

**A PRELIMINARY REPORT ON A PHYSIOGRAPHIC STUDY
OF BUCKEYE LAKE AND VICINITY.**

FREDA DETMERS.

For the past three years, beginning with the spring of 1909, I have been engaged in a study of the plant geography of Buckeye Lake. An understanding of the physiography and of the physiographic history of any region is essential to a comprehension of the development of the flora of that region; therefore as the physiographic study is so closely correlated with the botanical, the two were carried on at the same time.

A careful inspection of the topography, and an examination of the literature on the physiography of Buckeye Lake and its vicinity soon developed three topics of especial interest. These were: I, the existence or nonexistence of Lake Licking, a post or interglacial lake occupying the plains to the south and southwest of Newark, including Buckeye Lake; II, the physiographic history of Buckeye Lake and III, the location and extent of the Newark river valley, a preglacial valley, from Newark westward to the Franklin county line.

These three problems are discussed in this paper in the same order as presented above.

I. The existence or nonexistence of Lake Licking, a large post glacial lake south and southwest of Newark.

In the report on the geological survey of Licking county, by M. C. Read,¹ the statement is made that to the south and southwest of Newark a lake of considerable size covered the surface "in the latter part of the glacial epoch." The statement gives opportunity for a very wide interpretation as to the possible or probable age of this lake and it makes no reference at all to its longevity. As the region in question is covered by the Illinoian, the early and the late Wisconsin drift-sheets,^{2, 3} the lake may have been post glacial, that is: formed by the recession of the Late Wisconsin ice, or interglacial and formed by the advance or retreat of the Early Wisconsin or retreat of the Illinoian and still fall within the "latter part" of the entire glacial epoch.

In another paragraph of the same report Mr. Read⁴ says: "The larger channels are now filled with water-washed pebbles resting ordinarily upon the old rocky bed, but in places upon the remains of the original drift clay, by a succession of terraces and corresponding water plains. South and southwest of Newark these water plains expand covering a large area." From this

1. Read M. C. *Geology of Licking County*, O. Geol. Survey 3: 348-361, 1878.

2. Leverett, Frank. *Mon.* 41: U. S. G. S.

3. Chamberlain, T. C., and Salisbury, R. D. *Geology. Earth History.* 2: 3: 1906.

4. Read M. C. *Geology of Licking County*, O. Geol. Survey 3: 1878.

statement I infer that the "water plains", according to Mr. Read form the present surface of the region and were the bed of the former lake, presumably post-Wisconsin, which must have existed until very recent times; and that the present and recently drained swamps of this region were remnants of the lake.

In June, 1894, W. G. Tight⁵ published an article in which several pages are devoted to the topography and present drainage of Licking county. In this article he says: "The South Fork of the Licking flows with a sluggish current over a broad alluvial plain which is covered with a black lacustrine deposit of several feet in thickness. This is especially true of that portion lying between the Licking Reservoir and Newark. We have suggested the name Lake Licking for the body of water in which these deposits were made and of which the original lake in the Reservoir was a part, occupying a large kettle hole in the drift when the main body of water was drained away."

The above statement by Mr. Tight definitely refers Lake Licking to post Wisconsin times; as these "lacustrine deposits" and Licking Reservoir, the present Buckeye Lake, are at the surface and must therefore lie on the drift.

Black alluvial deposits indicate river beds or swamps rather than lakes. Moreover black soil does not prevail throughout this area, but is seen only in depressions, which have evidently been shallow kettles.

The region to the south and southwest of Newark is characterized by a mature topography, as an inspection of the country or a study of the topographic sheets of the Thurston, Thornville, Granville and Newark quadrangles clearly show. The hills are low and rounded, with gentle slopes; the streams flow in broad open valleys, which together with the hills are deeply covered with a drift mantle to a maximum depth of 453 feet. The valleys are so deeply filled that the present highest elevations are but 200-214 feet above the valley floors. This extensive leveling up has converted the low lands into a region with the topography of youth, characterized by low watersheds separated by broad plains and drained by numerous small, shallow, irregular streams, many of which are wet weather streams only; and also by numerous surface depressions varying in size from small kettles a few square yards in extent to swamps covering several hundred acres.

There is no well-defined either rock or morainal ridge of hills which could serve as the rim of a large lake. The surface cover, except in the kettles and beds of streams is unassorted glacial till, consisting of clay containing many small sharp angled stones, and with a striking absence of large boulders. I can nowhere find lake beaches, lake clays, sand or stream delta deposits. Glacial

5. Tight, W. G. A contribution to the knowledge of the preglacial drainage of Ohio. Bull. Den. Univ. 8: 1. 38. 1894.

till devoid of boulders and composed largely of clay is easily transported by streams and readily lends itself to delta formation. This is well shown by the relatively extensive deltas built by several small streams flowing into Buckeye Lake. One of these called the Southwest Feeder, a distributary from the Licking River, near Kirkersville, flows across the plain in a southerly direction and enters Buckeye Lake just north of Millersport. The Feeder dates from the completion of the Reservoir in 1832 and is therefore 80 years old. In this time it built a delta approximately 200 feet long. A dense mat of pond plants has so blocked the outlet that but little water is received by the lake from this source during periods of ordinarily dry weather.

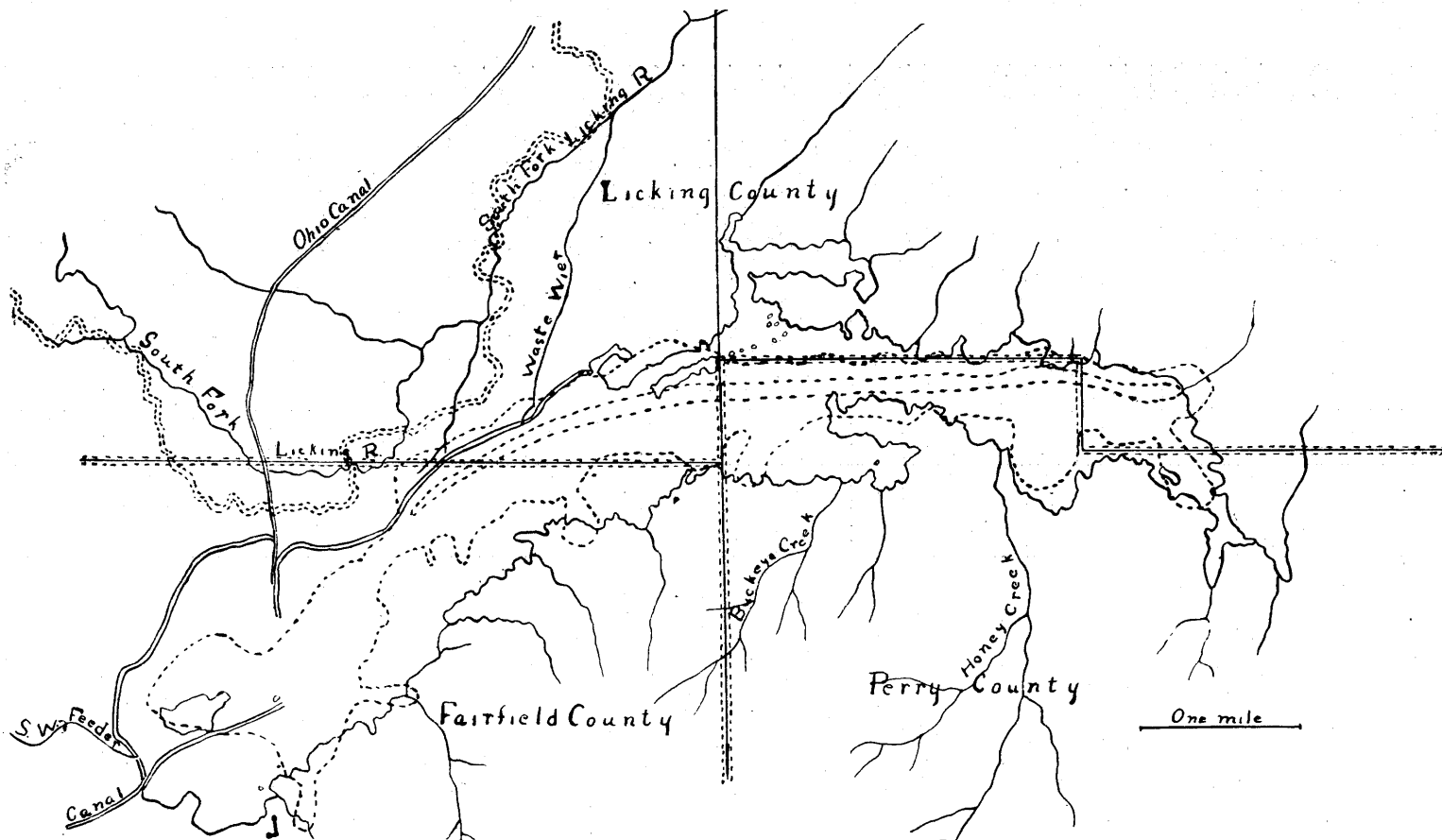
The mouth of Buckeye creek, one of the largest tributaries to Buckeye Lake from the south, is so shallow and so choked with aquatic and marsh plants that it is obliterated during the summer months. The same condition would prevail at Honey creek, another tributary from the south, if the channel were not dredged and thus kept open.

Streams dating from the recession of the Wisconsin ice must have built deltas so extensive, that they would be readily recognizable. Moreover, there cannot have been an extensive post Wisconsin lake of long duration if we accept Mr. Mather's⁶ conclusion as to the age of the gorge of the Licking River at the Licking Narrows. From his study of this gorge Mr. Mather concludes that it antedates the Wisconsin ice age. If this can be accepted, a post Wisconsin lake would have been drained by the eastward flowing Licking River, for this outlet is broad and deep enough to have prevented the retention of a large body of water to the west at the foot of the glacier.

It seems to me that all the positive and negative evidence which the region affords precludes the possibility of the existence of a large post Wisconsin lake or anything more than a temporary and shallow body of water which would naturally result from the melting of an extensive ice sheet.

What is the evidence for or against the existence of a large interglacial lake in the region under discussion? Such a lake if formed by the recession of the Illinoian ice sheet, must have extended 20 miles from north to south and 20 or more miles from east to west and with its bed at least as deeply excavated as the streams which entered it. The record of a gas well in the Raccoon creek valley, just before it suddenly widens to join the broad plain west of Newark and $\frac{3}{8}$ of a mile north of the crossing of the creek by the Ohio Electric railway, shows that the rock has been excavated to a depth of 453 feet below the present surface. This well marks the greatest depth in an old valley whose stream would have been

6. Mather, K. F. Age of Licking Narrows. Bull. Den. Univ. 14: 174-187. 1908, '09.



Map of the "Big Swamp" of the survey of 1799, superposed on that of the survey of 1909 by the Civil Engineering Department

a tributary to this lake. Moreover this lake if not with a larger outlet than inflow of water must have existed for a long span of time and would have left unmistakable evidence of its presence in lake beaches, sands and clay deposited on its floor and deltas at the mouths of its tributaries.

All the records of gas wells in this region, from which I was able to obtain details, show a thin mantle, in some wells but 8-10 feet thick, of glacial clay overlying a heavy bed of gravel. In one such well close to the Baltimore and Ohio railroad tracks and $1\frac{1}{4}$ miles north of the lake the gravel is but 2 feet below the surface and is 100 feet thick. In another well in the field west of the Ohio Electric railway and but a few rods from the north shore of the lake, there was, according to the foreman's notes, 10 feet of loam and 350 feet of sand and gravel. All the water wells near Buckeye Lake are in the gravel. In one at the Glass Hotel on the north shore, sand was entered at 10 feet below the surface, and the well is in gravel at 75 feet. In some of these wells sand lies above the gravel and in others beneath it. This thick stratum of gravel was not deposited in the quiet waters of a lake. So massive a load can only have been carried by the flood waters from a glacier. The gravel is evidently an outwash deposit.

II. The physiographic history of Buckeye Lake.

Buckeye Lake is situated in Licking, Fairfield and Perry counties, in Ranges 17 and 18, Townships 17, 18 and 19. It is a long irregular body of water with its longest diameter from east to west. It is approximately $7\frac{1}{8}$ miles long from the southeastern most extremity to the western and varies in width from $\frac{1}{4}$ mile in the eastern portion to $1\frac{1}{2}$ miles at the extreme western end. The area covered is estimated at 4,200 acres. The lake is quite shallow; the water over large areas does not exceed a depth of 6-8 feet at the normal water level; but there are a few deeper depressions. Soundings just off the south shore of Cranberry island revealed a depth of 15 feet, and near Avondale a depth of 25 feet, which Mr. Bootin, the engineer of the Canal Commission assures me is the greatest depth he has found.

This basin was built in 1832 to serve as a reservoir for the Ohio canal. On May 21, 1894, the General Assembly of Ohio passed an act reserving it for a public park and summer resort to be known as Buckeye Lake.

The site of the reservoir was a more or less completely tree-covered impassable swamp, known to the Indians and early settlers as the "Big Swamp," "Two Lakes" or "Big and Little Lake."⁷ It lay diagonally across the southeast corner of Township 17 and almost half across the southern border of Township 19. In shape and area it approximated the present lake. In the

7. Graham, A. A. History of Licking County, O. Chap. XVII, p. 165. 1881.

center of the swamp was, according to the surveys of 1799 and 1801, a long narrow lake fed by several small streams. This lake drained into the South Fork of the Licking River near the "Black Diamond," $\frac{1}{2}$ mile southwest of the present Waste Weir.

The location seemed well suited for a reservoir. It was a quite extensive natural basin, lying on a plain, with a rim of hills to the south, east and northeast immediately bordering the swamp; so that no levee would be necessary along these margins. To the north and west of the present lake are low fields which very likely were wholly or at least in part included in the original swamp. The swamp drained towards the north, the lowest place in the rim is indicated on the topographic map of the U. S. G. S. by a small stream, which apparently unites Buckeye Lake with the South Fork of the Licking River. This outlet, however, no longer exists.

The so-called "Old Reservoir" was begun on the morning of July 4, 1825, and was finished in 1828. The swamp was not deepened nor even cleared of trees. A levee, with a maximum height of 18 feet at the "Black Diamond" and decreasing somewhat to the east and west, was built along the north side from the present "Park" to the western extremity and was continued around the west end. This latter served as the tow-path of the canal.

The "old reservoir" did not furnish the canal with sufficient water to permit the carrying of even half a load during the drier summer months, therefore an additional 500 acres on the west were added in 1832. This addition was called the "new reservoir." An additional supply of water was also provided by a distributary from the Licking River, which taps the river just north of Kirkersville and enters the reservoir $\frac{1}{8}$ of a mile north of the western exit of the canal.

The old swamp lay in the preglacial valley of a tributary of the Newark valley, a valley now occupied in part by the west fork of Jonathan creek. Just east of Thornville station the tracks of the Newark and Shawnee Branch of the Baltimore and Ohio railroad, which parallel the east shore of the lake, and the Zanesville and Western railroad from the south meet in a cut or gap and continue eastward as parallel tracks. The floor of this gap is but little broader than the width of the two tracks.

A loop moraine was formed in Late Wisconsin time across the valley at this point and completely blocked the then westward flowing stream. The lower or westward portion of the valley was still filled with ice. As the ice receded, the water ponded behind the moraine broke through forming the gap now occupied by the railroad tracks, and flowed eastward down the valley. This overflow-gap is very distinct and was first referred to by G. F. Wright,⁸

8. Wright, G. F. The glacial boundary in Ohio, Ind., and Ky. 1884.

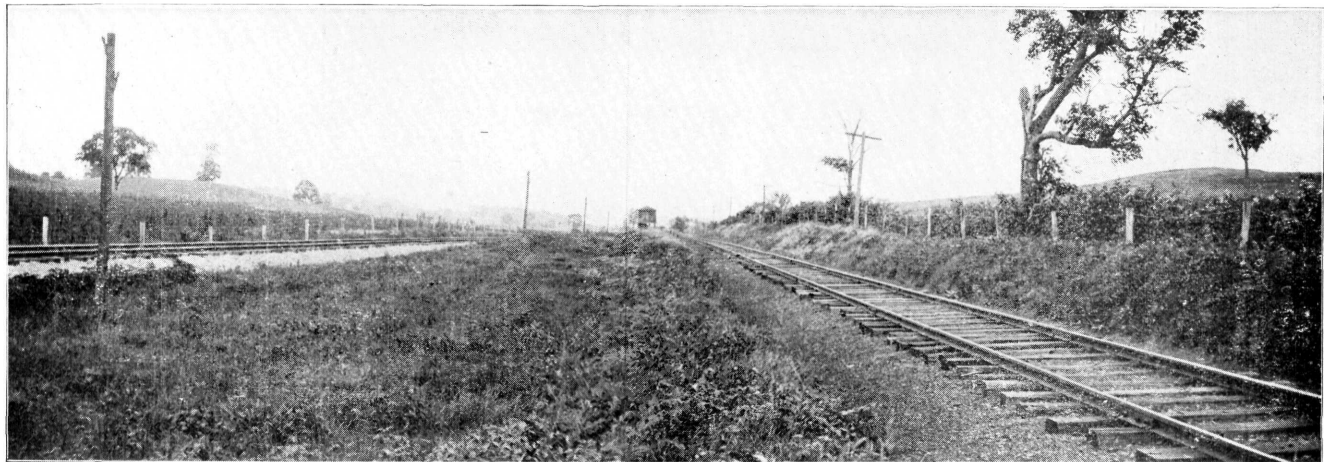
who says: "The reservoir occupies a great kettle-hole. the railroad which here cuts through the moraine follows for several miles towards the southeast an outlet for the glacial floods."

The overflow channel is 900 feet above sea level, whereas the surface of the present lake is 892 feet. This eastern outlet could drain the lake only when the water surface exceeded the 900 foot level. During the time when the water stood at or slightly above the 900 foot level, the area covered was much greater than the present one. The broad plain to the north between the present lake and Newark is less than 900 feet, with small irregular isolated areas from 900 to 960 feet above sea level. It is 10 miles from north to south. At the southern limits of Newark it is 3 miles from east to west and 10 miles from east to west at the northern margin of Buckeye Lake. When therefore the ice receded from this plain the latter was covered by a body of water measuring 10 miles from north to south by 10 miles from east to west at the southern and 3 miles at the northern end. This lake, if lake it can be called, stood at or above the 900 foot level for so short an interval that careful search has disclosed no beaches, deltas, lake sands or clays. The soil in the fields south of Thornville station at the 920 foot contour line, contains some fine sand, it is fine grained sandy loam; and there is also sand in the banks of a small stream which flows north and enters the southwestern lobe of the lake at Thornville station. There is however so little sand that it certainly does not form a well defined beach.

The water must have very soon drained away to the northeast and must have been in the nature of a broad river, rather than a lake over the plain southwest of Newark.

The recession of the ice from this plain uncovered an outlet lower than the 900 foot level and the southeastern one at Thornville station was abandoned. This new outlet was not deep enough nor with sufficient fall to completely drain the basin; for a long, narrow, irregular, typical finger lake, conforming in shape to the old river valley remained in the western portion of the pre-glacial valley of Jonathan creek. All of this lake but a narrow channel near the center had been reduced to a swamp by the close of the 18th century.

That this swamp, which was known as the "Big Swamp," dates from early post-Wisconsin time is shown by the presence of a cranberry-sphagnum bog which still exists in Buckeye Lake. This bog, locally known as the Cranberry marsh, lies in the eastern part of the lake, close to and parallel with the north shore. It is 3,250 feet from northeast to southwest by 750 feet from northwest to southeast, and has an approximate area of 45 acres, according to the survey made in the winter of 1910 by Professor Chamberlain of the Civil Engineering Department of the Ohio State University.



View of overflow channel just east of Thornville station.

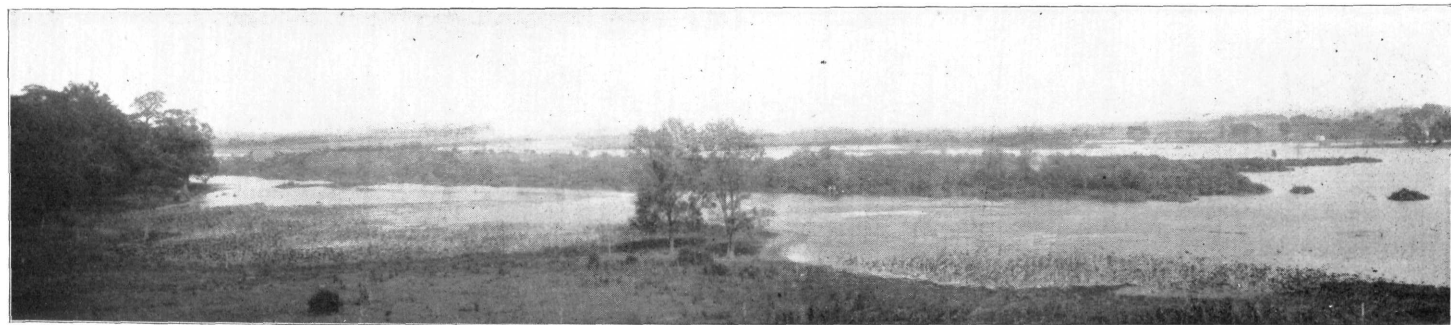
The outline is very irregular due to many indentations and small fringing islands, and changes from year to year. This is due to the frequent and extreme changes in water level in the lake. For four years within my knowledge, the water was lowered every summer, over 6 feet in 1909, so that repairs might be made. The storm winds of winter every year detach fragments of the island and sweep them away.

The vegetation is of peculiar interest; for it consists of typical bog plants characteristic today of high temperate latitudes and generally accepted to be relicts of early post-glacial times, stranded and persisting and now surrounded by the normal vegetation of the present climatic conditions.

The typical bog plants are several species of Sphagnum, the Cranberry (*Oxycoccus macrocarpus*), the Sundew (*Drosera rotundifolia*), several species of bog sedges as *Carex limosa* and *C. filiformis*, the Buckbean (*Menyanthes triloba*) and *Scheuchzeria palustris* forming a bog-meadow bordered by a zone of bog-shrubs of which the Poison Sumac (*Rhus vernix*) the Black Alder (*Ilex verticillata*) and the Choke Berry (*Aronia arbutifolia* and *A. nigra*) are the most characteristic

Soundings in the bog revealed the presence of a sandy shell marl, a lake deposit, at a depth of 28 feet. The marl was still found in some places at the 18 foot level giving a depth of 10 feet of shell marl. The presence of marl may be taken as an indication of Characeae or Cyanophyceae. Immediately above the marl was a dark brown or black plastic deposit with fragments of *Potamogeton* and *Scirpus lacustris*. These are pond plants growing in water not deeper than $5\frac{1}{2}$ to 6 feet. In another sounding the core from the 22 foot level showed a fine gradation between the marl and the pond deposit. At 15 feet the core showed a preponderance of sedge material, which indicates water at less than 5 feet. At 7 feet the core contained Sphagnum mixed with the sedge remains. At 5 feet the peat was loosely matted, coarsely fibrous but little modified Sphagnum fragments with roots and stems of cranberry and other plants. Large water pockets were encountered near the surface and even at a depth of 17 feet. At the bottom of this series containing evidence of lake and pond deposits is a fine grained blue clay. The blue clay varied from the 28 to the 40 foot level. Soundings deeper than 40 feet could not be taken as that was the maximum length of the sounding rod. This fine grained blue clay belongs I believe to the Illinoian drift.

The records of these soundings sketch the history of the island. At the northern margin of the ancient lake species of *Potamogeton* and other aquatics formed a more or less dense mat. The water gradually became more shallow through the accumulation of silt and plant remains; and the aquatics were succeeded by semi-



View of Cranberry Island from the west.

aquatic plants with fixed roots and submerged or floating leaves. Such plants as the pond lilies and lotus with large leaves and rhizomes add rapidly to the vegetal deposit and prepare the soil for sedges and other marsh plants which grow in quite shallow water. Sedges are well adapted to holding and adding to the soil and adding to the mat. Thus a sedge meadow was formed. The sedge mat in turn was succeeded by a sphagnum-cranberry bog. In such a mat the circulation of the water becomes impeded, gases set free in processes of decomposition collect and the mat is buoyed up so that it remains at or near the surface of the water. As the mat increased in thickness the surface finally rose above the water, became better aerated and the soil was prepared for shrubs and finally trees. The older portion of the bog was of course on the landward side. As the changes sketched were taking place in the bog it was constantly spreading out farther into the lake.

When thru the conversion of the swamp into the reservoir, the water level rose rapidly, all the fixed plants were submerged and killed but the floating mat of the cranberry-sphagnum bog was buoyed up on the surface and escaped extermination. Cut off from the shore by the water it became an island.

The presence of this bog presents conclusive evidence that the body of water in which it developed dates from the close of the glacial epoch.

The map of the survey of 1801 contains a number of smaller swamps to the west and northwest of the "Big Swamp." All of them have been drained and are either wood lots or are under cultivation. They vary in size from mere depressions in cultivated fields and meadows to 400 acres in area. Of these swamps the largest, known as "Bloody Run" or "Pigeon Roost" swamp, is 2 miles east of Kirkersville and $\frac{1}{2}$ mile south of the Ohio Electric railway. It is now almost wholly under cultivation, but 13 years ago it was a bog forest of soft maple, swamp ash and white elm with an undergrowth of willow and poison sumac. A drove well on one of the farms shows 17 feet of peat, then 3 feet of yellow clay, below this hard pan covering the gravel from which comes the water supply. These smaller swamps all lie at a lower elevation than the 900 foot level and as even the largest has a substratum of glacial clay they must have occupied depressions which were due to the inequalities of deposition.

III. The location and extent of the Newark river valley from Newark westward to the Franklin county line.

Frequent reference has been made to the existence of a broad and deep pre-glacial valley extending from Hanover westward to the Scioto Basin. Mr. M. C. Read was, I believe, the first to mention this valley. In the Report of the Geology of Licking county⁹ Mr. Read writing of this pre-glacial channel says: "A

9. Read, M. C. Geology of Licking County, O. Geol. Survey 3: 348. 1878.

deep pre-glacial channel from the north enters the county a little west of the Sandusky Branch of the Baltimore and Ohio Railroad, extending southward to Newark and is now occupied by the northern branch of the Licking River. At Newark it divides, one branch turning directly to the east in the valley of Licking River, and one branch extending *northwesterly, through what was evidently at one period a broad lake, and in which now the south branch of the Licking flows with a reversed current to join the main stream at Newark."

The presence of this old valley has been corroborated by W. G. Tight¹⁰ and Frank Leverett.¹¹

Mr. Leverett¹² sketches the position and extent of the old valley in the following paragraphs:

"Tight has shown that the greater part of the Muskingum drainage system was formerly connected with the Scioto system by a broad valley leading from Dresden (a few miles above Zanesville) westward past Newark to the Licking reservoir and thence into the Scioto Basin near Circleville. The present southward course past Zanesville is there a much narrower valley than the old line leading westward to the Scioto Basin, and the rock floor is markedly higher along the present course of the Muskingum than along the old course.

"At Hanover, an open valley sets in which extends westward to the vicinity of the Licking reservoir, where it is so filled with drift as to render its further course difficult to determine. A series of gas borings however, indicate that it passes southward about to Hadley Junction and then turns westward, passing near Canal Winchester and Groveport and coming to the Scioto River about midway between Columbus and Circleville, where it seems to have joined the old Kanawha system."

I have quoted Mr. Leverett at length, for his location of the valley is in the main verified by the data I have been able to secure.

The mantle of drift throughout this region is so thick that the beds in the streams lie in it, neither railroad cuts nor water wells cut through to the rock. The only data therefore which give the entire depth of drift must be obtained from gas wells, which fortunately are very numerous in this section. I obtained records from a large number of wells from Newark southwestward to a point on the Little Walnut about $2\frac{1}{2}$ miles east of Lockville.

*Northwesterly must be an error. The South Fork of the Licking flows from the southwest to the northeast across the plain, west and southwest of Newark. Northwesterly should undoubtedly read southwesterly.

10. Tight, W. G. Drainage modifications in southeastern Ohio and adjacent parts of W. Va. and Ky. U. S. G. S. Prof. Paper. 13.

11. Leverett, Frank. Glacial formations and drainage features of the Erie and Ohio Basins. Mon. 41: U. S. G. S. 155, 1902.

12. Leverett, Frank. Glacial formations and drainage features of the Erie and Ohio Basins. Mon. 41: U. S. G. S. p. 155, 1902.

From these logs the direction, location, depth and in many places width of Newark valley can be plotted quite accurately.

Beginning with the southwestern portion of Newark, a well just north of the junction of the South Fork of the Licking and Raccoon creek and half way between the union of these streams and the tracks of the Shawnee Branch of the Baltimore and Ohio railroad shows that the rock has been excavated to 527 feet above sea level, 323 feet below the present river at that point. From this point southwestern for a distance of 5 miles the center of the old valley lies a little to the west of the Ohio canal and the Ohio Electric railway. It then turns directly south to Buckeye Lake. A well $2\frac{1}{2}$ miles northeast of Hebron shows the rock to have been excavated to 510 feet above sea level, which is 360 feet below the present surface. Here the width of the ancient valley is clearly shown by well defined valley walls. To the west just north of Luray on the National road the rock walls are 930 feet above sea level; but 30 feet below the present surface; and to the east a well $\frac{2}{3}$ of a mile north of the National road and 300 feet east of the Baltimore and Ohio railroad tracks struck the rock at 920 feet above sea level, but 40 feet below the present surface.

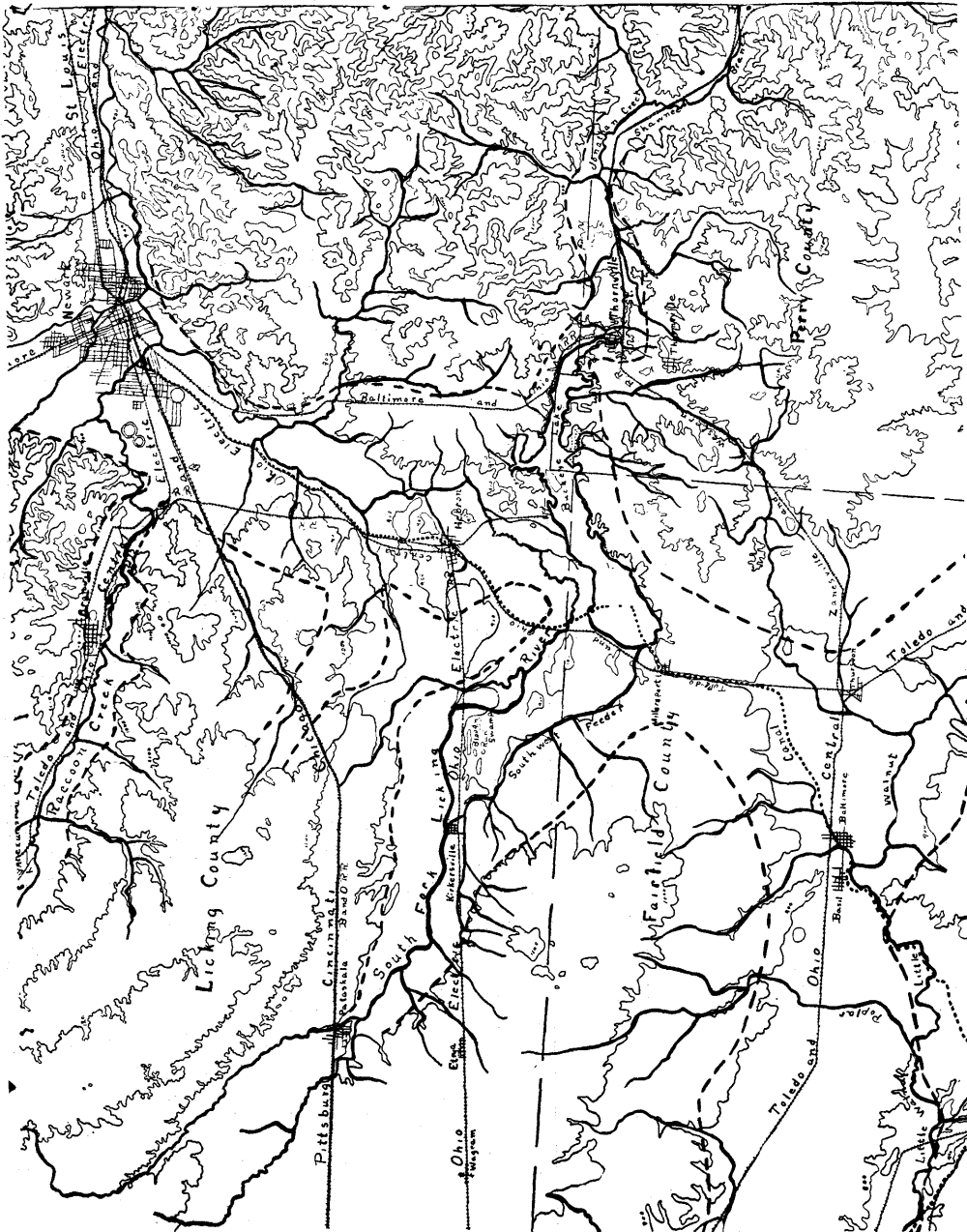
Measuring from these points I find the valley to have been $4\frac{3}{4}$ miles wide along the National road. The greatest depth in this area was found in a well in the field along the north shore of Buckeye Lake. Bed rock in this well was struck at 430 feet below the present surface, 450 feet above sea level. Buckeye Lake lies along the southern margin of the valley and not in the center. The trend from the lake is south and southwest to Basil and Baltimore. Between the lake and Baltimore I found but few wells so that the valley is not so clearly defined in this section, but it is much broader than immediately north of the lake.

Gas wells are very numerous at Basil, Baltimore and in the immediate vicinity of the two towns. Here the valley is at least 8 miles wide, is open and level. At Basil it turns more directly to the southwest following in general the course of the Little Walnut. It crosses the Franklin county line and connects with the valley mapped by Dr. Hubbard¹³ in Franklin county. Newark valley as I have traced it coincides quite closely with the one described by Tight¹⁴ and Leverett¹⁵ except in the southern portion. Among the well records of this section the greatest depth is recorded in a well in Basil, which shows that the rock has been excavated to 452 feet above sea level, 388 feet below the level of Little Walnut creek. If this greatest depth was approximately the center of the valley the stream was here farther north than the one mapped by Tight.

13. Hubbard, George D. *The Geology of Columbus and vicinity.* Bull. 14: Geol. Survey of Ohio. 1912.

14. Tight, G. W. *Drainage modifications in southeastern Ohio and adjacent parts of West Virginia and Kentucky.* U. S. G. S. Prof. Paper 13.

15. Leverett Frank. Mon. 41: U. S. G. S. p. 410.



- Legend**
 Streams
 Canal
 Railroads
 Contour Lines
 County Line
 Preglacial Valley

1 mile scale

Map of the region to the west and south of Newark, showing the present streams (heavy unbroken lines), and the preglacial Newark valley (broken lines), from Newark southwest to the Franklin county line. The largest preglacial tributaries are also shown. The light unbroken lines are the one hundred foot contours.

Newark valley had several large pre-glacial tributary valleys. There is one from the northwest and now occupied by Raccoon creek, which near its mouth must have been of the nature of a gorge, bordered on either side by rock hills $\frac{3}{4}$ of a mile apart; and now covered by a thin drift mantle. Two well records in the center of the valley at the mouth or point where the pre-glacial tributary joined the Newark valley show that bed rock has been excavated to 436 and 427 feet above sea level, 444 and 453 feet respectively below the present surface level. The valley of the tributary broadens abruptly from this point into that of the Newark river. Farther south is a tributary from the northwest. This valley is now occupied by the South Fork of the Licking river. It trends almost due east, then turns abruptly to the southeast and must have entered the Newark valley near the Bloody Run Swamp, where it suddenly widens. From the east Newark valley received a large branch which is now occupied in part by the eastern portion of Buckeye Lake and in part by the western portion of the now eastward flowing Jonathan creek. It is very evident from an inspection of the region and a study of the topographic maps of the Thornville and Zanesville quadrangles, that Jonathan creek is a composite stream.¹⁶ That part of the creek west of its union with Turkey Run flows in a larger, more open and older valley than that immediately to the east of this point. In the eastern portion to within a mile of Fultonham the stream flows in a narrow gorge like valley between rock hills. Turkey Run, a tributary from the south, flows northwest, which is almost at right angles to the course of Jonathan creek, then near its outlet makes a decided curve, turning north and then east, following closely the base of the hills, before it joins the larger stream. The valley of the headwaters of Jonathan creek broadens toward the west. A mile east of Thornville station it is 2 miles wide. Valley Run, its largest tributary from the north, also occupies a valley out of proportion to the size of the present stream. Moreover it comes in from the northeast and joins Jonathan creek headed or pointed up stream. These data seem sufficient on which to base the conclusion that the western portion of Jonathan creek is flowing with reversed current in an old valley, (a valley whose maturity suggest that it is at least pre-Wisconsin, probably pre-Illinoian.) This valley continues westward to its union with Newark valley, at the northern margin of the lake and about a mile west of the Buckeye Lake terminal of the Ohio Electric railway. A gas well record in this field bordering the lake at this point shows that the rock floor has been excavated to 450 feet above sea level, 442 feet below the level of the lake. This is the deepest record found close to the lake and indicates the location of the outlet of the ancient tributary.

16. Davis, H. J. Modification in the Jonathan creek drainage basin. Bull. Den. University 11: 165-173. Mar. 1899.

SUMMARY:

There seems to be sufficient evidence on which to base the conclusion that no large lake occupied the plain to the west and southwest of Newark after the recession of the late Wisconsin time.

The heavy bed of gravel between the late Wisconsin and Illinoian clays cannot have been deposited in a lake.

During the recession of the Wisconsin ice sheet a loop moraine was formed across the ancient valley of Jonathan creek just east of Thornville station.

The water impounded between the ice and moraine converted the lower portion of the valley into a lake.

The waters broke through the moraine forming a well defined overflow channel, not deep enough however to completely drain the valley.

This ancient basin is now occupied by Buckeye Lake.

The evidence obtained from gas well records corroborates the statements made by Read, Tight and Leverett of the existence and establishes the location and extent of Newark valley a pre-Illinoian valley from Newark, southwest to the Franklin county line.

This work was done under the direction of Dr. George D. Hubbard, now of Oberlin College, to whom I am much indebted for the assistance given in the field work and thru suggestions concerning and criticisms on this paper. I also take this opportunity to acknowledge my obligation to Miss Clara G. Mark for the excellent photograph and to Messrs. Bootin and Sawyer of the Canal Commission for information of Buckeye Lake.

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