

SOME HILLS OF CIRCUMALLUVIATION IN THE LOWER WABASH VALLEY

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INTRODUCTION

The purpose of this paper is to describe in detail two erosion remnants which stand above the broad alluvial floor of the Wabash valley in southwestern Indiana, and to present an explanation of their presence in the region. In addition to the two described, there are many others of similar character in the deeply alluviated floor of the lower Wabash valley. Among these are the Robeson Hills, Dicksburg Hills, Claypole Hills, Fouts Pond Hills, Dogtown Hills, Mumford Hills and Gordon Hills. They are regarded as hills of *circumdenudation* and *circumalluviation*. E. T. Cox¹ mentions several of these features in the region of Knox County, Indiana, and attributes them to the resistant power of the Merom sandstone. Malott² describes them in a general way and uses the term *island hills* as suggested by Shaw³. However, the erosional remnants in the lower Wabash in Indiana have not been described in detail.

In 1931 the writer made a study of these isolated hills in Knox County, Indiana, south of Vincennes. It is certain that these hills of bedrock rising above the alluvial floor of the Wabash valley are features connected with the history of the development of the valley itself. One of the hills studied, known as La Mamelles, is quite small, while the other, known as Chimney Hills, may serve as an example of the larger ones of the region. The author wishes to propose the term *valley braid core* to apply to these and other similar isolated masses formed in the same manner.

The writer wishes to acknowledge the able assistance and criticism rendered him by Dr. C. A. Malott of Indiana University.

DESCRIPTION OF THE REGION

The area in which the features are located is in the southwestern part of Knox County, about seven miles slightly west of south of Vincennes. The old valley floor of the Wabash is approximately flat, from three to seven miles wide, and is bordered by upland hills standing nearly 100 feet above the flood plain. On the Illinois side of the river, the upland bordering the broad valley floor is covered with glacial till

¹ Cox, E. T., Geological Survey of Indiana, 1873:324.

² Malott, C. A., Handbook of Indiana Geology, Indiana Dept. Conservation, 1922:103-104.

³ Shaw, E. W., New System of Quaternary Lakes in the Mississippi Basin, Jour. Geol., 19:481-491, 1911.

"Proc. Ind. Acad. Sci., vol. 42, 1932 (1933)."

and loess, while on the Indiana side it is mantled by wind-blown sands and loessial deposits. The Wabash River swings in broad curves across the deeply alluviated floor of the valley, occasionally touching the eastern or the western sides. In the northern part of Knox County the expansive plain lies for the most part in Illinois, but in the region of investigation it is largely in Indiana. The present Wabash River winds through this floor in a channel twenty feet or slightly more below the general surface of the valley floor, and in the mapped area (Figure 1) it is near the western side of the valley.

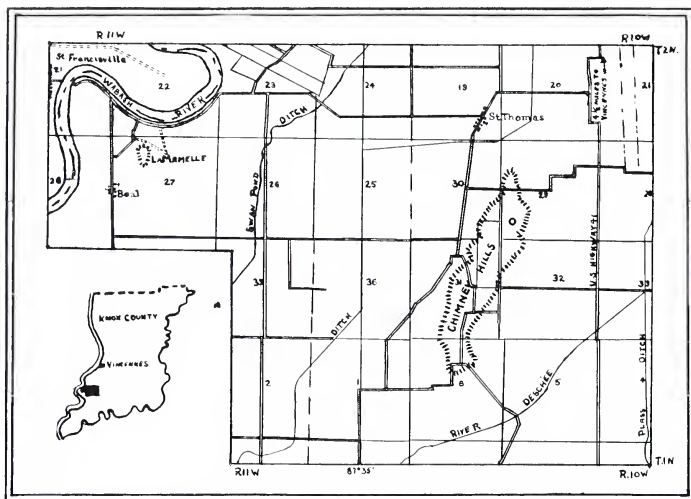


Fig. 1. Sketch map of a part of the lower Wabash valley in southwestern Knox County, Indiana, showing the location of Chimney Hills and La Mamelie.

It is assumed from the evidence produced by well records and exposures that the Wabash formerly flowed in a more restricted valley, far deeper than the present one. This prior valley served as a sluiceway¹ for the melt waters of the Pleistocene glaciers and for the waters from glacial Lake Maumee. In the vicinity of Vincennes it is believed that the eastern wall of this valley was overhanging. It is reported by Cox⁵ that a well in Vincennes penetrated several feet of sandstone and then passed into fluvial gravels and sands. The lower Wabash valley is filled with alluvium 100 feet or more above its bedrock floor, and cliffs and hills have been partly or entirely buried. The filling of the valley was attended by expansion over low parts of the adjacent upland. The tops of some of the remnants of the partially buried upland stand above the surrounding valley flat.

¹ The term *sluiceway* will be used throughout this paper and will have the meaning proposed by C. A. Malott and R. R. Shrock, Features of the Wabash Sluiceway of Northern Indiana, Bull. Geol. Soc. Amer., 40:101, 1929. "It (the Wabash valley-trough) is here designated a *sluiceway* because it is a troughlike runway through which coursed confined glacial waters of great volume."

⁵ Cox, E. T., Geological Survey of Indiana, 1873:324.

Geology. The Wabash valley in southern Indiana is carved in the Upper Pennsylvanian formations. In Knox County and in the adjacent parts of Illinois the following formations outcrop:

5. St. Wendell sandstone45 feet
4. Parker formation (undcl., coal, blk. sh., ls.).....20 feet
3. Merom sandstone60-100 feet
2. Ditney formation (coal, sh., ss.).....0-10 feet
1. West Franklin formation (ls., sh.).....15 feet

The Merom sandstone is a friable rock, loosely cemented with iron oxide and calcium carbonate, though on exposed surfaces it is often case-hardened. The color where exposed is brown to light yellowish brown. Due to the unevenness of the disconformable base of the Merom, the thickness of this formation is variable, ranging from 60 to 100 feet. In the described locality, the thickness has been shown by well records to be 100 feet or slightly more. The erosional remnants found in this section of the Wabash sluiceway are composed of this sandstone. Occasionally in the higher isolated hills, the Parker suite of coal, shale and limestone is exposed immediately above it.

In a personal communication from Dr. Malott, the writer learned that the top of the Merom had been determined in several points in Illinois adjacent to the described area. Two miles south of Lawrenceville and at St. Francisville the elevation is 425 feet above sea level, and at the foot of the Robeson Hills northeast of Vincennes it is 420 feet. The top of this formation at the Dicksburg Hills in southern Knox County has an altitude of less than 400 feet above sea level and is below drainage level at this point.

Chimney Hills. Chimney Hills are located about seven miles south of Vincennes near the eastern border of the old sluiceway floor, and extend about two and one-half miles from the SW $\frac{1}{4}$ of NW $\frac{1}{4}$, sec. 29, T. 2 N., R. 10 W., to near the middle of sec. 6, T. 1 N., R. 10 W. The trend of the major axis of the hills is 18° west of south, which is near the general direction of elongation of the majority of the erosional

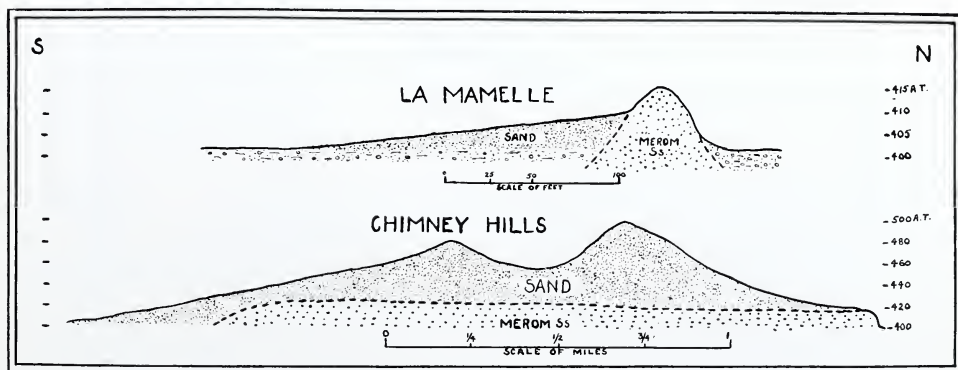


Fig. 2. North-south cross section of La Mamelle and Chimney Hills, showing the relation of the Merom sandstone to the two remnants.

remnants in the district. The hills have an average width of one-half mile, but narrow on the northern and southern ends.

The Merom sandstone underlies the entire isolated mass (Fig. 2) with the exception of the extreme southern end, where the sands have formed a "tail" stretching in a down-valley direction behind the buttress of the stone. At the northernmost end of the hills, the Merom forms a fifteen-foot bluff extending completely around this end. The rock is in place at this outcrop with the exception of several large blocks which have slumped from the sides. The altitude of the top of this exposure is 423 feet above sea level, so that it may be assumed that it is near the top of the Merom sandstone. The rock here is brownish in color on a fresh surface, and the exterior has been exceptionally case-hardened by iron impregnation.

One-eighth mile south of the bluff-head of the Chimney Hills, gravel with erratic pebbles is abundant in a small swale on the surface of the hills. These erratics are composed of gneiss, granite, quartzite, vein quartz, and schist. Farther south the crest of the hills rises to an elevation of 500 feet above sea level, or about 100 feet above the broad valley in which they occur. The southern end is composed of sands of the light brown variety found in the sand dunes which blanket the hills to the east of the sluiceway. The sand resting on the remnant hill is undoubtedly also of eolian origin. Beneath the sand dunes, the Merom formation is exposed in several gullies along the flanks of the ridge near the bottom, but in no place is the Parker formation to be found. It is apparent that the less resistant rocks have been eroded from the top of the hills.

Immediately back of the bluff at the northern end, the same rock is exposed over nearly an acre of the surface of the hills. There is no soil covering here and the rocks are marked in places by shallow scratches or striations. There are several sets of these grooves, inclined to one another at angles from only a few degrees to 90°. The principal scratches trend north-south and east-west, though many of the sets have a northwest-southeast direction. No northeast-southwest markings were noted. At first the writer was inclined to believe that these were glacial striae, carved by the movement of the Illinoian ice sheet over the region, though the angular relations of the sets of scratches were not readily explainable by the differential movement of the ice in the mass. Subsequent burial of the rock surface by till and the removal of the covering by the melt waters that flowed through the valley at a later time were postulated as the agencies which were responsible for the preservation and exposure of these interesting features. But in view of the fact that flumes have been found along the course 55 feet above the floor of the valley, it is not practical to assume that erosion in such a mass of water would not have removed the shallow scratches.

It is well known that blocks of ice containing included rock fragments floated down the Wabash River in the melt waters, since some of these foreign boulders have been found buried in the sands and gravels of the alluvial plain. In view of this fact, an alternative hypothesis for the formation of the markings is the stranding of cakes of floating ice on the rock mass when the valley was flooded with melt waters. If the

boulders in the stranded ice blocks were dragged across the rock, certainly scratches would be formed on the surface of the friable Merom sandstone. The shifts in the current would account for the various orientations which the grooves possess. These grooves may also have an artificial origin, and indeed some of them seem to indicate this, though the majority are too straight and evenly spaced to have been formed in this manner. It is possible that the scratches are due to a combination of the last two agencies mentioned, scratching by artificial means and the dragging of stranded ice blocks across the surface.

On the flood plain along the eastern side near the northern end of the hills, a narrow swamp occupies a small swale about 100 yards long. Immediately adjacent, to the east, a swell rises about ten feet above the general level of the broad alluviated valley floor. It is believed by the author that the swale was formed by the sweep of the current around the bluff at the northern end of the ridge. The swell was formerly a bar, originating from the material which was carried away from the river bed at the side of the former bedrock island.

La Mamelle. La Mamelle is located four miles slightly west of north of the Chimney Hills and about one-half mile northeast of the small village of Beal. It is in the NE $\frac{1}{4}$ of NW $\frac{1}{4}$, sec. 27, T. 2 N., R. 11 W. This hill is a cone-shaped erosion remnant composed entirely of Merom sandstone, at about the same horizon as that in the Chimney Hills. The visible part represents the crest of a hill which barely escaped complete burial beneath the alluvium of the broad valley floor (Fig. 3). The top of this isolated hill has an elevation of 423 feet above sea level, and stands fifteen feet above the surface of the flat sluiceway floor at this point. The elevation of the top of the exposure of Merom sandstone at St. Francisville, one mile northwest of La Mamelle, is 425 feet. Since the formation at this point lies nearly on the axis of the Central Interior Coal Basin, and the beds are almost horizontal, it may be assumed that the crest of the hill is at the top of the Merom.

A tail of sand (Fig. 2) extends for 200 feet downvalley from the remnant in a direction 25° west of south. This light brown sand is in contrast to the black alluvium covering the remainder of the area, and was formed as a bar behind the hill when it was a bedrock island in the former waters of the Wabash sluiceway.

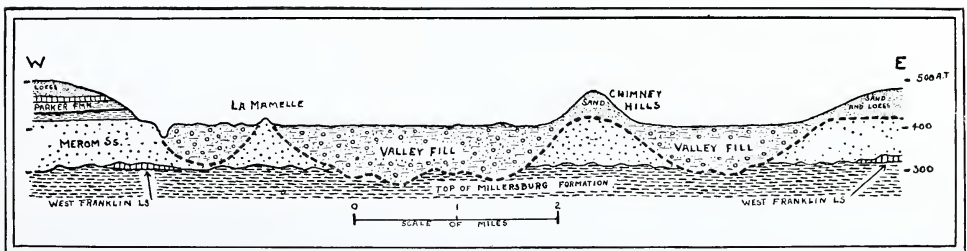


Fig. 3. East-west cross section of the Wabash valley in the vicinity of La Mamelle and Chimney Hills, showing the alluviated valley braids and hills of circumalluviation. The broken line represents the profile of the former valley floor.

CONCLUSION

It is a generally accepted fact that the Wabash River at the beginning of the glacial epoch or soon afterward occupied a valley much deeper than the present one, and that during the ablational period of the Wisconsin ice sheet great quantities of melt waters were discharged down this valley sluiceway. The enormous quantities of detrital materials furnished by the ice to this flooded stream were deposited on the bedrock floor, building it up until the heavily loaded stream was forced to seek additional channels in the pre-existent valleys at the edge of the bordering upland. At the places where the water first spilled over the fluves, the residual material was swept from the rock, and in Illinois a few of these rock floors, cleaned by the current, are still exposed. In the deeper parts of the fluves, alluviation was the dominant process, as was the case in the main channel of the sluiceway.

In many places in northern Indiana, evidences of anastomosing valley troughs are found along the course of the Wabash River. Cumings and Shrock⁶ have described the upper Wabash valley as consisting of a number of interlacing parts, all occupied at one time by the great anastomosing river. They have proposed the name *valley braids* to apply to the present streamless or abandoned valley channels. Malott and Shrock⁷ have also discussed these features of the Wabash sluiceway as follows: "*Valley braid* is a term proposed for the individual runway of a valley which is in anastomosis, its valley parts passing around features in bas-relief or about upland tracts. The floors of the valley braids may be near the level of the one which carries the present stream or they may be much higher. Valley braids are numerous in some stretches of the Wabash sluiceway. . . . The present river channel chooses its way among them, as it were, and occasionally passes through one with vertical walls strikingly close together. . . . They range in width from narrow rocky floors a few yards across to mighty valleys a mile wide. The wide valley braids are in glacial drift."

In the upper section of the river the valley braids never became exceedingly wide, but in the lower stretches of the sluiceway where the greatest alluviation occurred, these anastomosing streams extended their valleys laterally as the floors were raised by deposition, until the upland masses around which they were braided were reduced to mere fragments standing above the water. As the waters receded, the Wabash apparently occupied any valley of its choosing and the remainder of the valley braids became streamless valleys surrounding bas-relief features. It is for these fragmentary upland masses, surrounded by abandoned valley braids, that the writer proposes the name *valley braid core*, or more simply, *braid core*. This term is used in the same sense as the term *meander core* is used to denote the upland mass around which waters formerly flowed in a meandering valley.

⁶ Cumings, E. R., and Shrock, R. R., *The Geology of the Silurian Rocks of Northern Indiana*, Indiana Dept. Conservation, 1928:40.

⁷ Malott, C. A., and Shrock, R. R., *Features of the Wabash Sluiceway of Northern Indiana*, Bull. Geol. Soc. Amer., 40:102, 1929.