The Upper Alluvial Terrace Along the Ohio River Valley in South-central Indiana

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Abstract

Remnants of maximum Pleistocene alluviation along the Ohio River through the area of Chester outcrop in southcentral Indiana are preserved as terraces mantled with silt and sand dunes. In vertical section the maximum grain size of the outwash incorporated in these terraces decreases from gravel, with some cobbles and boulders on the upper surface of the valley train, to sand at depth. This coarsening-upward of grain sizes was caused by deposition in response to invasion of the Ohio River Basin by glacial meltwaters.

Excavation of the previous valley fill was evidently accomplished by the initial flow of meltwater. Subsequently, the valley was buried by an outwash train in which particles sizes formed a continuum with the smallest grains in the lead and an increase in grain size upstream. Aggradation of the valley caused the coarser sediments to override, rather than displace, the finer particles. The lack of symmetry, and of sediments corresponding to a waning phase of deposition, seems to indicate that abatement of meltwater flow was abrupt. The valley train material is surmounted by as much as 25 feet of clay, silt and sand which was apparently deposited as overbank material during floods prior to deep entrenchment of the River.

Return of the River to an essentially nonglacial regimen caused entrenchment of the aggraded surface producing the existing fill and cut terraces.

Introduction

The upper alluvial terrace was studied in that reach of the Ohio River Valley which extends from Mauckport to Cannelton, Indiana. In this area the bedrock valley of the Ohio River is cut mainly in rocks of the Blue River and Chester Groups (Mississippian). Sediments resulting from maximum Pleistocene alluviation are preserved in this part of the Valley as extensive terrace tracts that are locally overlain by silt and sand dunes. The materials comprising these tracts can be most readily studied where natural exposures, gravel pits and wells penetrate the fine-grained overbank deposits that mantle the valley-train material. In the study area exposures are located as follows: (*1*) two extensive sand and gravel pits at Mauckport, Indiana; (*2*) a small sand and gravel pit near Cape Sandy, Indiana; (*3*) a large natural exposure along Yellowbank Creek in Breckinridge County, Kentucky; (*4*) a sand and gravel pit at Cloverport, Kentucky (Figure 1). Data from these exposures coupled with well information permits interpretation of the sedimentary history of this portion of the alluvial deposits in the study area.

Characteristics of the Upper Alluvial Terrace

The upper alluvial terrace stands about 90 feet above normal pool stage of the Ohio River and about 45 feet above the modern floodplain. In most areas the boundary between the terrace and floodplain is dis-

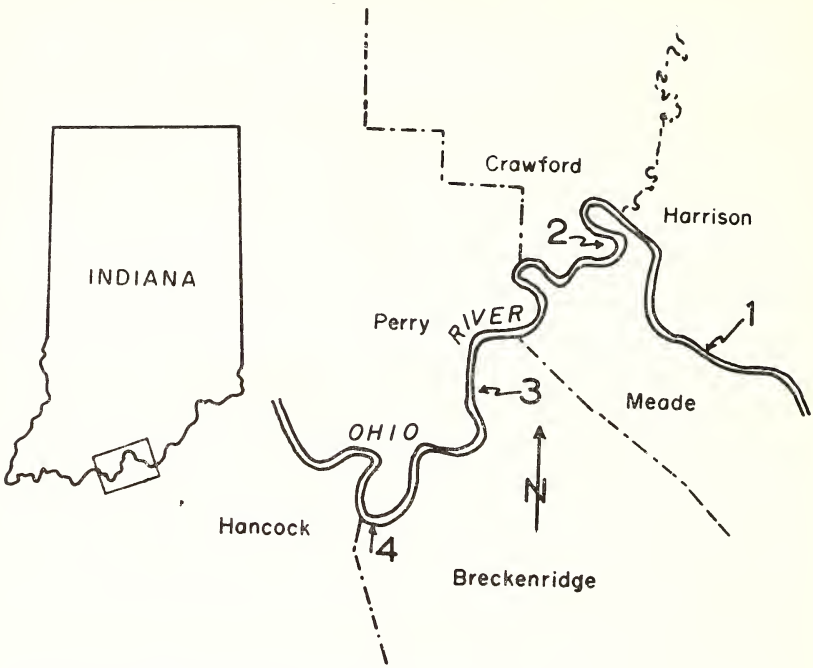

Figure 1.—Index map of study area showing location of exposures. *1.* Mauckport, Indiana; *2.* Cape Sandy, Indiana; *3.* Yellowbank Creek, Breckinridge County, Kentucky; *4.* Cloverport, Kentucky.

tinct and scarp-like. The terrace surface is relatively flat and rises from an elevation of 425 feet at Cannelton to 455 feet at Mauckport, Indiana, and has a gradient of 5 inches per mile. In comparison, the modern Ohio has a low-water gradient of about 4 inches per mile (1).

The exposures at Mauckport are typical and more extensive than elsewhere. Here, well information indicates that there is a basal zone of coarse gravel and boulders overlain by fine sand. A progressive upward increase in grain size, from this fine sand at depth, culminates in gravel-sized material near the upper surface of the valley-train deposits. The sand and gravel is cross-bedded and contains local intercalations of silt and clay. Sieve analysis of the outwash material indicates that there is a progressive decrease in mean-grain size downstream.

Throughout the area there is a distinct disconformity between the valley-train material and the overlying fine-grained deposits. Locally, as along Yellowbank Creek in Kentucky, braid channels and islands are preserved on the upper surface of the outwash sand and gravel. These channels are 4 to 6 feet deep and contain boulders to 18 inches in diameter. This irregular surface is overlain by 10 to 25 feet of fine-grained leached and oxidized overbank deposits. At Wolf Creek, Kentucky, and Dexter and Tobinsport, Indiana, these overbank deposits are mantled by elongate silt and sand dunes.

Depositional History

A large portion of the pre-Wisconsin alluvial fill of the Ohio River Valley was excavated during late Sangamon and early Wisconsin time. The initial flow of glacial meltwaters coupled with a low stand of sea level most likely caused the deepest scouring. That most of this material was removed is indicated by small remnants of older alluvium penetrated in two wells located in protected areas of the River Valley. The course gravel and boulders on the bedrock floor of the valley are interpreted as the bed load of the stream which produced this scour.

Subsequent to excavation the valley was buried by an outwash train in which particle sizes formed a continum with the smallest grains in the lead and an increase in grain size upstream. Aggradation of the valley caused the coarser sediments to override, rather than displace, the finer particles. The lack of symmetry of the valley train deposit, that is, the lack of sediments referable to a waning phase of deposition, seems to indicate that abatement of meltwater flow was abrupt. Withdrawal of the glacier from the Ohio River Basin is the most likely cause of this sudden change in regimen of the Ohio River.

The upper surface of the valley-train has been interpreted as an erosional surface by Walker (2). Ray attributes the fine-grained overbank deposits to the waning phase of glacial outwash deposition, and thus denies the existence of a disconformity between the valley train and the overbank deposits (1). That the upper surface of the valley train is not an erosional surface is indicated by the presence of relic braid channels and islands, such as those preserved along Yellowbank Creek in Kentucky. Undoubtedly local unprotected areas were scoured prior to deposition of the overbank deposits. Flat unconformity surfaces such as the one at Mauckport were most likely produced in this manner. The sharp line of demarkation between the fine-grained materials and the valley train and the contrasting compositions of the two materials precludes interpretation of this contact as being gradational.

Abatement of meltwater flow caused an abrupt change in regimen of the River; consequently, the River began to entrench the valley-train materials and formed a single channel (Figure 2 A & B). Floods during this period of downcutting spread fine-grained sediments across what is now the upper surface of the terrace. Overbank deposits were laid down on this surface until the River was entrenched to the point that this surface was no longer inundated during floods (Figure 2 C). At present only very large floods reach the base of the terrace scarp, and overbank deposition is taking place mainly on the modern flood-plain (Figure 2 D).

This interpretation of the origin of these fine-grained sediments is at variance with the postulates of Walker (2) and Ray (1). Walker considered there deposits to be normal nonglacial sediments deposited because of a late glacial rise in sea level. As mentioned above Ray considered this material to be deposits laid down during the waning phase of valley-train emplacement.

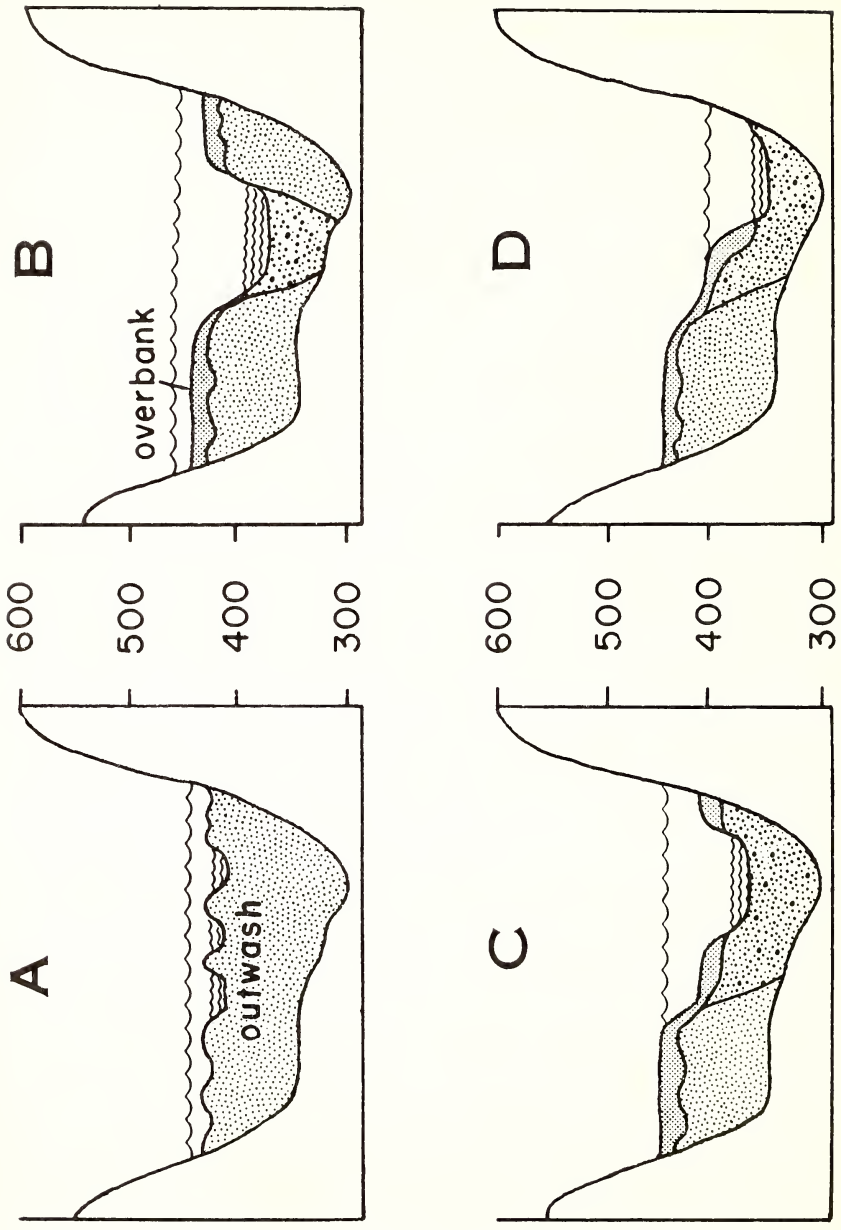

Figure 2.—Sequential development of the alluvial fill of the Ohio River Valley. A. Maximum alluviation due to glacial outwash; B. Following a change in regimen the river formed a single channel and entrenched the outwash; C. Progressive entrenchment and deposition of overbank material by the River; D. Configuration of present alluvial fill.

Summary

Most pre-Wisconsin sediments in that reach of the Ohio River Valley from Mauckport to Cannelton, Indiana, were removed by erosion prior to invasion of the Valley by outwash of Wisconsin age. Invasion of the Valley by glacial meltwaters and outwash resulted in emplacement of a valley train in which maximum particle sizes grade from fine sand near the base to gravel at the upper surface. This material is overlain disconformably by fine-grained overbank deposits of dominantly non-glacial origin. Entrenchment of these materials by the Ohio River formed the terrace tracts present in this reach of the Ohio River Valley.

Literature Cited

1. RAY, L. L. 1965. Geomorphology and Quaternary Geology of the Owensboro Quadrangle Indiana and Kentucky. U.S. Geol. Survey Prof. Paper 488. 72 p.

2. WALKER, E. H. 1954. The deep channel and the alluvial deposits of the Ohio Valley in Kentucky. U.S. Geol. Survey Water-supply Paper 1411. 25 p.