The Origin of the Devil's Backbone, Jefferson County, Indiana

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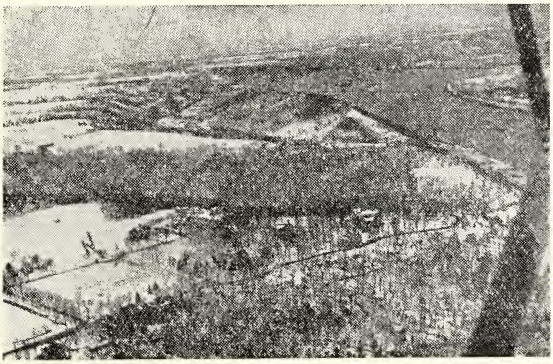
Introduction

About two miles west of Madison, Indiana, an isolated mass, commonly called the "Devil's Backbone" rises some 360 feet above the Ohio River. It is separated from the adjacent upland by a well defined valley known as the "Hog Trough" whose bottom is subject to flooding, by backwater from the Ohio, except at its highest point which is a divide just west of the Jefferson County Infirmary. This report will consider various hypotheses of origin of this feature.

Geology

Bedrock. The Backbone, like the adjacent upland, is made up of Ordovician and Silurian rocks. The various formations in these periods



occur in the same relative position in the Backbone and upland. That the Backbone has at some time been a part of the adjacent upland and that unusual erosive forces have conspired to separate it is assumed.

Alluvium. The "bottoms" along the Ohio River are alluvium, sand, silt, and gravel. These bottoms rise in a series of terraces described by Culbertson[1] as flood plain 458 feet, first terrace 475 feet, second terrace 508 feet, and third terrace (absent on Indiana side of the river, but 544 feet at Milton, Kentucky, across the river). The Ohio river itself is given as 425 feet above sea level when at pool stage.

[1] Culbertson, J. Archer. Notes on some Ohio River terraces. Proc. Ind. Acad. Sci. **37**:120.

Borings made in the bed of the Ohio prior to building the Madison-Milton highway bridge passed through 68 feet of alluvium before meeting bedrock. Segments of both first and second terraces can be recognized in the valley west of the Backbone.

Hypotheses of Trough Origin

The bedrock similarities already mentioned as well as a complete lack of faulting in the area eliminates any structural hypothesis. Underground water may have played a part in forming the trough. A few tiny sinkholes are found on the adjacent upland but there are no caves, underground rivers, or other karst features. In view of this evidence ground water was not considered as an erosive agent. Five hypotheses of trough origin are considered in detail.

Hypothesis 1. Work of Present Stream.

Clifty Creek, a mile away, carries in a narrow V-shaped gorge several times the volume of water carried by Hog Trough Creek. Since the vastly more powerful Clifty has been unable to widen its valley, certainly the tiny Hog Trough Creek could not have produced the broad arable bottom in which it flows.

Hypothesis 2. A Former Channel of the Ohio.

Most observers on first viewing the Backbone and Hog Trough develop a mental picture of the Ohio flowing in the Hog Trough and eroding that valley.

At its narrowest the Ohio is over one-fourth mile wide, and averages perhaps one-half mile. The bottom of the Hog Trough is nowhere over one-eighth mile wide. This is too small to carry the volume of the Ohio without leaving some striking evidence of scour.

If the entire flow of the Ohio could not pass through the Hog Trough valley might a part of the flow at some time have gone that way? The presence of terrace segments in the Trough indicates that glacial waters did indeed pass through. But that these waters first scoured away 300 feet of rock does not necessarily follow.

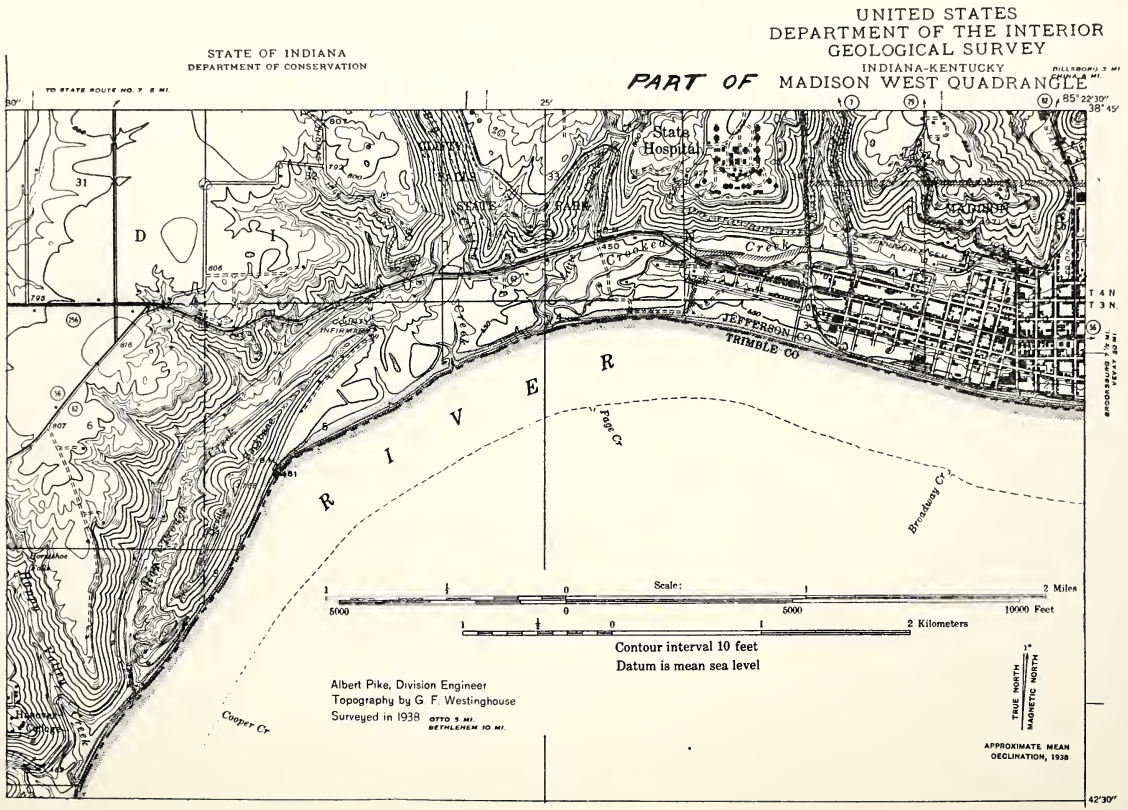
Bretz[2] in his "Channeled Scablands of the Columbia" studies has shown that such scouring indeed may occur. But the channeling of the Columbia Plateau was general over a wide area whereas the Hog Trough is a unique feature of the local landscape.

Finally the Scabland channels were abandoned when lower outlets were uncovered by ice retreat. No such condition occurs in the backbone area. If a stream powerful enough to cut the Hog Trough valley was ever present there is no reason to suppose it would not continue to keep its channel open.

Hypothesis 3. The course of Crooked, Clifty and tributary creeks was once through the Hog Trough.

This hypothesis has much to recommend it. The combined flows of these creeks should be sufficient to erode the Trough. The transverse

[2] Bretz, J. Harlan. The Channeled Scablands of the Columbia Plateau. Jour. Geol. 31:617-649, 1923.


STATE OF INDIANA
DEPARTMENT OF CONSERVATION
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
INDIANA-KENTUCKY
PART OF MADISON WEST QUADRANGLE
State Hospital
STATE PARK
Creek
JEFFERSON CO
TRIMBLE CO
R I V E R
Page Cr
Broadway Cr
Cooper Cr
Scale:
2 Miles
5000
0
5000
10000 Feet
2 Kilometers
Contour interval 10 feet
Datum is mean sea level
Albert Pike, Division Engineer
Topography by G. F. Westinghouse
Surveyed in 1938
APPROXIMATE MEAN
DECLINATION, 1938
TRUE NORTH
MAGNETIC NORTH
T 4 N
T 3 N
85°22'30"
38°45'
42'30"

valley profile of Crooked Creek north of Madison is strikingly like that of the Hog Trough. The principle of "piracy by lateral planation" is familiar and accepted. It seems to apply here admirably.

A map of the area reveals serious objections to a full acceptance of this hypothesis. The heads of Hog Trough, Clifty and Crooked Creeks and their tributaries, with the exception of Little Crooked, trend south and southeast, never southwest. This southeast trend is against the dip of the underlying rock. By inference then, a southeast rather than a southwest drainage existed when these valleys were established. The valleys of Happy, Crowe, Butler, and others south of the Backbone are in accord with the present Ohio drainage. The relationship is somewhat complicated by the right angle bend of the Ohio, yet is significant.

A valley should widen downstream but the Hog Trough valley is narrower at its mouth than upstream. This narrowing at its southern end is masked somewhat by alluvium, but where bedrock measurements are possible it can be shown as true.

Another objection to this combined stream hypothesis is the lack of continuity of the stream systems. If the Ohio had captured the headwaters of a greater Hog Trough Creek there should be some evidence of continuity between the head and behcaded portions of the valley. This continuity cannot be made out. The hypothesis would seem untenable.

Hypothesis 4. Movement of the Great Ice Sheet eroded the valley.

Near Bethlehem, Indiana, a tributary of Knob Creek is eroding a course roughly parallel to the Ohio. If for the moment we assume a similar preglacial topography in the Backbone area, continental ice spreading over the area would destroy the narrow divide between the two streams, scour out their valleys and give us the present feature.

Essentially, of course, this is a modification of hypothesis 3, making ice rather than water the agent. As such it is open to the objections already cited. In addition, there is little evidence that continental ice had much erosive power in southern Indiana. Bed rock is not striated, nor is it stripped of its regolith in places. Furthermore this is close to the southern limit of glaciation for the continent and that in itself ought to mean that the ice had little erosive power.

Hypothesis 5. Glacial damming and reversal of drainage.

Fowke[3] in his "Evolution of the Ohio River" gives considerable space to the origin of the Backbone and Trough. He considers that a divide existed at the eastern edge of the city of Madison. Ice blocked the established drainage east of this divide, causing ponding and eventual overflow. Part of this flow found its way through the Hog Trough, but more of the flow took a straight and lower course down a hypothetical Milton Creek that enlarged to take all the flow of the Ohio.

The depth of the Hog Trough Valley, the weathering of its slopes, its slightly greater width at its eastern compared with its western end,

[3] Fowke, Gerard, Evolution of the Ohio River. Hollenbeck Press, Indianapolis, 1933. p. 113-119.

the barbed drainage and the presence of glacial terraces indicate a preglacial eastward flowing stream system. It cannot be the stream reversal proposed by Fowke, however, since his divide is east of Madison and all the above features are west of the city.

Just where this divide existed in preglacial time the author is not prepared to state. However, the creeks in accord with the present drainage, Happy Valley, Crowe, and Chain Mill, suggest that it must have been near the western end of the Backbone. Furthermore it is to be noted that the narrowest portion of the divide between the Ohio and the Muscatatuck drainage systems lies immediately west of the Hog Trough.

An hypothesis of glacial damming must consider the possibility of stagnant ice filling the Hog Trough during the reversal period. No evidence for such stagnation was found in the area.

Conclusion

Final judgment on these various hypotheses should perhaps be withheld until further evidence is discovered relative to: first, the power of a continental glacier to erode near its margin; second, the discovery and tracing of buried channels of an eastward and northward flowing stream system in preglacial times if such existed.

The evidence now at hand, however, indicates that a preglacial, eastward flowing stream established the Hog Trough Valley. This flow was blocked by glaciation. An outlet for the ponded waters developed to the south which enlarged to take the flow of the Ohio.