present rate of retreat. The time in years would be about 400,000, which would seem to indicate that the age of Butler Valley is about that of Clifty Valley or possibly somewhat younger, and had its origin about the time of the Illinoian ice advance.

NOTES ON SOME OHIO RIVER TERRACES.

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Some of the best developed alluvial terraces to be found in the central states are located along the Ohio River where it forms the southern boundary of Indiana. A typical development is found in Jefferson County, Indiana, and Carroll and Trimble counties, Kentucky, where they are known as "first bottoms" and "second bottoms." The terms "third bottoms" and "fourth bottoms" would be applicable though they are not used.

These deposits, varying from a few feet to more than a mile in width, alternate on both sides of the river with steep bluffs which rise abruptly from the water's edge to a height of about four hundred feet. A bluff on one side is faced by a wide "bottom land" on the opposite side and vice versa, because of the swinging of the current from one side to the other. The length of each separate alluvial area varies from less than two miles to more than six, and the area ranges from approximately one-half square mile to more than four square miles. (Fig. 1.)

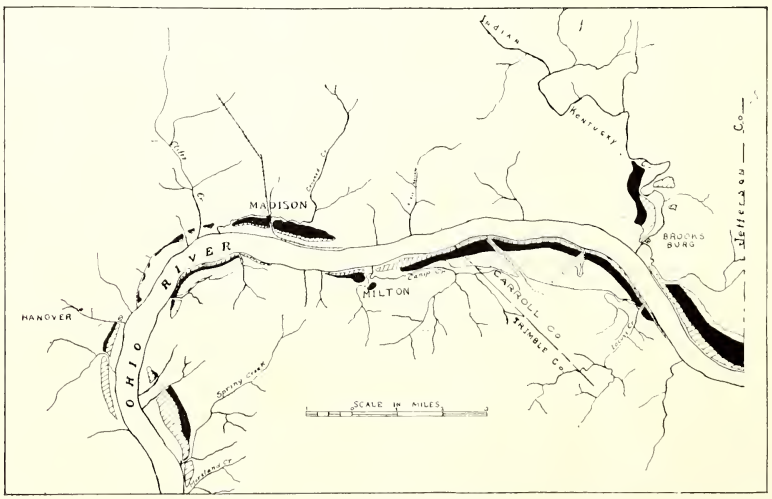

Fig. 1—Parts of Jefferson County, Indiana, and Carroll and Trimble Counties, Kentucky, showing area and location of terraces.

Diagonal lines / / / / terrace number one.

Solid black ——— terrace number two.

Stippled ..... terrace number three.

Area between diagonal lines and the Ohio River represents flood plain.

East of Madison there are three well developed terraces and south, with one locality excepted, there are only two. The flood plain varies in width from a few yards to more than a quarter of a mile, being wider as a rule where there are only two terraces. One terrace can be said to have the greatest area in all localities, though the largest single expanse is covered by the third or uppermost terrace, east of Milton, Kentucky.

Using the Ohio River as a datum plane and correcting the error caused by its rise and fall by observing the U. S. Government River Stage Report, the following elevations were obtained by use of an aneroid barometer. A bench mark on the Madison courthouse steps has an elevation of 500.725 feet, and the river at a ten-foot stage is approximately 420 feet above sea level.

The elevations taken in Jefferson County, Indiana, are as follows:

	Jefferson-Switzerland County Line	Madison	Hanover Landing
River.....	430 feet	424 feet	420 feet
Flood plain....	460 feet	458 feet	455 feet
First Terrace..	480 feet	475 feet?	465 feet
Second Terrace	510 feet	508 feet	490 feet?
Third Terrace..	550 feet	absent	absent

The following are the elevation records taken in Carroll and Trimble counties, Kentucky:

	4 miles east of Milton	2 miles west of Milton	5 miles south of Madison
River.....	430 feet	425 feet	420 feet
Flood plain....	460 feet	460 feet	455 feet
First Terrace..	480 feet	477 feet	475 feet
Second Terrace	510 feet	510 feet	492 feet
Third Terrace..	555 feet	544 feet	absent

These elevations show that the top of the first terrace is usually from 15 to 20 feet above the elevation of the flood plain and from 40 to 50 feet above the Ohio River at a ten-foot stage. The second terrace rises about 60 or 70 feet above the flood plain and from 15 to 50 feet above the first terrace. The third terrace when present has an elevation of 85 to 95 feet above the floor plain and 15 to 20 feet above the second terrace. The exact level was difficult to obtain in some cases; however, it is easily seen that the Ohio Valley is filled with alluvial deposits 40 to 100 feet above the level of the present flood plain. These same deposits also reach a depth in some localities of at least 100 feet below the level of the flood plain. (Fowke, Ind. Acad. Sci. Proc. 1924, p. 90.)

The terraces are found to slope with the present stream, with the rate of slope slightly greater than that of the river at present. A profile across the terraces shows that they slope gently away from the river. Often that part adjacent to a higher terrace is low enough to be swampy and it probably formed a slough through which a portion of the flood waters passed at one time. The edges of the terraces were probably

built up when they were flood plains as natural levees are now being built. (Fig. 2.)

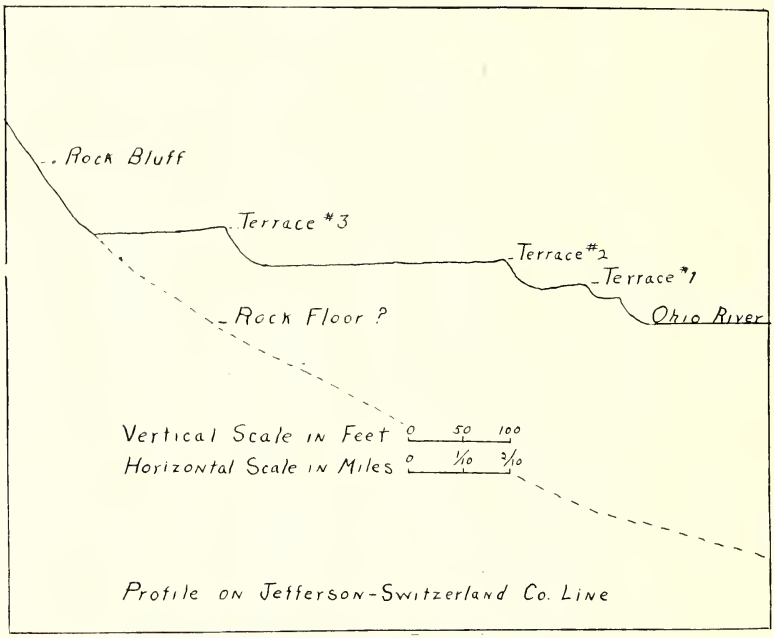

Fig. 2—Profile on terraces at Jefferson-Switzerland County line.

These deposits are composed of varying proportions of cross-bedded gravel, sand and clay. In most places they are covered by two or three feet of excellent sandy loam, though occasionally it is too sandy or too gravelly to be used for farming. In many places the gravel is suited for use on roads without any necessity for washing. On the farm of W. W. Walker, one-half mile south of Hanover, the overlying soil is mixed with the gravel and used on state highways. The soil helps pack the gravel but is somewhat objectionable on account of the dust it forms during dry weather. One portion of the pit contains gravel clean enough to be used for concrete. Most of the output is used for maintenance of highways and the state requirements for that purpose give a good idea as to the size of the pebbles. Not more than 3 per cent should be retained by 1½-inch mesh and 96/100 per cent by a number 28 mesh. Although gravel pits are located in all three terraces and the flood plain, the larger and better pits seem to be located in the second terrace. The gravel would undoubtedly be used much more were its location, below the Ohio River bluffs, more convenient to a greater number of people. One pit in Madison has been abandoned because the gravel is so firmly cemented with lime that it cannot be used without crushing. There is an immense supply of gravel in this area but it is doubtful if the demand will ever be great. In two pits at Madison almost pure sand may be obtained.

This material which partly fills the Ohio Valley is undoubtedly glacio-fluvial in origin, and a part of the valley train carried from the melting edges of the late Wisconsin ice sheet. The presence of three terraces and the higher elevation of the top of the vally train upstream from Madison and the presence of only two terraces and lower elevation downstream from Madison may lend support to Fowke's theory of a major divide at Madison as the present Ohio was formed by the successive ponding and overflow of northward flowing pre-glacial streams. (Ind. Acad. Sci. Proc. 1924.) Such would at least suggest at least enough ponding to cause the valley to be more nearly filled with glacio-fluvial material above Madison than below. The terraces directly south of Milton, Kentucky, seem to be similar in elevation to those east of Madison, so from this line of evidence only, the divide would be located to the west of these deposits.