

## Three Pleistocene Terrace Levels Near Terre Haute, Indiana<sup>1</sup>

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During the summers of 1953 and 1954 the authors were engaged in mapping five 7½-minute quadrangles along the Wabash River in the northern half of Vigo County and the southern half of Parke and Vermillion Counties. Some difficulty was experienced in trying to delimit the boundaries of two sand and gravel terraces. This difficulty led the authors to make a more detailed investigation of the area.

These sand and gravel terraces are of Wisconsin age. They were noted at least 85 years ago by Bradley (3) while he was making a study of the geology of Vermillion County. Although he did not have time to study the terraces, he suggested that they resulted from action of local tributaries of the Wabash River. Many later workers, namely Cox (4), Scovell (9), Ashley (1), and Leverett (8) observed and discussed these terraces. Most workers considered them to be one unit. Dryer (5) described the terraces as to size and location; he stated that they extend from Montezuma to Terre Haute and rise to two or three steps from 20 to 80 feet above the floodplain of the Wabash River.

Fidlar (6, fig. 1) recognized two terraces in the vicinity of Vincennes and named them according to their origin. The uppermost terrace level was formed during Wisconsin time when the ice advanced to its southernmost extent. This limit of ice advance is marked by the Shelbyville moraine, which extends eastward across the Wabash Valley in the northern part of Vigo County. During the time that this moraine was formed tremendous volumes of water came from the melting ice and, carrying clay, sand and gravel, flowed into the drainage systems of the Wabash River. Large boulders, gravel, and sand were deposited in the valleys near the edge of the ice. The detrital material became better sorted, and grain size and quantity of material decreased downstream.

The valley fill was built to the highest level near the moraine and gradually sloped downstream. This high aggradational surface now has been greatly dissected and forms the tops of irregular patches of terrace along the Wabash River. Because of the relationship in time between the Shelbyville moraine and the upper terrace, Fidlar (6) designated it the Shelbyville terrace.

This upper level does not begin at the south edge of the Shelbyville moraine, however, but continues at about the same slope several miles northward, where it is overlapped by younger outwash. One should expect the valley fill to continue northward because torrents of water carrying a heavy load of gravel, sand, and clay continued to flow down the Wabash River and to fill the valley with outwash sand and gravel as the ice melted and the ice front receded.

The upper surface of the lower terrace was developed at the end of

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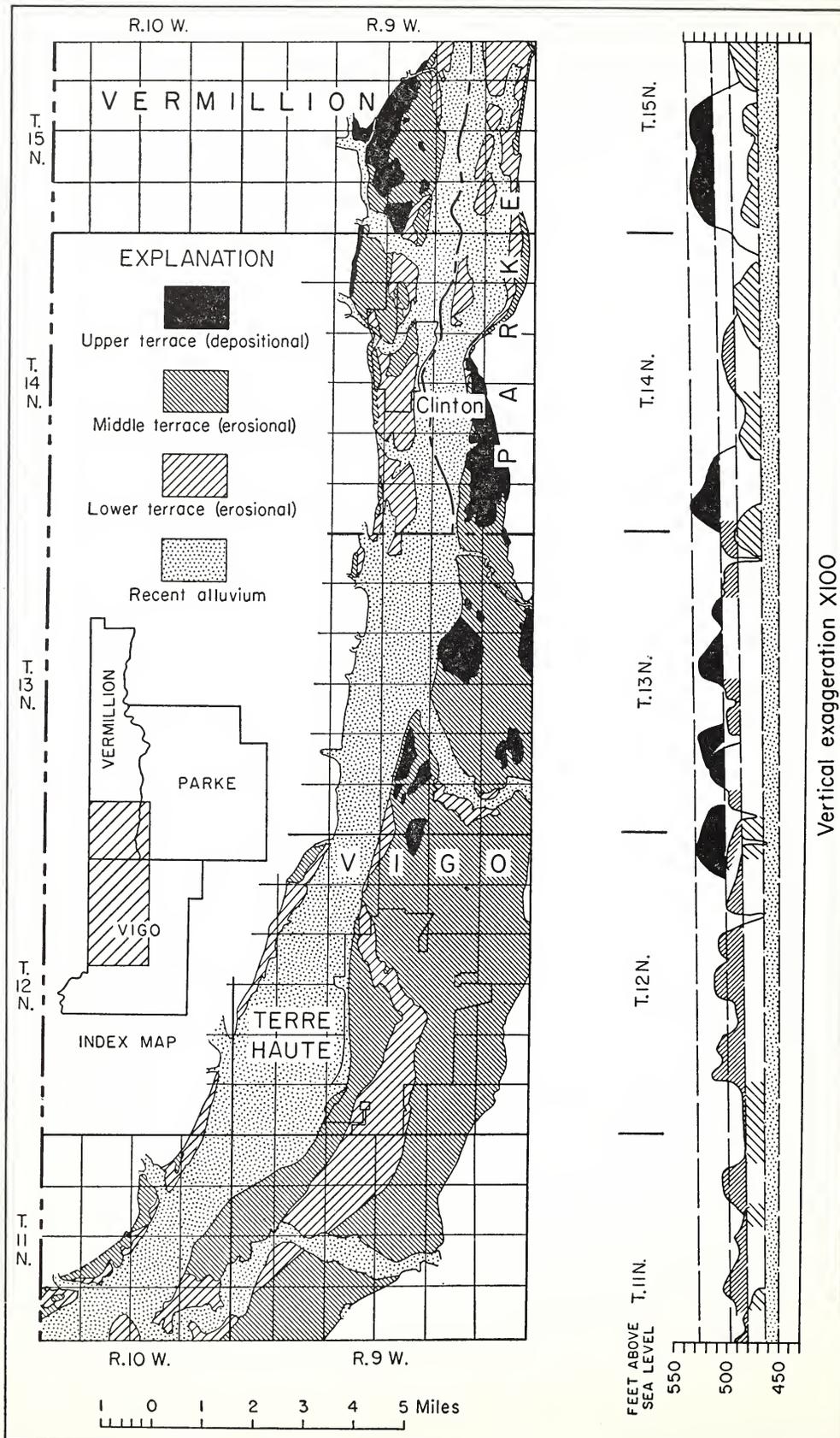


Fig. 1. Map and cross section showing vertical exaggregation X100 near Terre Haute, Indiana.

Cary time when floodwater from Lake Maumee flowed down the Wabash River. After the Erie lobe had completely withdrawn from Indiana, water was ponded in Lake Maumee northeast of Fort Wayne, Ind. The surface water at this place normally would have flowed northeast through Lake Erie, but this area was still covered with ice, which served as a dam. The water rose in Lake Maumee until it spilled out into the Wabash drainage.

Remnants of the beach of this lake and the spillway are still well preserved near Fort Wayne. The spillway is now occupied by the Little Wabash River. The water from Lake Maumee was relatively clear inasmuch as the clastics from the glacier already had settled out in the lake. This torrent of water eroded large amounts of sand and gravel that previously had been laid down as outwash from the glacier and it cut the river bottom to a lower level. This level of erosion forms the top of the Maumee terrace (6).

Recent studies indicate that more than two terraces are present. Certainly three terraces can be recognized in the Clinton-Terre Haute area and perhaps more could be mapped if altitudes were carefully plotted. Remnants of the upper terrace level were mapped by Fidler (7) along the Wabash River from about 10 miles north of Terre Haute southward to about 10 miles north of Vincennes. Wayne (11) mapped a similar upper level of valley fill northward to Lafayette. Only the uppermost level of the Shelbyville terrace of Fidler and the uppermost level of valley fill of Wayne are here mapped as the upper terrace (fig. 1).

The composite cross section shown in figure 1 extends along the river in the mapped area and includes the entire width of the valley. Representative remnants in the middle and on both sides of the river are included. A few remnants which are difficult to interpret because of a cover of hillwash or wind-blown sand were left off. Because the vertical exaggeration of the cross section is 100 times, all differences are accentuated.

The upper terrace has an altitude of 550 feet 5 miles north of Clinton and 530 feet in the north side of Terre Haute. This level also is farther south in the southern part of township 11 and the northern part of township 10 at an altitude of 505 to 510 feet. Thus the top of the upper terrace slopes southward 1.25 feet per mile.

The upper surface of the middle terrace is 20 to 25 feet below the top of the upper terrace in the mapped area. It is represented as a well-defined area just north of our map in the northern part of township 15 at an altitude of 530 feet. It occurs at an altitude of 510 feet at Clinton, 500 feet at Terre Haute, and 490 feet at the south end of the mapped area. This middle terrace is not as distinct as either the upper or lower one and, in some localities, appears to be a broad slope between the two, but distinctly separated from them. In townships 11 and 12 the upper surface of the middle terrace is not well marked. The middle terrace may rise locally as much as 10 feet higher than the interpolated slope (fig. 1) would allow. Part of this discrepancy may be due to wind-blown sand piled on top of the terrace, but sand is not thick enough to account for all of the difference. Perhaps this anomaly represents incomplete cutting down of the upper

terrace or possibly an intermediate level between the upper and middle terraces.

The top of the lower terrace is sharply defined. It lies approximately 40 feet below the upper terrace and slopes southward about the same amount as the upper terrace. The lower terrace is 510 feet in altitude in the northern part of the mapped area, 500 feet near Clinton, 490 feet at Terre Haute, and 470 feet in the southern part of the mapped area.

Three small island terraces, each less than 1 mile long, are shown in township 15 north. These island terraces are 10 to 15 feet below the projected level of the lower terrace as shown in the cross section; they probably resulted from partial erosion of the lower terrace. The area mapped as lower terrace just north of Terre Haute in section 35 probably owes its origin to erosion by flood waters from Otter Creek rather than from Lake Maumee.

The upper terrace is probably the uppermost level of valley fill that was deposited during Wisconsin time when the ice sheet reached its maximum southern extent and then retreated northward. In Wabash County (13) the upper level of valley fill is younger; it was deposited during Cary time and is called the Mississinewa terrace. During the time Cary sand and gravel were deposited in the upper reaches of the Wabash River, some sand and gravel were being eroded in the lower part of the Wabash. The erosion which produced the middle terrace may be accounted for by water which flowed for a long period of time down the Wabash River after the time of maximum deposition of sand and gravel and before the Maumee overflow.

Withdrawal of the ice sheet in Indiana from the Shelbyville moraine was not continuous and uniform (12) but consisted of two distinct fluctuations. After the ice receded northward it readvanced, although not as far southward, to form the Bloomington moraine. Again the ice receded and again advanced a shorter distance, deposited the Packerton and Mississinewa moraines, and receded. Other fluctuations of the ice must have occurred between these known ones.

The time which elapsed between the deposition of the Shelbyville moraine and the spilling of Maumee waters down the Wabash River must have been more than 5,000 years. Recent radiocarbon dating (2) indicates a date of  $19,500 \pm 800$  years for wood found at the base of Wisconsin till near Greencastle. Suess (10) gives a date of  $13,020 \pm 400$  years for a material deposited in Late Cary time in Steuben County and approximately 11,400 years for a deposit from the Two Creeks interval from Manitowoc County, Wisconsin. The overflow from Lake Maumee down the Wabash River must have occurred between these two dates. During nearly all of this time glacial meltwater in varying amounts flowed down the middle and lower Wabash Valley.

The lower terrace was eroded to its present level by floodwaters from Lake Maumee. The present floodplain and channel were cut down after the water from Lake Maumee no longer flowed down the Wabash River but flowed through an outlet into Grand River and across southern Michigan. Since that time the ice sheet has been absent in Indiana, and normal runoff waters have eroded the floodplain to its present level.

In summary, at least four distinct topographic levels are represented by straths of outwash sand and gravel in the Clinton-Terre Haute area. The upper terrace level is the upper level of valley fill. The middle terrace is a level of erosion that had been reached before the water from Lake Maumee spilled down the Wabash River Valley. The lower terrace is the bottom of the valley after erosion by Lake Maumee water. The present floodplain resulted from erosion since the time that Lake Maumee water ceased to flow down the Wabash River. Cutting down to the middle terrace level took 5,000 to 8,000 years. Cutting down to the top of the lower terrace probably required a few hundred years, and cutting down to the present floodplain level required another 10,000 to 13,000 years.

When terrace remnants are plotted on a cross section of the entire Wabash Valley, a series of overlapping slopes should become apparent. Each slope represents a fluctuation of the ice front and consists of a depositional part at the upper end and an erosional one at the lower end.

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