

THE
AMERICAN NATURALIST.

VOL. XVIII.—*JUNE*, 1884.—No. 6.

THE THEORY OF A GLACIAL DAM AT CINCINNATI
AND ITS VERIFICATION.

BY PROFESSOR G. FREDERICK WRIGHT.

IN prosecuting investigations upon the boundary of the glaciated area in the Ohio valley, one of the most interesting facts brought to light is, that the true glacial drift is found on the Kentucky hills a few miles south of the Ohio, opposite Cincinnati. Granitic boulders, striated pebbles, and till are found all over Brown and Clermont counties, in Ohio, down to the margin of the Ohio river, where they cease. Nothing of the sort is found on the hills in Bracken county, Ky. But on crossing the river from New Richmond in Clermont county, Ohio, to a point in Kentucky near the boundary of Kenton and Campbell counties, glacial drift at once reappears upon the south side of the river at about an elevation of three hundred or four hundred feet, covering the hills for two or three miles back from the river. Till several feet deep here occurs, containing numerous granitic pebbles and small boulders and excellent specimens of striated stones, whose native place is not far north in Ohio.

I did not personally go over the hills in the northern part of Campbell county, but did explore Northern Kenton and Boone counties with considerable minuteness, and found glacial deposits extensive over the northern part of Boone county as far south as Burlington. About three miles east of Burlington, on the road to Florence, there is, for instance, a notable collection of boulders, of which I counted fifteen or twenty in the space of a few yards. These are in a shallow valley of Gunpowder creek, a small stream entering the Ohio near the southern part of the county. This clus-

VOL. XVIII.—NO. VI.

ter of boulders was by my barometer 450 feet above the river, and the water-shed was at least a hundred feet higher. Two of the boulders are veritable specimens of the jasper conglomerate, so abundant about the outlet of Lake Superior. Granitic boulders and striated pebbles were also found at numerous other points over the northern part of Boone county, from Greenwood lake to Bellevue. Glacial accumulations also occur upon all points of the river north of this down to the river valley. It thus appears that from Moscow, in Clermont county, about twenty-five miles above Cincinnati, to Petersburg, Ky., about the same distance below Cincinnati, that is, for a distance of about fifty miles, the valley of the Ohio was for a short time during the glacial period filled with ice, forming an obstruction to the water at least 550 feet high. The water-shed to the west, between the Licking and the Ohio, is nowhere less than this height. Walton station, seventeen miles south and a little to the west of the water-shed, is 473 feet above the river, 913 feet above the sea.

Throughout nearly its whole extent the Ohio river occupies a narrow valley of erosion less than a mile in width, and from three hundred to five hundred feet in depth. There are enlargements in this trough wherever tributaries come in, either from the north or from the south, which also uniformly occupy valleys of erosion of corresponding depth, the width varying according to the size of the stream.

It is evident that during the continuance of this supposed glacial dam at Cincinnati, a narrow lake corresponding in depth to the ice-barrier, must have extended far up the Ohio and all its tributaries; among which may be specially noted the Licking in Kentucky, the Kanawha in West Virginia, the Allegheny and Monongahela in Pennsylvania. The difference between the levels of Pittsburgh and Cincinnati is about three hundred feet; so that a barrier of six hundred feet at Cincinnati would submerge the city of Pittsburgh to a depth of about three hundred feet.

It is also evident that if there was, for any considerable period, such a glacial back-water dam as is supposed, there ought to be some evidence of it in the shape of terraces marking the old lake margin. Such evidence was not long in coming to hand, and it is all the more significant because furnished by independent parties. In March, 1883, I read a paper before the Boston Society of Natural History in which I reported the main facts just recounted.

Upon seeing this report, Professor I. C. White, of Morgantown, West Va., situated in the Monongahela valley, and who has for many years been an active member of the Pennsylvania Geological Survey, informed me that the ice dam at Cincinnati was exactly what was needed to explain the terraces along the Monongahela. It appears that from Pittsburgh as far south as Fairmount, in West Virginia, a distance of 130 miles (which was as far south as Professor White had examined), the valley of the Monongahela shows signs along its edges of having been partially silted up with heaps of trash, such as clay, sand, gravel, boulders, drifted logs and other rubbish, brought in by its tributaries from higher land. The striking peculiarity of these terrace deposits is, that they "suddenly disappear at an elevation of 1050 or 1075 feet above tide; not a single rounded and transported boulder ever being found above that latter horizon, though occurring in countless numbers below this level. The hills above the river often rise three hundred or four hundred feet higher than the upper limits of the deposits, so that there can be no mistake about the elevation at which the terrace deposits disappear. * * Back from the channel of the river, especially where the surface configuration would make quiet water, there occur thick deposits of very fine, bluish-white clay in which great numbers of leaves are most beautifully preserved. This deposit is purest near the upper limits of the terraces.

"In the vicinity of Morgantown terraces of transported material occur at the following approximate (measured by barometer) elevations :

	Feet above river.	Feet above tide.
First terrace	30	820
Second terrace	75	865
Third terrace	175	965
Fourth terrace	200	990
Fifth terrace	275	1065."

The deposits of the fifth terrace in this series are frequently found far inland from the Monongahela on the tributary streams. In such a deposit near Morgantown, called the Flats, and covering three or four square miles, wells have been sunk sixty-five feet without striking bed rock. This is 275 feet above the river and 1065 feet above tide.

Other tributaries of the Monongahela, along which Professor White "has noted the clay and other deposits of the fifth terrace,

are Decker, Dunkard, Whitely, Muddy and Ten Mile creeks, and in each case the deposits disappear at the same absolute level at which they cease along the river."

Professor Lesley informs us also that the terraces along the Allegheny and its tributaries, preserve this same absolute level.

Coming down to the Great Kanawha river, another branch of the Ohio, which drains an unglaciated region, Professor White finds water-worn boulder deposits disappearing at an elevation of from two hundred to three hundred feet above the present level of the stream. About fifteen miles below Charleston, West Va., there is a deserted river channel followed by the Chesapeake and Ohio railroad, which extends through Putnam and Cabell counties to the mouth of the Guyandotte, at Huntington. This deserted valley is from one to two miles wide, is two hundred or more feet above the Kanawha, and "is filled to a great depth with rounded boulders of sandstone, chert, cannel coal and other trash, which has plainly been transported down the Kanawha from above Charleston, so that it was clearly seen that the water of the Kanawha had once found an outlet to the Ohio by way of this valley," a distance of fifty miles.

During the summer of 1883, I explored a similar deserted channel a little ways further down the river, in Greenup county, Ky. This valley extends from near the mouth of the Big Sandy to Greenupsburg, a distance of about twenty miles, and is from one to two miles wide, is 220 feet above the present high-water mark of the river, running parallel with it and about two miles distant. This, like all the valleys in this region, is a valley of érosion, the hills rising on either side from two hundred to three hundred feet, and the bottom of it is covered with rounded pebbles of quartz and quartzite, from an inch to two feet in diameter.

Coming to the Licking river, in Kentucky, Mr. G. H. Squier informs me that near Owingsville, Bath county, in the angle between Slate creek and the East Fork of Licking, there is an extensive low tableland which is covered by erratics, including numerous water-worn fragments of sandstone and coal, which must have been brought down from the coal fields twenty miles or more to the north-east, and could not have been scattered around as they are over this immediate tableland and the low hills adjoining it, except there had been an extensive body of still water occupying the area. This is just what would have been produced

by the glacial dam which I have supposed to have existed at Cincinnati. The facts had so impressed Mr. Squier that before knowing of my discoveries he had come to the conclusion that there must have been some such barrier as I have supposed. (See *Science*, Sept. 28, 1883.)

Strong as these confirmations are, it is important that the hypothesis of an ice dam should be verified by much wider observations in the field. All along the Ohio river, and in all its tributaries above Cincinnati, there should be found numerous facts, explicable only by this theory; while the absence of terraces of a corresponding level upon the eastern side of the Alleghenies, to which Professor Lesley has called attention, excludes the hypothesis that these high terraces in the Upper Ohio are due to a general Champlain subsidence.

Nor must the phenomena below Cincinnati be overlooked. During the summer of 1883, I continued my investigations into Southern Indiana to the Illinois line in Posey county. But I will not here speak in detail of the results attained. The problem of determining the southern limit of the glaciated area of this region, however, has been complicated by what I supposed to be the results of the Champlain subsidence, amounting to five hundred feet or more in the Mississippi valley. Here, for the first time in my western investigations, I have encountered the loess overlapping and intermingling with the terminal deposits of the glaciated area in a very interesting and puzzling manner. I hope during another summer to get additional light upon the subject. Meanwhile, I am anxious to obtain any information or instruction which the experience or wisdom of other investigators may be able to furnish me.

—:o:—

THE STRUCTURE OF THE TRACHEÆ OF INSECTS.

BY PROFESSOR G. MACLOSKIE, D.S.C., LL.D.

1. *Historical.*—Blanchard's theory of two tracheal membranes with an interposed spiral thread, and of peritracheal circulation, though it was accepted by Louis Agassiz and some other authorities, may be set aside as obsolete. It was well refuted by Joly; and Claparède, in refuting its author's cognate theory of a complex