

Figures 2 and 3 show an unconformity. These figures, however, are in part ideal, as the actual line of contact, or unconformity (if such it is), was not observed, being covered with debris. It is not possible, from the data in hand, to say surely whether this strip of limestone owes its existence to an unconformity or a fault.

The peculiar distribution of this strip of limestone effects the topography of that section of the country in which it is found. West of the easternmost line of contact the country is rolling, with quite a number of sink holes, characteristic of limestone formations. East of that line of contact the country is very rough; the streams are in deep, narrow ravines characteristic of the knobstone area.

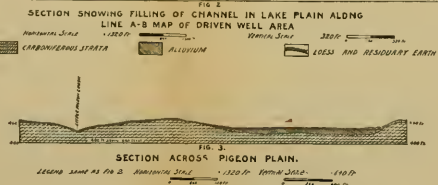
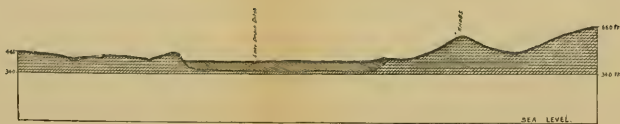
The present location of the streams running north and south near this point is due largely to the unconformity, they following the line of contact, or, having cut below the limestone level, are following channels in the knobstone.

AN OLD RIVER CHANNEL IN SPENCER COUNTY, INDIANA. BY ARTHUR
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All that portion of Spencer County south of the line which separates townships 5 south from that of 6 south, and west of a line running north and south through Grandview, may be divided into two physiographic regions, a plain and a hill region.

The plain may be subdivided into three parts. First, a broad, level plain extending southwest along the western boundary of the county. (See Fig 1.) It has the same general trend as Little Pigeon Creek, and will therefore be called Pigeon Plain, although it is not now occupied by Little Pigeon Creek. The two valleys are separate and distinct. Where Pigeon Plain enters the northern part of the area under consideration it is about two miles wide. It gradually widens until at Midway it is about four miles, at Richland five, and continues at this width until it enters the second division of the plain region, the river plain of the present Ohio.

Only a portion of this river plain comes properly under the present discussion of Spencer county, as a part lies in Kentucky. Taking the two parts together, the average width of the plain is between four and five miles. That portion which lies in Indiana is very irregular on account of the meandering course of the river. It includes all land locally termed the



river bottoms. Near Grandview the bottoms are about a mile wide. At Rockport the river strikes against the bounding bluffs, so the Indiana portion of the valley is here reduced to zero. The river then rebounds toward the bordering hills in Kentucky, which it strikes at Bonne, Harbor Hill, a few miles below Owensboro, Ky. This makes the plain north of Owensboro three and a half miles wide. At Enterprise, seven miles below Owensboro, the plain is only half a mile wide. Three and a half miles below Enterprise the river plain merges into Pigeon Plain.

The third portion of the plain enters the river plain between Grandview and Rockport, its southern portion including part of the town of Rockport. It is here three miles wide. Narrowing down to two miles, it extends westward three miles, where it turns abruptly northward and enters a gorge a full mile wide. After going three miles in this direction it turns westward again and enters Pigeon Plain two miles east of Richland, in section 31, township 7 south, range 6 west. The narrow part of this plain was occupied by a shallow pond of water when this country was first settled. This pond was called "The Lake" by the early settlers. For this reason this division will be called Lake Plain, although, as will be shown later, the lake is a result and not a cause of the plain.

These three plains so merge into one another that it is impossible to tell where one begins and the other ends. The difference in levels of all three is very slight, not being over 25 feet except in four places, where Honey Creek, Lake Drain Creek, Enterprise Creek and Little Pigeon Creek have cut narrow, deep channels in the yielding alluvium.

The surface is so nearly level that large portions either are or were swampy. In Lake Plain is Swan Pond, covering portions of sections 5, 8 and 32; township 7 south, range 6 west, drained by Swan Pond Ditch; a marshy place, near Silver Dale Church, drained by Kennedy's Ditch, and the Lake covering sections 5, 8 and 32, township 7 south, range 6 west, drained by a ditch constructed in 1896 and emptying into Lake Drain Creek.

In Pigeon Plain is a series of ditches draining the "black land" north of Midway; Sweezer's Ditch, draining Sweezer's Pond; Lake Ditch, draining a swampy area in sections 24 and 25, township 7 south, range 7 west, and sections 19, 30 and 31, township 7 south, range 6 west; Cow Pond and Hoop Pole Ditches, draining land near Richland, and Shoptaugh and Willow Pond Ditches, draining land farther south. In the river plain there are many small ditches draining low tracts.

The hill region occupies all land not occupied by the plain. It will be seen from the location and interconnection of these plains that the hill land is divided into two parts. One, a roughly triangular portion, has its apex at the meeting of the Lake and Pigeon plains and its base roughly a little below the southern line of township 7 south. This region is characterized by a great number of hills rising on an average from 40 to 60 feet above the plain. The highest part of the triangular hill land is in Rockport, near the junction of Lake and River plains, where the hills rise 120 feet above the plain. The next highest is at the junction of Pigeon and River plains, where the hills reach the height of 90 feet. The bordering hills are in general higher than the interior hills and the hills on the south and east higher than those on the west.

The other portion of the hill land is higher and more irregular. The highest point measured is in the northwest quarter of the northwest quarter of section 3, township 7 south, range 6 west, where the "knobs" rise 240 feet above the mean level of the plain. It is probable that the Centerville knobs, three miles to the north, are higher.

Pigeon Plain is naturally divided into two parts by a terrace (Fig. 1) about 15 feet high, which begins near the point where Lake Plain joins Pigeon Plain and extends in a general northwesterly direction past Midway to Little Pigeon Creek. The plain north of this line is about 15 feet higher than the portion south. The soil to the south is the same as that which covers the river bottoms; that to the north is entirely different, being a sort of reddish clay in some parts of the region and a very black peaty soil in others. This black portion is locally known as "black land." Other differences between the northern and southern parts of Pigeon Plain will be mentioned later.

All the hills on the border of the triangular hill land, the hills along the southern boundary of the northern hill land from Grandview as far as the point where Lake and Pigeon plains meet, and the hills from that point to Little Pigeon Creek, along the line of the terrace, are covered with typical river bluff loess.

The region in the interior of all the triangular hill land and for a short distance north of the southern boundary of the northern hill land is covered with typical interstream loess.

In all the plain region bounded by the loess-capped hills; that is, all the River Plain, Lake Plain and that portion of Pigeon Plain south of the terrace, except a narrow strip in a few places along the base of the hills,

wells reveal a great trench filled with an irregular series of clays and water-bearing sands and gravels. This is the region of the driven wells (see map of "Driven Well Area"). In the hill region and most of the region in Pigeon Plain north of the terrace all wells strike rock at comparatively shallow depths.

As the name would imply, in the region of driven wells all wells are driven. This method of sinking wells makes accurate well sections hard to obtain. The only thing that can be obtained accurately is the depth or depths of the water-bearing strata and in a general way something of what was passed through before water was found. Only a few open wells are found in this region, and they were dug so long ago that less can be learned from them than from the driven wells.

The depth of the driven wells varies considerably, in one place a difference of 10 feet having been noticed between two wells on level ground not 40 feet apart. The deepest wells found are near Rockport. One is 70, the other 65 feet. Neither struck rock. The normal depth of wells in middle Lake Plain and Northern Pigeon Plain south of the terrace range from 17 to 40 feet. Very few wells are deeper. One well, 56 feet deep, in the narrowest part of Lake Plain, did not strike rock. In River Plain they range from 30 to 60 feet.

From these wells we learn something of the original depth of this filled valley. If all these sands and gravels, which underlie Lake, River and a portion of Pigeon Plain could be removed, a valley extending at least 56 feet and probably more than 70 feet below the present plain level, and having its sides of middle carboniferous formation, would be revealed. (See Fig. 2.)

This valley is the same depth as the half-filled Ohio gorge, of which it is a continuation. It is filled with the same materials. The hills on each side are covered with typical river bluff loess in the same manner as those on the erosion scarp of the Ohio. The levels of the Plains are so nearly the same that a portion of the waters of the flood of 1884 rushed through the Lake Plain, and entering Pigeon Plain, one part followed the terrace and then turned southward to meet the other part and join the waters of the Ohio again where Pigeon and River Plains meet. This stream was four feet deep, and flowed with such swiftness along the base of the bluff where Pigeon and Lake Plains meet that a man could not have stood upright in it.

All these facts lead to the conclusion that the Ohio River at one time flowed through Lake Plain and down through Pigeon Plain, entering the

Ohio Valley again between Enterprise and the eastern part of Warrick County.

To the erosive power of the river is to be attributed the greater part, if not the whole, of the valley now occupied by Lake Plain. In Pigeon Plain the work done was simply the deepening, and it may be a little broadening, on the eastern side of a broad valley, extending from the northeast, which the river entered after cutting through the rock in Lake Plain. A portion of this more ancient valley extending from the northeast still remains intact north of the terrace. The terrace being simply the northern boundary of the Ohio's down cutting in the more ancient valley.

The work done in cutting out the Lake Plain valley through solid sandstone, limestone and shale is probably just about equal to the deepening of the more ancient Pigeon Plain. This would explain in great part at least the conspicuous difference in width which exists between various parts of the old river cut-off.

Nearly all the swampy area mentioned above, that is the lands drained by Swan Pond, Lake Drain, Lake, Sweezer's Cow Pond, and Hoop-pole ditches are simply portions of the old channel which have been but imperfectly filled. They are in some respects similar to the half-filled old river cut-offs and marshes of the lower Mississippi, but differ in that the cut-offs of the Mississippi are made through soft, yielding alluvium, while this one has been made, in part at least, through solid rock.

The ancient stream plains which the Ohio entered after cutting through the hills two miles east of Richland is locally called Pigeon Valley, but as has been intimated before, is not at present occupied by Little Pigeon Creek. A cross section (see Fig. 3) of the country running southeastward along a line drawn from a quarter east of the middle of section 35, township 5 south, range 7 west, to a quarter south of the middle of section 6, town 6 south, range 6 west, shows Little Pigeon Creek in a young, narrow, V-shaped, rock-bound valley separated by a hill of sandstone thirty (30) feet high from the broad flat alluvial-filled valley east of it. Well sections in this valley reveal in a few places a depression 60 feet deep filled with blue sand.

Near the base of the hills, bounding the River Plain, north of Enterprise is a series of gravels and sands which are of considerable value in determining the age of the old Ohio cut-off. The gravels rise 40 feet in the hills near the junction of River and Pigeon Plains, but after the hills along the eastern part of Pigeon Plain are reached they are nowhere

to be found. Evidently where these gravels were deposited no considerable breach existed in the line of hills from the extreme southwestern point of the triangular hill-land to Warrick county. The Ohio River therefore flowed through Pigeon Plain since the deposition of the gravel.

The presence of typical river bluff loess on the sides of the valley shows that it was a valley at the time of the deposition of the loess. This channel was therefore cut between the deposition of the gravel and the loess. According to McGee the loess belongs to the Columbia division of the Pleistocene.* Briefly there are four reasons for referring the gravel to the Tertiary:

1. Absence of glacial pebbles in the deposit.
2. Unconformity and old soil between gravel and loess.
3. Lithological resemblance of bed to known Tertiary beds.
4. Erosion record furnished by old river channel.

If the gravels are Tertiary they must belong to the Lafayette division of the Neocene, for they resemble no other Tertiary formation.

These facts seem to establish the age of the old river channel. Since it seems probable that Lafayette sands and gravels are not found in the old channel, it was cut after the Lafayette time. The loess shows that it existed as a valley during the Columbia period. It was therefore cut during the Post Lafayette and Pre-Columbia High Level, or in other words, in the high level period which preceded the first glacial invasion.

During the "Pre-Lafayette High Level" the land in this region stood just about the same height as now, and thus the Ohio cut or deepened the valley it now occupies. This was followed by the Lafayette low-level, when the ocean covered the eastern plain and a great bay extended up the Mississippi Valley. An arm of this bay extended up the Ohio past Spencer county. During this time the sands and gravels were laid down as an estuarine deposit.

After the deposition of this gravel the land rose probably 100 feet above its Pre-Lafayette level in Spencer County, and the Ohio cut out most of the gravel beds laid down in the Lafayette. It trenched over 70 feet into the underlying Carboniferous rocks, and at some time during this period, for reasons not evident at present, it turned aside and cut out the channel now occupied by Lake Plain and that portion of Pigeon Plain south of the terrace.

* U. S. Geological Survey, 12th Annual Report, p. 384.

