

A GEOLOGICAL SURVEY OF STARKE COUNTY.

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Starke County is bounded on the north by Laporte and St. Joseph counties, and the Kankakee River (the later flowing south-west); upon the west by Jasper County; upon the south by Pulaski County, and upon the east by the county of Marshall, a boundary which gives it the outline of a right-angled and peculiarly truncated triangle, of which the Kankakee River produced would be the very crooked hypotenuse.

TOPOGRAPHY.

Starke County lies mostly in the region drained by the Kankakee River, and its surface varies between very interesting topographical extremes. Wherever there are hills they are found to be mere sand heaps closely resembling the famous Hoosier Slide at Michigan City, while the level portions of the surface alternate between flat weed prairies and dense groves of oak. The soil is excellent for grass and leguminous plants, and in many parts of the county corn and wheat grow luxuriantly.

The topography of Starke County will be understood better when it is remembered that it lies within the large area so thickly dotted over with the small lakes that make the northern part of the map of our State appear peculiarly speckled. Along the dividing line between this county and Marshall, the sand ridges and hills above noted appear, running thence in broken masses and isolated cones across to the immediate valley of the Kankakee. The sand of which these ridges and hills are composed is colored a fine pale buff, and is uniform in its granulation, the particles showing worn surfaces and rarely a sharp angle. It is lake sand, such as is cast up from all our great northern fresh water basins, and differs very materially from the sand of the low country in the Gulf and Atlantic States. It creeps in the direction of the prevailing winds wherever it is stripped of vegetation and freed from the bonds of roots and hindrance of grass, weeds, trees and shrubs.

This light sand not only constitutes the body of the high lands of Starke County; it affects the prairies as well, though here it is a small per cent. of the soil, which, when drained, is dark, loose and productive.

In a general way the sand ridges have a trend nearly north-east and south-west, presenting a billowy succession of yellowish, almost soilless deposits, with intervening fertile and beautiful reaches of land.

On the west side, or rather the north-west side of the county, lies English Lake, a large body of water formed by a widening of the Kankakee River. Near the shore of this lake is a very large, isolated and interesting sand hill known as Mt. Olympus. It stands a little way south of the mouth of Yellow River, which is the principal water course through the county. Indeed, Yellow River is a beautiful stream, swift, clear and exceedingly pure, stocked bountifully with fine fish, and bordered by tracts of good land. It runs across the county with a course quite tortuous, but nearly east and west in general, passing just north of Knox, the county seat, a small but thriving town.

A little east of south from Knox, nearly six miles, lies Cedar Lake, a lovely little basin full of cold, clear water, mostly rimmed with high sand bluffs covered with beautiful groves of oak, cedar and maple trees. I sounded this lake and found it ranging from thirty-four feet in depth down to an average of two feet at the shores. Its area is about five thousand acres, and its shore line, for the greater part, is marked by a clean beach of pale buff sand, hereafter described. Its bottom is a basin of bluish bowlder till, through which many cold fountains have made their way to feed the beautiful reservoir, supplemented by a number of springs along the bluffs, several of these latter being strongly impregnated with salts of iron. Many bowlders, varying in size from a diameter of three feet to mere pebbles, are scattered over the blue clay at the lake's bottom, along with a stratum of sand of uneven thickness. In the shallower places near the shore, mosses and water-plants of various sorts, including lilies, grow profusely. All the conditions are present to favor the healthy growth of fish, especially the black bass.

Quite a large area of the southern portion of the county is swampy, the moss from which is collected and hauled to the railroads, where it commands a good price. Much of it, when dried, is used by florists in packing their plants for shipment.

Near the extreme north-eastern corner of the county is Koonts Lake, and near the south-east corner is Manitou Lake. These are shallow bodies of water, infested with aquatic plants and probably well stocked with fish.

All the prairie lands of Starke County are excellent grazing grounds, where large herds of cattle are cared for by professional herdsmen. Across a portion of the prairies, from Cedar Lake to English Lake, a ditch has been made which was unfortunately cut into the former, draining off about two feet of its depth without serving any good purpose in this regard and somewhat injuring the lake. This outlet should be closed, as it would not hurt the efficiency of the ditch and would benefit the property around the lake.

The Tippecanoe River, by a short loop, enters and leaves the county near the south-eastern corner. It is, like the Yellow River, a clear, clean, rapid stream, well stocked with fish, and affords excellent water-power. A large part of the wet land of the county might easily be drained into these streams and their small tributaries.

The railroad facilities of Starke County are excellent, but as yet its towns are small, the principal ones being San Pierre in the extreme west, Knox near the center, Ora in the south-east, and North Judson midway between English Lake and the south line of the county. These towns, though small, are important business centers, and are quite flourishing.

As has been unfortunately the case in so many parts of our State, valuable forests have been shorn of their best timber trees all over the county, but a great deal of fine oak still remains.

During my survey I had little time to study the natural history of this county; but it offers a rich field for the botanist, the ichthyologist, the herpetologist and the ornithologist. The botanist especially will be sure of a fine return for his labors, as everywhere the ground is covered with an almost endless variety of plant life, appearing under the most favorable conditions for study in the field or for collecting. I call attention to this field with the hope that it may not long remain unworked. The swamps appear to be exceedingly rich in mosses, fungii, ferns and blooming aquatic and semi-aquatic plants.

Although the soil of Starke County is, for the most part, sandy, it seems to hold the vegetable mold of the woods and prairies with considerable tenacity, and I saw very heavy corn growing upon the sides of the sand hills.

GEOLOGY.

The geology of Starke County is of the glacial and more recent periods, there being no stratified rocks outcropping that I could discover. Everywhere, upon cutting through the sand or soil, the fine silicious boulder till, of a pale ash-blue color, is found. This is quite impervious to water, save where springs, charged, as a rule, with salts or iron, have forced their way up from the silt or sedimentary stratum, which seems to underlie it. Wells bored at Knox, at Cedar Lake and other points, after passing through the surface buff-sand, give the following general section:

Boulder clay	20 to 40 feet.
Gravel, sand and silt	To water.

I could not learn that any boring had reached stratified rock. From reasons apparent in the following facts, I feel safe in saying that none of the wells will be found to go through the entire Drift deposit, and that the

water is reached in a stratum of sedimentary matter interposed between two members of the impermeable clay. For instance, a boring at the north end of Cedar Lake gave the following section :

Buff sand	5 ft.
Light bluish clay	1 ft. 6 in.
Darker blue clay	8 ft.
Sand and gravel	3 ft.
Blue clay	18 ft. to water.
Total depth	<u>35 ft. 6 in.</u>

But the deepest water found in the lake was 34 feet, with boulder clay bottom; hence the clay at the lake's bottom was about on a level with the bottom of the well. Indeed, I have found the general rule to be that the Drift deposits gradually deepen toward the north and east, as if the whole mass had been left in the form of an irregular wedge, whose thicker end lies in the neighborhood of the lakes, and whose thinner end touches the Ohio River.

The red clay, which so commonly overlies the boulder till in Central and Southern Indiana, is almost wholly wanting in Starke County, its place being taken by a fine buff sand. While this sand is of lake origin, it is not the technical lacustral or loess, and I could find in it no traces of organic remains indicating a fresh water origin. It is a clean, thoroughly washed silicious sand, apparently barren of indices of the life borne by the waters which once covered it. It seems not to contain any boulders, these being on the surface of the underlying blue clay, or huddled together in the dry basins, or scattered over the bottoms of the lakes.

The general slope of the county is from north-east to south-west, though the local drainage falls into the Yellow, Kankakee and Tippecanoe rivers from all points of the compass. In the bluffs of these rivers the sand and clay are curiously stratified with intercalated layers of soil marking former periods of alluvial deposition.

In many of the swampy places there is a tendency toward a formation of peat, though I saw no genuine bogs, and I looked in vain for any appearance of marl or lime deposits about the lakes. From some of the wells near Cedar Lake I saw flakes of iron ore, somewhat arenaceous, but there are no paying deposits of mineral in the county, unless the bog ore, in the region of the Kankakee, should some day prove profitable. The wells at Knox, Ora and San Pierre all pass through similar formations—blue clay, ferruginous sand and partially cemented gravel with silt.

On the northern shore of Cedar Lake, near the margin, a spring gushes up in a peculiar way, giving forth a five-inch stream of iron water. I was told that so great was the force of this fountain a fence rail thrust into it would be flung out. From a careful examination and consideration of the formation here, I was led to conclude that if the bores were sunk deeper,

so as to pass through yet another stratum of impervious clay, fine flowing wells of chalybeate water could be had, though the conclusion may be erroneous.

The surface geology of Starke County presents a peculiarly interesting study, not that it is extremely diversified, but rather on account of its monotonous alternation of sand ridge and flat prairie. Here is not the place for theorizing, but I may be allowed a few words as to the existing facts. I have said that the general trend of the sand formations is from north-east toward the south-west; but this is only observable in a comprehensive way, for locally the ridges are broken into every form of knobs, bluffs, cones, lateral or flanking ridges, and, indeed, a chaos of tumbled sandheaps which reach to a considerable distance south of the southern line of the county. Under this confused, billowy deposit lies a comparatively smooth and level sheet of bowlder clay scattered over with rounded fragments of granite, gneiss, green-stone and other metamorphic rocks. In this clay are scooped the basins of the little lakes whose waters appear to rise mostly from below. Here and there an isolated sandhill rises, as if heaped there by design, with the clay, scattered over with bowlders, coming up to its base on all sides. At a number of points are dry basins of formerly existing lakes, notably in the south part of the county, with great sand bluffs set round them to the north, the east and the south-east, leaving a point of drainage at the south-west over wet, weedy prairies, or through timbered swamps. Some of the ridges are sharply serrated, sweeping in a crescent form, and half inclosing areas of flat, dark semi-marsh, heavily grown over with weeds, vines and small shrubs—a favorite resort for the woodcock and rails. It was in some of these marshes that I saw traces of bog iron ore outcropping along the lines of drainage.

I visited a party of laborers who were cutting a large ditch across the flat prairie between Ora and Cedar Lake, and made a careful examination of the exposure. I found that the soil, very dark, was a mixture of vegetable mold, sand, and a ferruginous trace of clay. Under this came the ash-blue bowlder clay, very tough and hard, bearing pebbles and worn fragments of quartz, granite, gneiss, etc. In fact, but for the little lake basins and the stream beds, if the sand were removed from Starke County there would remain a smooth, gently undulated plain of blue clay or till, cumbered with a variety of bowlders. All the streams of the county flow in a well-defined trough worn into this tough till, and their waters appear to be appreciably touched with salts of iron; especially is this observable in the Kankakee, which is fed in many places from springs running over bog iron ore and through ferruginous sand. I was told that many persons seek the Kankakee during the warm season with great faith in the efficacy of its water for the relief of indigestion and kidney troubles.

English Lake, which, as I have said, is a widening of the Kankakee,

presents many features of interest; but these belong rather to natural history than to geology. Yellow River, which flows into this lake, has its mouth lost in a wild jungle, reminding one of the Kissimee, or Lake Okechobee in Southern Florida, shut in as it is with a bewildering mass of tall water-grasses, weeds, aquatic plants, and wooded tussocks. Pushing through this tangled jungle, I flushed many ducks, an occasional rail and sandpiper, and numberless herons of several species, notably *Ardea herodias* and *virescens*, but the birds did not appear to be in good plumage. I saw a number of nests in the trees on the wooded points, but was unable to identify them.

In the south-east corner of the county there are spots bare of sand and dotted over thickly with bowlders, but, although they are partly surrounded by terraced ridges of sand, they hardly appear to be the beds of dry lakes. North of Manitou Lake I saw a great number of these bowlders on the surface, apparently lightly bedded in the blue clay.

Along the banks of both the Yellow and the Kankakee rivers, at intervals, rise immense terraced sand piles, often overgrown with oak trees and underbrush, but when their tops are clear they afford wide views of the country, especially in the direction of prairies or sheets of water. These sand piles, or ridges, do not always conform to the direction of the streams, but have been cut through by them at many points, proving that the sand was in place before the rivers were formed in their present channels; in fact, the only apparent "divide" between the Yellow and Tippecanoe rivers is this deposit of sand. No doubt the swamp lands and prairies skirted by these sand formations were mostly shallow lakes at one time, as the soil is often of a consistency that resembles peat. A careful study of the bottoms of the lakes and ponds in all the northern part of Indiana will be of great value in determining the nature of our Drift deposits, for some of these lakes are very deep, and if the bowlder till is under them all, then their basins have been scooped out since that material was deposited. Doubtless the sand of Starke County is of lake origin, but has it come from the great lakes further north? Does it indicate a southern boundary long since abandoned by Lake Michigan? Or does it owe its origin to the action of comparatively local forces, water-currents, for instance, washing and separating the sand from the silicious clay?

SOUNDINGS OF CEDAR LAKE.

The following soundings of Cedar Lake, in Starke County, have been made since the foregoing report was written, and with the best appliances for the purpose, beginning at a point off north-east shore and running with the channel in a southerly direction:

90 feet from shore	8 ft.
300 feet from shore	14 ft.
600 feet from shore	16 ft.
Off Cranberry Point	25 ft.
Northwest of Cranberry Point	28½ ft.

This was the deepest water found, though on a former trial a much greater depth was indicated. This last sounding is correct, though there may be some point of deeper water covering a very small area not sounded. Everywhere the lake's bottom is either sand or a thin vegetable sediment covering indurated boulder clay.