferruginous limestone	1 ft.	0 in.
Clay parting		1 in.
Gray, cherty limestone		8 in.
Gray shale in thin ledges	3 ft.	0 in.
Compact, gray limestone with iron, in ledges from 8 to 14 inches thick	4 ft.	6 in.
Total	13 ft.	7 in.

The rocks are exposed here for the distance of about one hundred yards on the east bank of the creek, and on the north side of the railroad. Just south of the railroad, on the farm of Mr. John Allen, is an outcrop which shows a much greater thickness of buff-colored limestone capping the exposure. The exposure is shown as follows:

SECTION.

Soil and clay	3 ft.	0 in.
Buff limestone	3 ft.	6 in.
Gray, cherty limestone in thin layers	5 ft.	6 in.
Total	12 ft.	0 in.

This exposure is three or four hundred yards south of the one first described. The gray limestone has a few fragments of crinoid stems in it, but no other fossils were found. The stone is quarried to some extent at both places for foundations for out-buildings. It is also used generally for walling wells. It serves this purpose well. It breaks with an irregular fracture in the direction of the usual line of cleavage, except in the seams, but vertically it breaks down through several layers for a distance of four or five feet, forming a perpendicular wall with a smooth, even surface. At these lines of cleavage there seem to be vertical seams, extending down for several feet.

ST. LOUIS GROUP.

The stone of this group is extensively exposed along Flint Creek, in Wayne Township, for a distance of about four miles above the mouth of the stream. The rock consists largely of dark-colored or gray silicious shales, near the top of the strata, with an occasional layer of compact, gray or blue limestone two to six inches in thickness. At, or near the bottom of the exposures, the shales give place to a larger proportion of limestone, dark-gray or blue in color, the ledges varying in thickness from one inch to eight or ten inches. The limestones are fine-grained, hard and durable as foundation stone. An occasional layer is found twelve or fourteen inches in thickness. This stone is pretty generally quarried for local use. No shipments of it have ever been made. It is used largely for foundation work and bridge abutments. It weathers exceedingly well. It is not affected by climatic influences. In the examinations of the bridge abutments along Flint Creek, built of this stone some years ago, it was found that it does not scale, spawl off nor crack. The ledges are full of vertical seams, therefore the stone can not be quarried in blocks of very large size. Two to four feet in width, and four to six feet in length, are about the largest sizes that can be obtained. It is taken from the quarries in rhomboidal blocks. The vertical seams give the rhomb shape. The stone is largely silicious and makes a very poor quality of lime.

The shales disintegrate and decompose rapidly. They contain a small portion of lime. The water, percolating through the soil and gravel, reaches these shales, and carries the lime away in solution. The springs flowing out of the low bluffs, along Flint Creek, are strongly impregnated with lime. At many points along the creek small caves have been formed in the bluffs by this disintegrating and dissolving process. Upon reaching the atmosphere the lime, held in solution, combines with the carbonic acid gas of the air, and is precipitated upon the surface, forming beautiful concretions of carbonate of lime. These concretions projected from the roofs of the caves, in the form of icicles, are called stalactites. They form on the floors like water freezing as it drops steadily at one point upon the ground, and are called stalagmites. In many places the walls of these low bluffs are covered with a thick growth of beautiful green moss. The water trickling down through this delicate green robe deposits its pure, white crystals of lime on stem, and branch, and leaf. The moss continues to grow, and the concretions continue to form, till finally there are great masses of this calcareous tufa that perfectly preserve the form of leaf, branch and stem of this "petrified moss." Beautiful specimens of this tufa may be obtained at "The Caves," on the farm of Mr. Turner, near the mouth of Flint Creek. There are three of these caves but a short distance apart. They are very small, and aside from the beautiful concretions that are continually forming around them, they possess but few interesting features. The first is a small room about 10x20 feet in size; the second is about 15x30, and the dimensions of the last about 12x30. Their hight is from five to seven feet. A section of the bluff at this point shows the following:

SECTION.

Soil and gravel	20 ft.
Dark gray and blue limestones, in thin ledges, with shaly partings	30 ft.
Total	50 ft.

The water is continually dropping from the roofs of the caves. The floor is hollowed out in one of them, and quite a pond is formed. The water, dropping from the roof, makes a continual splash, splash, splash, in the water beneath.

Flint Bar, in the Wabash bottom, about a mile below the mouth of Flint Creek, and just over the line in Fountain County, is a great mass of silicious deposits. The stone lies in ledges four to eight inches in thickness. It is evenly bedded, and the exposed layers have the appearance of compact silicious limestones. But they lack tenacity. A single blow with a light hammer will break a block one by two feet in size into 50 or 100 pieces. The "bar" covers many acres, and the whole surface is covered with small, angular fragments of these broken flints. The

pieces are usually in small flakes from one inch to four or five inches in length. No better metal is found anywhere for highway purposes or street improvements. The deposit is practically inexhaustible. The streets of Lafayette have been largely paved with this material, and its permanent qualities have been thoroughly tested. It packs evenly, and is the most durable material yet known. This deposit lies below the limestones and shales exposed on Flint Creek. These beds belong to Mr. Amos Welsch, of West Point, Tippecanoe County. The following section of the bar was obtained:

SECTION.

Bed of flint flakes	1 ft. 3 in.
First ledge of chert	6 in.
Second ledge, dark blue flint	8 in.
Third ledge, grayish color	4 in.
Fourth ledge, dark blue	8 in.
Fifth ledge, dark blue	8 in.
Total	4 ft. 1 in.

On the farm of Mr. A. J. Swaney, one mile south-east of West Point, on the main branch of Flint Creek, is an exposure of fifteen feet of soft, silicious shales. They form the east bluff of the creek at this point. The ledge is nearly perpendicular here. These shales are in layers two to ten inches in thickness. The top of the ledge contains no fossils, but for a thickness of about two feet at the bottom fossils are found quite plentifully. Among the fossils identified are: *Nautilus clarkanus*, poorly preserved; another *Nautilus*, species undetermined; *Spirifera striatiformis*, *Spirifera* like *camerata*, *Productus Indianensis*, *P. biseriatus*, *P. semi-reticulatus*, *Discinas*, *Terebratulas*, *Lingulas*, and several species of Bryozoans. About one-fourth of a mile down the creek in the limestones are found *Allorismas*, *Grammysias*, *Nuculas*, *Spirifers*, *Producti*, crinoid stems, Bryozoans and well-preserved specimens of *Nautilus clarkanus*. About one-fourth of a mile north-east of West Point, immediately back of the cemetery, is a limestone bluff from ten to twenty feet in hight. It is on the north side of the creek, and is about 200 yards in length. The ledge forming the bluff consists of shales and limestones in alternate layers near the top, but lower down the ledge consists of compact layers of limestone in layers four inches to one foot in thickness. This is the best foundation stone found in the county among the limestones. The abutments of the West Point bridge were made of this stone several years ago, and the thorough test given there proves its durability. None of this stone works easily. It breaks with an irregular fracture, and does not rough-dress well. Nearly all the fossils mentioned above were found at this quarry. The Bryozoans, alone, were absent. About 200 yards above the cemetery, in the limestone taken from the creek bed,

were found, in addition to the fossils already mentioned, several species of fucoids, *Euproops* ———? a *Phillipsia*, species undetermined, and another crustacean.

At West Point the limestone is found, in digging wells, from 8 to 12 feet below the surface. The following is the section of Mr. Welsch's well, on section 18, township 22, range 5:

SECTION OF MR. WELSCH'S WELL.

Soil	2 ft.
Sand and gravel	16 ft.
Solid limestone	30 ft.
Water at	48 ft.

North of the residence of Mr. Welsch the limestone is not reached in the wells. Approaching the Wabash River the erosions have been deeper and deeper, and near the river wells bored to the depth of 130 feet do not pass through the immense deposit of gravel. At the residence of Dr. Adkins, one mile east of West Point, the limestone was found ten feet beneath the surface. The Doctor's residence is on High Gap Ridge. The following is a section of his well:

SECTION.

Soil and gravel	10 ft.
Shaly limestone	12 ft.
Water at	22 ft.

In the Wabash bottoms, opposite Black Rock, on the farm of Mr. M. E. Sherry, these limestones are found from one to four feet below the surface. In draining the swamps and bogs near the bluffs, ditches have to be cut down through these shales from one to six feet in depth. No fossils were found here.

CHESTER GROUP.

The rocks of this group are not extensively exposed in Tippecanoe County. They are found only on Flint Creek at three points. They crop out on the farm of Mr. A. J. Swaney, about one and one-fourth miles south-east of West Point. They occur also on the main branch of Flint Creek, on the farm of Mr. J. C. Whitehead, near his saw-mill. They are also exposed on the South Fork of Flint Creek, about one mile south of West Point. These rocks, as they occur here, are of a bright yellow color, generally. They are a fine sandstone, very light and porous, yet very firm and elastic. They are very hard to break with a hammer. They do not split evenly, and are hard to work into any desired shape. These yellow stones are known locally as "fire-stone," as fire seems to have no effect upon them, except to make them harder. They have been

largely used in the place of fire brick for furnaces, and in the early settlement of the county, they were used exclusively for fire-places to chimneys. Wherever the old fashioned fire-places are yet in use these "fire-stones" form the jambs and back walls. They make durable foundation stones, and are largely used for that purpose also. They are found overlying the St. Louis limestones and shales, but separated from them by a stratum of sandstone about two to three feet in thickness, of a yellowish gray color. This gray stone has been manufactured into grindstones to some extent for local use, but it is too soft for satisfactory use. The finer qualities of it make a good, coarse whetstone. The greatest thickness of these beds yet found is about ten feet. An exposure on the farm of Mr. Swaney shows the following:

SECTION.

Yellow sandstone, layers 4 to 10 inches	8 ft.
Gray sandstone, layers 3 to 6 inches	2 ft.
Total	10 ft.

In a well at his residence, Mr. A. J. Swaney found this sandstone only four feet below the surface. The following is the section of Mr. Swaney's well:

SECTION.

Soil and gravel	4 ft.	
Yellow sandstone	2 ft.	6 in.
Grayish sandstone	2 ft.	
Limestone	10 ft.	
Water at	18 ft.	6 in.

Near Mr. Whitehead's mill, two miles south-east of West Point, this stone is found in the bed of Flint Creek. There are only four feet of the yellow sandstone exposed. It has been quarried here to a limited extent. It is taken out in blocks 8 to 12 inches in thickness, and of almost any size desired. Mr. Whitehead uses it instead of fire brick in his mill furnaces. Aside from the purposes enumerated above, this stone possesses little value. The extent of the deposit seems to be limited to a small area. It is found only at the tops of the highest hills and ridges, extending over a few hundred acres, except at the one exposure at Mr. Whitehead's mill, on Flint Creek. No fossils of any kind were found in it.

CONGLOMERATE SANDSTONE.

Very little of this rock is found in this county. But two exposures are known, and it is probable that no others occur in the county. The two outcrops mentioned occur on the farms of Charles Schwomberger, and Charles Ad, just at the Warren County line, and but a mile or so north of the point where the Wabash River strikes the line of Warren County. On the farm of Charles Ad, the south bluff of a deep hollow that enters

the Wabash Valley from the west, is formed of this stone. There is a perpendicular wall of sandstone here about forty feet in hight. On the top of this bluff the stone is exposed as it slopes off toward the precipitous wall. The total thickness of the stone is about sixty feet. The exposure is about seventy-five yards in length. The stone is dark-gray in color, fine grained, firm and compact. It is the very best quality of building stone. It works easily into any desired shape, and withstands climatic influences as well as any of the famous Warren County stone. The good qualities of the Williamsport sandstone are well known, and this stone is identically the same. The exposure on the farm of Charles Schwomberger is about one mile north, and a little east of the outcrop on Mr. Ad's land. The exposure there is also along the bluffs of a deep hollow. This stone has been quarried some for local use. In color and quality it is the same as that found on Mr. Ad's land. The exposure on Mr. Schwomberger's land is not more than one-half mile east of the Warren County line. That on Mr. Ad's farm is just on the county line. The great drawback to the opening of extensive quarries here is the inaccessibility of the stone. The outcrops occur in deep hollows, far away from any public road. They are too far from the river, and are still farther from any railroad than they are from the river.

At Black Rock, the Conglomerate sandstone is seen resting primarily upon the St. Louis limestone. From low-water mark, a section of the bluff at Black Rock was obtained:

SECTION AT BLACK ROCK.

Soil	2 ft.
Conglomerate sandstone	75 ft.
St. Louis limestone	120 ft.
Total	197 ft.

The limestone consists largely of dark-colored shales. The sandstone near the top is yellow, coarse and worthless for any economic purpose. It is soft and crumbles easily. Nearer the bottom it becomes dark-red in color, or nearly black, on account of the large proportion of iron in it. Immediately at the bottom it consists of large pebbles, cemented together with carbonate of iron. The name "Black" was applied to this rock on account of its dark color, derived from the iron contained in it. It has been worn into caves and arches by the action of the elements in ages past. It arises before the spectator a grand and picturesque wall, furrowed and grooved by the hand of time. On account of its weird and somber aspect, it has become a favorite resort for excursionists and tourists. From its lofty summit a grand view may be obtained of the Wabash River, winding its way in the valley below, and of the broad and fertile country beyond.

THE DRIFT.

An exhaustive study of the Drift must be extended over a wide area. Facts must be closely collected and carefully grouped. Every locality in this widely distributed formation must be patiently examined and thoughtfully studied. Geologists can not jump at conclusions, but years of continual patient study may unfold the mystery. The assertion may be ventured that no county in the Union affords a more varied exhibit of this puzzling deposit than Tippecanoe.

Mention has been made of the ancient valley which crosses the northern part of the county from east to west, and also the great basin in the central part of the county. The area of this basin is not less than 250 square miles. This ancient basin is now filled with gravel, containing a small proportion of clay, sand and bowlders. The ancient valley is filled with blue clay and sand. The following section of the Drift at Lafayette is approximately correct:

SECTION OF DRIFT AT LAFAYETTE.

Soil	2 ft.	
Sand	10 ft.	
Gravel, clay and sand	70 ft.	
Gravel, coarse	20 ft.	
Gravel and bowlders	20 ft.	
Cemented gravel	40 ft.	
Sandstone—cemented sand	6 ft.	
Cemented gravel and bowlders	15 ft.	
To surface at the Artesian well		183 ft.
Section of the Artesian well		170 ft.
Total		353 ft.

At the Lafayette Junction, one mile south of Lafayette, the following section of the north bluff of Durgee's Run was obtained:

Coarse and fine gravel	12 ft.	
Cemented coarse gravel	10 ft.	
Cemented fine gravel	4 ft.	
Cemented sand	1 ft.	
Cemented gravel—carbonate of iron		4 in.
Coarse and fine cemented gravel	25 ft.	
Total	52 ft.	4 in.

The above section was taken immediately south of the Junction Depot. About eighty yards farther west another section was obtained, as follows:

Gravel and sand	14 ft.	
Cemented gravel	10 ft.	
Cemented fine gravel	2 ft.	
Cemented small bowlders	1 ft.	6 in.
Cemented fine sand	3 ft.	4 in.
Cemented gravel and sand	35 ft.	
Total	65 ft.	10 in.

In Sleepy Hollow, two miles north-west of Lafayette, on the opposite side of the Wabash River, was obtained the following section:

SECTION OF THE NORTH BLUFF OF SLEEPY HOLLOW.

Soil and gravel	20 ft.	
Fine sand	6 ft.	
Sandstone—cemented sand		2 in.
Fine sand	8 ft.	
Cemented gravel	20 ft.	
Total	54 ft.	2 in.

The point from which the section given above was taken is known as the "sand pit." West of this about 200 yards is the "stone quarry." Here an exposure along the north bluff of the hollow reveals a stratum of sand so firmly cemented as to form a hard, durable stone. When it was first discovered a quarry was opened out here with the expectation of finding an inexhaustible supply of good building stone. This stratum of cemented sand is about six feet in thickness, on an average. It is composed of moderately fine, sharp grains of sand, firmly cemented together. It hardens, somewhat, on exposure, and, so far as tested, it proves to be a very good material for foundations for light buildings. It would be utterly worthless, however, for heavy structures. While the stratum is six feet in thickness, but a small portion of it can be procured in suitable sizes for economic use. It occurs between beds of cemented gravel, as shown by the following section:

SECTION AT STONE QUARRY, SLEEPY HOLLOW.

Soil and gravel	30 ft.
Cemented gravel	15 ft.
Sandstone—cemented sand	6 ft.
Cemented gravel	20 ft.
Total	71 ft.

Tenth Street Hollow, at Lafayette, shows grand exposures of this cemented gravel, sand and bowlders. Here, as well as at the points already mentioned, these materials are so firmly cemented together as to form immense masses of solid conglomerate. Tenth Street Hollow is a miniature cañon, eroded by the waters of the Recent Period. The bluffs of this hollow are high and precipitous. The walls of conglomerate stand up on either side in picturesque grandeur. Along their perpendicular sides may be distinctly seen the lines of stratification. Here, at Durgee's Run, on Perin Avenue, in Sleepy Hollow, on Burnett's Creek, at Battle Ground, and every point where a view may be obtained of a north or south wall these lines of stratification may be distinctly seen, and with a uniform dip to the west of usually about 15 to 20 degrees. The immense gravel deposits of the Wea Plains, and the corresponding terrace on the opposite side of the river, embracing

more than 100 square miles of territory, at every point observed show clearly that the whole mass is distinctly stratified; that it is in layers as evenly and uniformly placed as are the solid rock deposits beneath it. Wherever the gravel is solidly cemented together these lines of stratification may be followed the full length of the exposure. Excavations made in the gravel beds to procure material for road building always reveal the same facts. And further, it is always plainly disclosed that there is a slight dip toward the west. This dip to the west is observed equally on both sides of the river. On Indian Creek, Laramie Creek, Wild Cat Creek and Wea Creek—wherever this cemented gravel, sand or bowlders are exposed, the same uniform westerly dip is observed. The conclusion arrived at here is that these gravel and sand deposits, forming terraces adjacent to the river, sometimes called "alluvial terraces," are not river terraces at all, but that they were formed by the same agencies that made all the wide plains of Indiana long ages before the Wabash River traced its serpentine course across the surface. The Tippecanoe Basin was filled with clay, sand, gravel and bowlders at a period far remote from that in which the Wabash began wearing a channel through the hills and rocks of Warren and Fountain counties, to find its way to the sea.

A correct idea of the character of the gravel deposit of Wea Plains may be obtained from a section of Mr. George Humbert's well, section 30, township 23 north, range 6 west, three and one-half miles north of West Point, and about one and one-half miles south of the Wabash River.

SECTION OF MR. HUMBERT'S WELL.

Soil	3 ft.
Fine gravel	40 ft.
Sand and gravel	32 ft.
Gravel	40 ft.
Water at	115 ft.

To obtain permanent water at many points a little nearer the river than Mr. Humbert's it is often necessary to go to the depth of 125 or 130 feet, but the character of the strata passed through is always the same—sand and gravel in alternate beds. Farther away from the river, water is obtained at a less depth than at Mr. Humbert's. The farther away from the river, on Wea Plains, the nearer to the surface is water obtained. This is easily accounted for. This great mass of gravel drains the water like an immense sponge. The water from the surface sinks into the gravel, and, percolating through, sinks lower and lower as it seeks its way to the river. The water from the springs at the sides of the basin flow out through the gravel over the surface of the underlying rocks. The depth of gravel is much greater near the river, which flows through the great basin a little north of the center. Consequently the water continues to sink till the level of the Wabash River is reached.

In the southern and south-eastern part of the county the character of the Drift changes. Soil, yellow clay and blue clay occur in regular order, with more or less sand and gravel. The total depth of the Drift in this part of the county is not known, as no wells have been bored through it. Water is usually found here in sand or gravel veins from twenty to forty feet below the surface. At the residence of Mr. Omar Vickery, one and one-half miles north-west of Culver's Station, the following section was obtained:

SECTION.

Soil	2 ft.
Yellow clay	8 ft.
Blue clay	23 ft.
Water in gravel at	33 ft.

Section at the residence of Mr. E. R. Kinney, section 15, township 22, range 4, west, two and one-half miles east of Culver's Station:

Soil	2 ft. 6 in.
Yellow clay	8 ft.
Blue clay	40 ft.
Hardpan	3 ft.
Water at	53 ft. 6 in.

Section of well 100 yards north of the last:

SECTION.

Soil	3 ft.
Gravel	10 ft.
Water at	13 ft.

Section of Mr. Orlando Fiddler's well, two miles south-west of Culver's:

Soil	7 ft.
Clay and gravel	6 ft.
Gravel	5 ft.
Sand	16 ft.
Water at	34 ft.

Section of well at the residence of Mr. Allen DeHart, section 25, township 22, range 4, west, one and three-fourths miles south-west of Culver's:

Soil	2 ft.
Yellow clay	7 ft.
Blue clay	8 ft.
Gravel	1 ft.
Water at	18 ft.

Section of well at Mr. DeHart's barn, 100 yards west:

Soil	2 ft.
Yellow clay	11 ft.
Sand	1 ft.
Blue clay	19 ft.
Gravel	2 ft.
Water at	35 ft.

Section at school-house No. 6, Wea Township, three miles south-west of Culver's:

Soil	2 ft.
Yellow clay	8 ft.
Sand and gravel	6 ft.
Blue clay	41 ft.
Water at	57 ft.

The wells at Stockwell are all very shallow. Water is usually found in that neighborhood at a depth of from 12 to 20 feet below the surface. The following is a representative section of the wells there:

SECTION OF WELL AT STOCKWELL.

Soil	1 ft. 3 in.
Yellow clay	12 ft.
Coarse gravel	6 ft.
Total	19 ft. 3 in.

At Monroe, two miles east of Stockwell, the wells are a little deeper. The following section shows the character of the deposits there, so far as known:

SECTION OF WELL AT MONROE.

Soil	1 ft.
Yellow clay	13 ft.
Blue clay	13 ft.
Water at	27 ft.

The following is a section of the bluff of Laramie Creek, on the Lafayette road, north of the bridge:

Soil	1 ft.
Yellow clay	12 ft.
Blue clay	30 ft.
Total	43 ft.

In the neighborhood of Dayton the deposit of yellow clay is much thicker. The following is a section of the well of Solomon Divorce, three miles east of Dayton:

SECTION OF MR. DIVORCE'S WELL.

Soil	0 ft. 8 in.
Yellow clay	28 ft.
Hardpan	3 ft.
Total	31 ft. 8 in.

Section of Mrs. Tuey's well, three miles north-east of Dayton:

Soil	1 ft.
Yellow clay	28 ft.
Hardpan	2 ft.
Total	31 ft.

Section of Wm. Glick's well, three and one-half miles north of Dayton:

Soil	0 ft. 8 in.
Yellow clay and sand	25 ft.
Hardpan	2 ft.
Total	27 ft. 8 in.

At the bottom of this well a bowlder three feet in diameter was found.

The foregoing sections fully illustrate the character of the Drift in this part of the county. No borings have ever been made to a greater depth than that necessary to procure a constant supply of pure water. The following is a section of an almost perpendicular bluff of Cedar Hollow, five miles northwest of Lafayette:

Soil and sand	20 ft.
Clay and gravel	150 ft.
Total	170 ft.

In this hollow was found a large bowlder about five feet in diameter, with a planed and striated surface. Several bowlders planed and striated in the same manner were noticed in the neighborhood of Lafayette.

In the neighborhood of Montmorenci water is found at a depth of 25 to 30 feet below the surface. The whole of that part of the county is underlaid with blue clay. The following section of Mr. Godman's well at that point illustrates fully all that could be learned of the sub-strata there:

SECTION OF MR. GODMAN'S WELL.

Soil	3 ft.
Yellow clay	6 ft.
Blue clay	25 ft.
Total	34 ft.

In the neighborhood of Battle Ground, and north, east and west of that point, water is not found, usually, until a much greater depth is penetrated. Below is given section of wells in that vicinity.

Section of Mr. J. M. Hick's well, at Battle Ground:

Soil	3 ft.
Hardpan	3 ft.
Gravel and sand	73 ft.
Total	79 ft.

Section of J. P. Clute's well, Battle Ground:

Soil and yellow clay	4 ft.
Coarse gravel	25 ft.
Sand	30 ft.
Blue clay	1 ft.
Total	60 ft.

The two wells above described are both located on the low ridge lying between Burnett's Creek, and the swamp heretofore mentioned. Water was found a little below the level of the swamp. The following is a section of the clay bluff of Burnett's Creek, north of the town of Battle Ground:

Soil and yellow clay	10 ft.
Fine sand	30 ft.
Blue clay	50 ft.
Total	90 ft.

A little farther west another section of the same bluff shows the following:

Yellow clay	40 ft.
Gravel	50 ft.
Total	90 ft.

Below is given a section of Mr. M. L. Thomas' well on Moots' Creek, three and one-half miles east of Battle Ground:

Soil and clay	4 ft.
Gravel and sand	20 ft.
Hardpan	20 ft.
Sand and gravel	25 ft.
Gray clay	2 ft.
Total	71 ft.

Section of Wm. Hoyleman's well, four and one-half miles north-east of Battle Ground:

Soil and clay	6 ft.
Hard blue clay	54 ft.
No water at	60 ft.

This well was bored in the bottom of Moots' Creek.

Section of well at the residence of Mr. John Gross, six miles east of Battle Ground:

Soil	6 ft.
Gravel	40 ft.
Gray clay	10 ft.
Gravel	10 ft.
Water at	66 ft.

Section of Mr. Wm. Peffley's well, one mile northwest of Colburn:

Soil and clay	4 ft.
Blue clay	40 ft.
Dry, coarse gravel	20 ft.
No water	64 ft

Section of John Livingstone's well, two miles west of Battle Ground:

Soil and yellow clay	30 ft.
Fine dry sand	20 ft.
Blue clay	30 ft.
Cemented gravel	2 ft.
Loose gravel	13 ft.
Water at	95 ft.

Section of James Bryant's well, three miles west of Battle Ground:

Soil and yellow clay	4 ft.
Blue clay	50 ft.
Dry sand	20 ft.
Coarse gravel	2 ft.
No water at	76 ft.

Section of John Stanfield's well, two miles north of Buck Creek Station:

Soil and clay	4 ft.
Fine sand	45 ft.
Gravel, coarse	12 ft.
Fine gravel	4 ft.
Water at	65 ft.

Large bowlders were found in the bottom of this well.

Section of Moses Cole's well, one and three-fourths miles west of Buck Creek Station:

Soil and yellow clay	6 ft.
Gravel and sand	49 ft.
Blue clay	5 ft.
Total	60 ft.

One-fourth of a mile north-east of this well Mr. Cole found plenty of water in the sand, thirteen feet below the surface.

The following is a section of W. W. C. Brown's well, at Buck Creek Station:

SECTION OF MR. BROWN'S WELL.

Soil.	2 ft.
Yellow clay	3 ft.
Blue clay	15 ft.
Fine yellow sand.	30 ft.
Total	50 ft.

Section of swamp drained by the Southworth ditch, two miles south-west of Montmorenci:

Soil.	4 ft.
Blue clay	4 ft.
Quick sand	4 ft.
Total	12 ft.

The foregoing sections illustrate fully the character of the Drift in this county.

MARL BEDS.

There are a number of marl beds in the neighborhood of Indian Creek, and several were visited on Flint Creek. These marl deposits seem to have derived their lime from the disintegrated and decomposed limestones in the immediate vicinity. In the neighborhood of the marl beds on Indian Creek, there is no outcrop of limestones nearer than the exposure of Keokuk limestones, two miles north, but it is evident that the same rocks are but little below the surface in the vicinity of the marl deposits. The marl is of a whitish gray color, and effervesces freely on the application of acids. A ditch through a bed of this material shows a depth of more than four feet of pure marl. The thickness of the deposit may be greater as the ditch did not reach the bottom of it. A ditch running out of a swamp in the same vicinity shows the following section:

Soil	2 feet.
Gray marl	3 feet.
Gravel and iron	6 feet.
Total	11 feet.

On Mr. M. E. Sherry's farm, three miles north-west of West Point, there are extensive beds of this marl. The thickness of the deposits is from two to eight feet. Here it is plain that the lime in these beds is derived from the decomposition of the St. Louis limestones in the immediate vicinity.

This marl is whitish, soft and easily obtained, as it lies just underneath the surface. It is readily burned into a poor quality of lime. In its natural state it makes the best of fertilizers, and is a valuable addition to soils lacking in lime.

Peat beds also occur in many of the swamps on Indian Creek. In this locality it has been procured and used for fuel to some extent. But the labor of procuring and drying it is greater than the benefits derived from its use.

Iron ore is found in many of the swamps. In opening the Southworth ditch through the farm of Mr. Charles Rowe, two miles south of Montmorenci, large quantities of this mineral were brought to the surface. Many of the blocks of this bog ore weighed upward of a hundred pounds.

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