A Physiographic Survey of an Area Near Terre Haute, Indiana.

By Chas. R. Dryer and Melvin K. Davis.

The Survey.—In the summer of 1909 the senior author of this paper, in despair of living long enough to receive any help from the U. S. Geological Survey or from the State of Indiana, resolved to try what might be done by his own students toward a serviceable topographic survey of the area around Terre Haute. Four young men and two young women were ambitious enough to undertake the work. For a base map the atlas of Vigo county was used and found to be very poor, in fact a disgrace to the surveyor, the draughtsman, the printer and the whole community concerned. We simply made the best of it. The profiles of three railroad lines traversing the region were obtained, and other base lines and points were determined with a surveyor's level. Most of the topographic work was done with the hand level and staff. It was found possible to require that no discrepancy between different lines of levels should exceed one foot. Highways and divides were followed and section and other cross-country lines were run wherever necessary. About two days a week for six weeks were spent in the field, and the result was found to be worth while. While surveying was being done the location of particular features was noted in order that no time would be lost when their special study should come. The map drawn by the junior author of this paper from the data thus secured has proved adequate for the purpose in view.

General Description.—The area surveyed is immediately west of Terre Haute and comprises about 25 square miles in Sugar Creek township, Vigo county, Indiana. It is bounded on the east by the Wabash river and includes a portion of its flood plain. West of the Wabash bluffs, here eighty to one hundred feet high, the area consists of an originally smooth upland of glacial drift 540 to 560 feet above sea level, which has been submaturely dissected by the branches of Sugar creek. The remnants of the original surface have been reduced to the scrap-tin outline characteristic of the leaves of the pin oak. The larger valleys are flat bottomed and contain alluvial filling to a depth of 40 or more feet. The drilling of a well at Vandalia mine No. 81, section 24, showed the deposit to be 40 feet

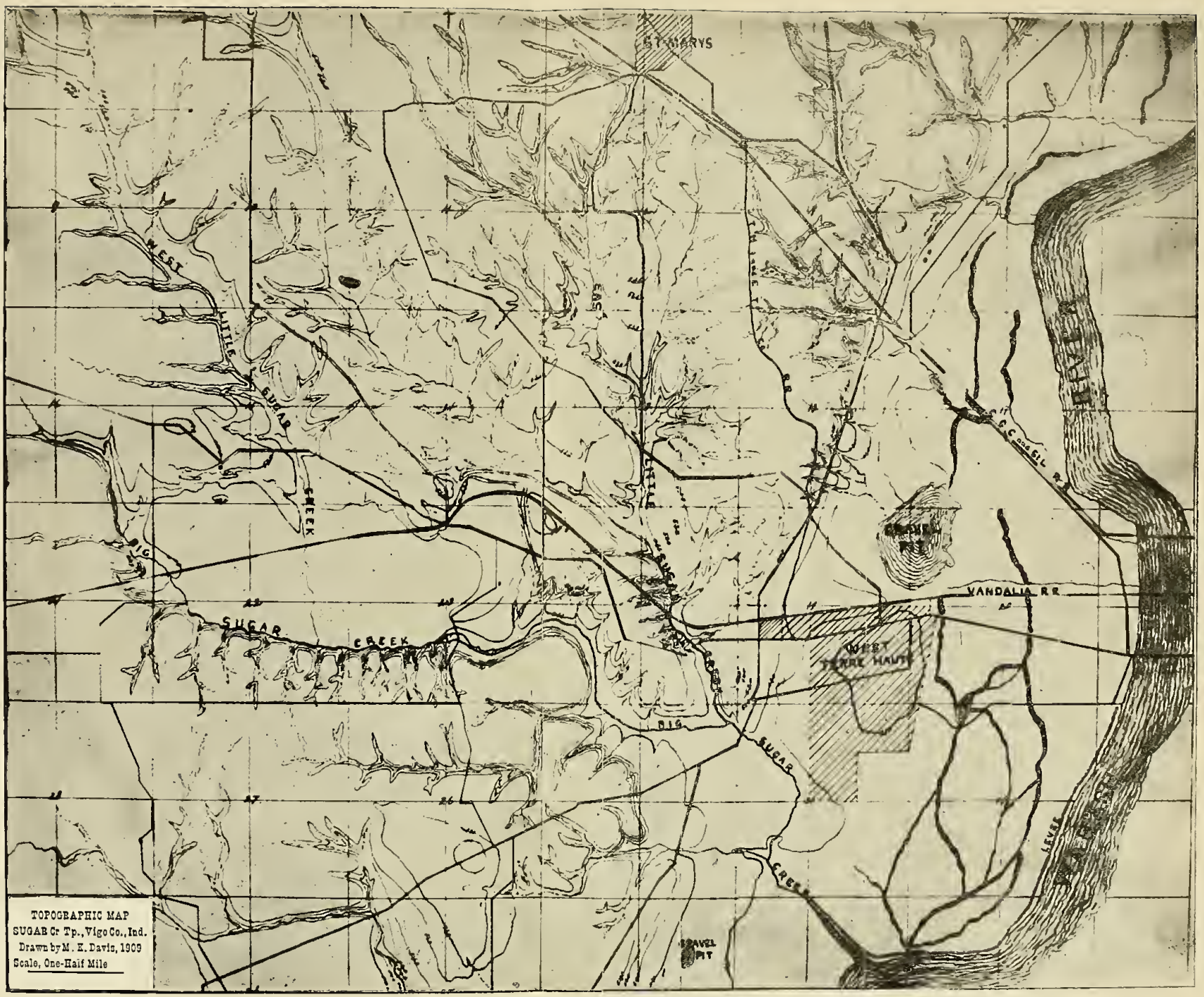
deep. The slopes of valley sides are generally steep and the ravines of the ultimate tributaries are exceedingly narrow and sharp. The depth of the glacial drift is generally from 40 to 60 feet, and the streams only here and there touch bed rock.

Many beds of recent conglomerate appear along west Little Sugar creek. The principal valleys are preglacial, with a base level determined by the level of the preglacial Wabash, which was 60 or 70 feet lower than the present river. These valleys were filled with drift which the post-glacial streams have scarcely half removed. The drainage has developed by headward erosion into an intricate, dendritic system of insequent branches which penetrate to nearly every acre of the area. Judging from the position of large trees there is reason to believe that the lines of drainage were well defined before vegetation sprang up.

Stratigraphy.—The underlying bed rocks of the area are the shales of the coal measures with several workable seams of coal, the uppermost of which outcrops along the foot of the Wabash bluffs. The shales above the coal form about one-half the height of the bluffs. The upper half consists of glacial drift. Intercalated with the shales are several thin strata of limestone, two of which exercise a notable influence upon the topography. Below the 500-foot level a tough, flinty limestone four or five feet thick has resisted river erosion to such an extent as to form a terrace between the Wabash flood plain and bluff, in some places 500 feet wide and 20 feet above the plain. We call it the flinty limestone. A similar but less silicious limestone lies about thirty feet higher. In section 31 the waters of the Sugar creek system have cut a gap in these strata and reach the Wabash at grade.

The glacial drift belongs to the Illinoian drift sheet of Leverett and lies just outside the border of the Shelbyville moraine. The mass of it consists of a tough boulder clay, weathering on exposed faces into roughly hexagonal columns and containing numerous striated and faceted boulders of moderate size. Large boulders are rare. In some places the till is one-half fine gravel. There are occasional thin partings of sand. In a railroad cut about one mile to the north of the area surveyed buried logs of wood up to nine inches in diameter are numerous along a level horizon, but no difference can be discovered between the overlying and the underlying till. In the south bluff of Sugar creek beds of laminated silt are intercalated in the till and point to the occurrence of an interglacial interval of notable extent. The upper four or five feet of drift often con-

TOPOGRAPHIC MAP
SUGAR Cr Tp., Vigo Co., Ind.
Drawn by M. K. Davis, 1909
Scale, One-Half Mile


ST. MARYS
WEST
LITTLE
SUGAR
CREEK
BIG
SUGAR
CREEK
SUGAR
CREEK
BIG
SUGAR
CREEK
VANDALIA R.R.
WEST
TERRE HAUTE
LEVEE
GRAVEL
PIT
TOPOGRAPHIC MAP
SUGAR Cr Tp., Vigo Co., Ind.
Drawn by M. E. Davis, 1909
Scale, One-Half Mile

sist of a deep red, pebbleless and structureless loam, the origin of which is an unsolved problem. The red loam, even upon moderate slopes, gullies rapidly and has greatly facilitated the dissection of the region.

The Wabash Plain, two miles in width, presents the usual flood plain features of levees and bayous. At one point, S. W. ¼ of S. E. ¼ of section 8, shale outcrops in the midst of the alluvium. Before the valley was filled this was an island in the river with deep water all around it. The valley filling in some places is 80 feet deep, and consists of sand and gravel carried into the valley by water and floating ice. At a railroad gravel pit in section 36 twenty-five feet of fine gravel is exposed, with an occasional stratum containing enough clay to resist rain wash and cause the formation of earth pillars two or three feet high. A terrace of coarse, roughly stratified gravel formerly occupied an area about one mile by one-half opposite the city of Terre Haute and was an island at high water. The town of West Terre Haute stands upon the southern half of it. The northern half has been entirely removed by the railroad companies and excavated to the level of low water in the river. The remaining surface is from 15 to 25 feet above the plain.

The Sugar Creek Drainage System presents several peculiar features and furnishes some of the most interesting problems of the area. The small tributaries of the Wabash are usually of the parallel type, not combining into systems, the main streams flowing nearly at right angles to the Wabash. The Sugar creek system is fan-shaped, consisting of four principal streams which converge southward and eastward to a junction and pass out through a single gap upon the Wabash plain. East Little Sugar creek flows southward seven miles parallel with the Wabash river and about one mile west of the bluff. In sections 25 and 26 a nameless stream flows about one mile eastward, turns northward one-half mile and again eastward, both bends being right angles. This seems to be due to harder material in the stream's course.

Sugar Creek Lake.—At the western border of the area surveyed the valley of Sugar creek widens abruptly from less than one-half mile to about a mile. Two miles below it narrows abruptly and flows for a mile through a gorge twenty to forty rods wide. The expansion and the narrows present each its own but related problem.

The expanded portion of the valley, about one mile by two, is bounded on the south by a boulder clay bluff sixty feet high; on the north by lower

and gentler slopes and is invaded near the east end by a flat spur projecting like a dam from the north side nearly to the bluff on the south. Near the south end of the dam the stream has cut a narrow gap thirty feet deep. The lower ten feet exposed in the gap is shale with a thin cap of flinty limestone. The upper twenty feet of the dam is glacial clay with the exception of a little poorly stratified gravel and sand at the south end of the dam near the creek. These features present on their face the characteristics of a drift-dammed lake drained by the down cutting of its outlet. The supposed lake bottom is underlaid, so far as discoverable, by six feet of alluvium on top of the flinty limestone. The flat-topped dam appears to be a terrace and is accordant in level with other terrace fragments in the valley of West Little Sugar creek above. In the south bluff the boulder clay is interrupted for a few rods by ten feet of finely laminated lacustrine silts, the bottom of which is at about the same level as the terrace tops.

Various hypotheses may be entertained; (1) The expansion of the valley is due to the lateral corrasion and shifting of the preglacial stream over the surface of the resistent flinty limestone. The whole valley was filled with glacial clay. The interglacial stream had a temporary base level fifty feet higher than at present and cleaned out the filling down to the terrace level (510 feet above the sea). During this process a tributary stream from the south cut a valley out of the boulder clay down to the terrace level, which was afterward filled with silt. By a lowering of the base level in the Wabash the stream was enabled to cut down the dam and to clear out the valley to the present level, draining the lake and leaving fragments of the valley filling as terraces.

(2) The preglacial and interglacial course of the stream was northeastward into the valley of East Little Sugar Creek. A readvance of the ice left a till dam across the former course and the portion of the present valley through the narrows is entirely postglacial. The complete sequence of events is not so clear as could be wished.

(3) The resistance of the two limestone strata which outcrop along the Wabash bluff and over a belt about two miles wide, west of the bluff, may account for the southward course of East Little Sugar Creek, for the narrows of the lower end of the valley and for the single gap in the bluff through which the waters of the system escape to the Wabash plain.

Period of Ravine Cutting.—The valley slopes of the ultimate tribu-

taries are so steep and the ravines are so narrow and sharp as to prevent cultivation and they are in most places forested. The frequent occurrence of large trees, one hundred to two hundred years old, in the bottom of the ravines, indicates that the present rate of downward corrasion is very slow, and that possibly the dissection of the region in the drift area was mostly accomplished during the period of ice melting and the succeeding period of bare ground, before the surface was covered with vegetation.

Culture.—The alluvial lands in the valleys are chiefly occupied by corn fields. The broken upland areas between the ravines are inconvenient for farming but many of the small fields produce good corn, oats and hay, especially hay. The only way by which cuts, fills, and bridges can be avoided in road building is to run the roads on the narrow divides between the heads of ravines. Coal mines are numerous. Along the front of the Wabash bluffs shale and coal are accessible near the surface and four large brick and tile factories have been established. The new industries have multiplied the population of West Terre Haute by five in ten years, and have caused three considerable villages to spring up from nothing in the same time.

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