

A GEOLOGICAL SURVEY OF CLINTON COUNTY.

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Clinton County is bounded on the north by Carroll and Howard counties, on the east by Howard, Tipton and Hamilton, on the south by Boone, and on the west by Tippecanoe and Montgomery counties. This gives the outlines of a parallelogram, the north-east corner of which is severed diagonally by a zigzag line. The general course of surface drainage is to the west and south-west, the streams having, as a rule, deep-cut channels set in narrow valleys, the boundaries of which are marked by bluffs, more or less abrupt, rising to near the general level of the table-lands. The topography of these table-lands will be incidentally described under the head of geology, but it may be noted here that the changes from timber to prairie lands are often very sudden, the dividing line being clearly defined by both soil and surface configuration.

GEOLOGY.

The geological features of Clinton County belong chiefly to the glacial period, and a study of the county is interesting as a part of the general plan of examination which must be adopted by the student who would arrive at a valuable knowledge of the surface of our State and of the causes that have affected it. The soil of the county is, for the great part, a black, fertile mold or loam well mixed in places with fine sand, especially toward the southern part where the prairie gives place to gently rolling timbered land.

Such diggings and borings as have been made in the county have reached the blue clay or till a few feet below the surface. Wherever red clay is found it overlies the blue. Both these clays contain a large amount of gravel and crushed stone, but the blue is more compact and silicious than the red.

In many places along the streams of the county there are bold bluffs of the bluish-gray boulder clay, sometimes obscurely stratified, showing partings of fine buff sand. It is not unfrequently the case that a sheet of this sand will be overlaid with a thickness of ten or more feet of refractory "hardpan," that is intensely solidified blue clay practically impervious to

water. This geological feature of the county is the source of the fine flowing wells which supply the beautiful and thriving city of Frankfort with an excellent quality of chalybeate water in exhaustless quantities.

It may be well to remark just here, for the benefit of all who may be interested in boring for flowing wells, that wherever springs, and especially springs of iron water, are found flowing vertically from the ground with a strong stream, there a boring may be made with confidence, and often the water will be found to rise a number of feet higher than the ground surface if properly piped.

The area, near Frankfort, in which flowing wells are to be had, appears to follow the valley of Prairie Creek, and the water rises to nearly the level of the highest point in the city. I made an examination of this water, but no analysis. It is evidently pure, extremely cold, and holds in suspension salts of iron in sufficient quantity to color a dingy yellow whatever it runs over. Many beautiful fish ponds, with musical fountains in the center of each, have been made by boring these wells, and the carp with which they are stocked are thriving remarkably. As a rule, the source of the water is found in sand immediately under the Boulder Drift clay, at about eighty feet below the bed of Prairie Creek. It is proposed to erect water works in Frankfort, to be supplied from this underground reservoir.

In connection with the subject of sand deposits in the boulder clay, it is worth recording here that some years ago, when I was building the L., C. & S. Railway (now the T. H. & L.), I was present superintending the construction of an excavation in Carroll County, a few miles north of the Clinton County line, when a human skeleton was dug up. The bones crumbled to dust on exposure but some teeth were preserved. The position of this skeleton was in the fine buff sand, ten feet below the surface of the soil, and overlaid by a mass of peculiarly obdurate red hard-pan, nine feet thick. This hard-pan was composed of a stiff, almost dry clay, unstratified, unassorted, and in place just as left by the agency that transported or precipitated it where found. It was removed by blasting, and broke into irregular blocks from one foot to two feet across.

No paleozoic rock outcrops in Clinton County, so far as I was able to observe, nor is there a bore with any authentic section preserved down to any stratified deposits. It was said by Mr. Stealy, editor of the *Crescent*, a gentleman to whom the survey owes much, that formerly, before the bed of Prairie Creek was somewhat changed, there was an obscure outcropping of a substance resembling a silicious shale low in the west bluff of the stream, within the limits of Frankfort; but, as the boring for water shows blue boulder clay eighty feet below the streets of the city, I am inclined to think that this so-called shale was indurated clay, in fact. A careful examination did not disclose to me any indication of a genuine stratified outcrop in the county.

A large part of Clinton County is prairie, beautifully undulated, and unsurpassed for fertility of soil. Much excellent ditching, both open and tiled, has been done, and a great deal more needed in order to bring the quality of the land and the health of the people up to the maximum. The public roads of the county have not kept pace with the splendid growth of Frankfort. This is not easily understood, when one takes into account the vigorous enterprise of the citizens and the inexhaustible deposits of excellent gravel found near the city. The good gravel roads already built serve to show what a wonderful change a few more of them would work in the way of developing the agriculture of the county and the commerce of the city.

Frankfort is the county seat, and has a population of five thousand. There is no more stirring and prosperous city in the State. Its manufactories are in the hands of able and liberal men, and the city government has been noted for its efficiency. In making my survey, I took Frankfort as the center or *datum* from which I measured, and to which I referred. North of the city to the Carroll County line the land is chiefly a high plateau, once very heavily timbered, and still holding many valuable forests of oak, beech, maple, ash, walnut and tulip (or so-called poplar). South of Frankfort to the county line of Boone and Montgomery a large part of the county is prairie, near the middle of which, at Saulsbury's house, on the T. H. & L. R'y, is the highest point between Logansport and Terre Haute. West and south of this apex runs a great boulder ridge, whose general line is south-east and north-west, marking, it appears, the terminal moraine of the glacier, whose flow was south-west. I say this *appears* to indicate a terminal moraine, but further study may show that it is due to some post-glacial agency. The region where the mass of clay and bowlders is heaped in wildest confusion is on what is called Stony Prairie, some five or six miles south-west of Frankfort. Here huge fragments and rounded masses of granite, gneiss, greenstone and other metamorphic rocks fairly cumber the surface of the earth, rendering their removal necessary before the soil can be successfully tilled. On the farm of Mr. Watt I examined a great number of these bowlders, among which I noticed one of pink granite, remarkable for its fine grain and beautiful texture. Many of the larger bowlders, before they are broken to be removed, are of several tons' weight, lying half buried in the earth. In following the line of this so-called boulder trail, I noted that near the point where it crosses the eastern boundary of Tippecanoe County the surface of the earth is broken up into short wave-like mounds or hillocks, composed of coarse till and gneissic and granitic fragments of every size, from immense angular bowlders down to mere chips and pebbles. There appears no evidence of the sorting action of swift water currents, but every feature indicates that all this blended, fragmentary mass has been pushed into its present place in front of a vast plough-like glacier, or by

some other agency equally powerful. The surface configuration suggests that in places a shallow and slow current of water has passed over this boulder ridge, and it seems probable that, for a long series of years, while the glacier was melting and receding, this up-piled dyke was the stranding place of icebergs loaded with these angular and unworn fragments of metamorphic stone.

The wells in the neighborhood of this "stony prairie" are from thirty to fifty feet in depth, through a bluish clay, often densely packed with the boulders. All the fragments taken from the wells showed more of the effect of glacial grinding than those found on the surface, many of the latter being notably free of *striae* or planed faces, and showing no rounded sides. Taken as a part of the singular Drift formation running through the State from Ohio to Illinois, Clinton County offers the student of this feature of geology the finest example of what may be called the undisturbed condition of morainic matter I have ever seen. The mass in the western part of the county presents that tumbled, billowy, unassorted mixture of clays, gravels, pebbles, boulders and amorphous fragments of stone, such as the geologist would expect to find at the terminal point of a glacier which had brought its load from the regions far north of us. Features so marked as those I here speak of must of necessity be somewhat local in their nature, from the fact that the action of immense volumes of water, running with great velocity, has cut the entire body of our Drift deposits with a net-work of channels in all directions. Many of these channels have been silted up or filled up by other means, and are to be discovered now only by borings. I am led to believe that future observers will discover that sedimentary deposits of various kinds form a large part of our so-called Drift-material. This has resulted from the action of the water upon uneroded rocks during the post-glacial age, and from the formation of lakes of greater or less extent, all over the Drift area. Many of these lakes still exist as such, while others are disappearing in the form of bogs and swamps. The prairies of Clinton County are mostly the beds of old lakes never very deep—mere straggling ponds, indeed, whose water was full of aquatic vegetation in the shallower parts. This system of lakes or ponds extends southward into Montgomery County, where it spreads over the Black Creek and Lye Creek marshes. If these waters contained shells other than those of diatoms I have been unable to discover any trace of them.

In connection with the survey of Clinton County, I have pushed my examination into both Montgomery and Tippecanoe counties in order to get a better knowledge of this boulder mass. Across the northern part of Montgomery there is a well-defined boulder trail or dyke passing into Boone County on the east and obscurely connecting itself with the irregular line which crosses Clinton.

On Potato Creek and Lye Creek prairies, in Montgomery County, I

observed the same features that marked a part of Stony Prairie in Clinton County, and near Lafayette Junction in Tippecanoe County, the railroads are cut through a most interesting series of deposited matter, composed of blue till, red clay, and fine buff and reddish sand. As a rule, the coarser and cleaner gravel of this (apparently) morainic mass is found in the north and north-east sides of the hillocks. What is called Twelve-Mile Prairie is a beautiful rolling plain lying east and north of the boulder trail, and is itself a deposit of black prairie soil on heavy, comparatively "water-tight" whitish-blue till, charged with pebbles and bowlders of crystalline stone. From the bottom of a ditch I selected a number of small pebbles that were imbedded in a very light-colored clay, broke them and examined them with a good glass. One was greenstone, two were red granite, one apparently mica schist, and three were of gneissic structure. I observed a tendency toward the formation of bog iron ore in many places where the prairie soil had been cut through, but there are no considerable deposits of iron in the county.

North of Frankfort, the upper clay is red, apparently resting evenly on the refractory gray-blue hard-pan, the latter showing in escarpments in the bluffs of Wildcat and other streams. The red clay suddenly disappears at the margin of the prairie and its place is taken by a deep, coal-black soil, which, as I have said, rests on a very compact, whiteish-blue till. East of Frankfort, in the direction of the western limit of Tipton County, a heavy swell of the surface appears to mark the northern or inner line of the moraine, if it is properly so called. This ridge swings to the south of Frankfort and at Saulsbury's house, as I have said, marks the maximum altitude between Terre Haute and Logansport.

Prairie Creek, which runs near the east line of Frankfort northward into one of the branches of Wildcat Creek, no doubt marks part of an ancient valley of erosion which had been partly silted up before the last great glacier pushed into it the mass of till which now covers the old "quicksand" to the depth of forty or fifty feet. It is out of this silt, below the glacial deposit, that the water of the flowing wells rises.

The clays of Clinton County are, at many points, well suited to the manufacture of tubular ditch tile and building bricks; there is no kaolin nor pottery clay in the county.

A glance at any good map of the State will show that the drainage of Clinton County is peculiar. A large stream, almost a river, known as the Middle Fork of Wildcat Creek, cuts across Ross Township in the extreme north-west corner of the county, breaking the land up into ravines with bold bluffs and rugged terraces. Here the red clay overlying the blue is very thick and strongly impregnated with lime and iron. The soil is a light brown loam where it is mixed with sand, but gray and colder where the sand is wanting.

Near the east line of Madison Township is the confluence of Kilmore

Creek and the South Fork of Wildcat, in reaching which the two streams flow westward almost parallel to each other through Johnson, Michigan, Jackson and Washington townships. Prairie Creek runs north, past the east side of Frankfort, into the South Fork of Wildcat Creek. In the south-eastern part of the county Sugar Creek crosses Kirklin and Sugar Creek townships and passes, by a south-westerly course, into Boone County.

It will be seen that the general course of the mass of the bowlder trail and moraine-like matter is practically at angles with that of Sugar Creek and diagonally across the valley of Wildcat Creek, but the latter appears to have been deflected and forced into its present course by the obstruction offered by the moraine, as we provisionally shall call it, which is projected into and probably across Tippecanoe County.

The first outcropping of paleozoic rock adjacent to the southern boundary of Clinton County is in the banks of Sugar Creek, near Darlington, in Montgomery County, where the Keokuk formation shows itself in masses of blue shale and coarse, hard limestone. The inclination of this deposit is such that it probably passes out and gives place to an inferior formation before reaching the line of Clinton County, where the uppermost stratified rocks will no doubt be found belonging to the Knobstone group in the western half, and to the upper Devonian in the eastern half of the county. This, however, is simply an inference from facts observed outside the limit of my survey. The outcrops near Delphi, in Carroll County, on the north, those in Howard County on the east, and the Sugar Creek outcrops in Montgomery County on the south, all point to such a conclusion. The line between the Devonian and Knobstone rocks probably passes very close to Frankfort, but there are no borings from which any sections can be procured. I made careful inquiry, but could hear of no well or boring in the county reaching below the water-bearing sand and gravel of the Drift.

In connection with the survey of Clinton County, I visited a spot in Montgomery County, near its northern boundary, where were found the remains of an *Elephas primigenius*, consisting of the lower jawbone with two teeth in a fine state of preservation, and the two tusks, nearly eleven feet long, with a number of rib fragments. I tried to get possession of these interesting remains for the State cabinet, but the owners were unwilling to part with them for any reasonable sum. The place where they were found is the bed of Black Creek, a small stream running along the border of a flat bog on the land of Milton N. Waugh. This is some distance north of the bowlder trail in Montgomery County, and appears to be near the confines of what was formerly a lake covering a large part of Sugar Creek and Madison townships of that county.