survey. The secondary stations along the Mohawk valley are from four to seven miles apart. Where tertiary work has been done, the stations are from half a mile to a mile distant from each other.

In the matter of marking stations, the New York survey has departed widely from the method of the U. S. coast survey, which has preserved its points by burying in the ground within eighteen inches of the surface a pot, jug, or other object, leaving no surface mark whatever. The state-survey stations are marked by sinking a hole five feet deep, in the bottom of which is placed an earthen pot of truncated-cone shape, with centre mark, and stamped with the letters 'N. Y. S. S.' The earth is rammed about and above this for about four inches. A granite monument six inches square by four feet long is then placed in the hole, and its centre adjusted over the pot. The upper extremity of the stone, which projects above ground, is dressed, and the same letters and the number which designates the station are cut deeply into it. Diagonal grooves on the top of the stone mark its centre.

The monuments are of one pattern, and from a single quarry. These stones, deeply embedded in the earth, are very difficult to move or destroy without the perpetrator of such an act being detected. They are easily found by local surveyors or others wishing to identify the points. The action of freezing and thawing unequally on the north and south sides of the stones will eventually throw them over toward the south. Any disturbance of this kind can be detected by the edges being out of plumb; and the stone can be recentred over the pot, which, being below frost-line, can never move. In addition to the deeply buried pot and stone, two witness-pots are buried from twelve to eighteen inches deep, and three feet from the station. On their tops are stamped arrows which point to the station.

The work of the survey is carried on by a director and a permanent corps of trained assistants divided into three parties, — two for observing angles of the primary and secondary triangles, and one for signal-building. Assistant O. S. Wilson, formerly of the U. S. northwest boundary survey, and Assistant Horace Andrews, jun., formerly of the U. S. coast survey, have charge of the observing parties; and Assistant O. H. Bogardus, of the signal-building party. In addition to the regular force, from six to nine heliotropers are employed in summer. During the winters the assistants are engaged in reducing the results, and the preparation of maps and reports, in the offices of the survey in the state capitol at Albany.

In the bill providing for the expenses of the state government, an annual appropriation of $15,800 is now made to carry on the survey.

This sketch of the causes which brought about the New York state survey, the purposes for which it was instituted, its guiding policy, its plans, grade of precision, methods, and organization, is essential to a right understanding of the results of the work whose progress will be described hereafter.

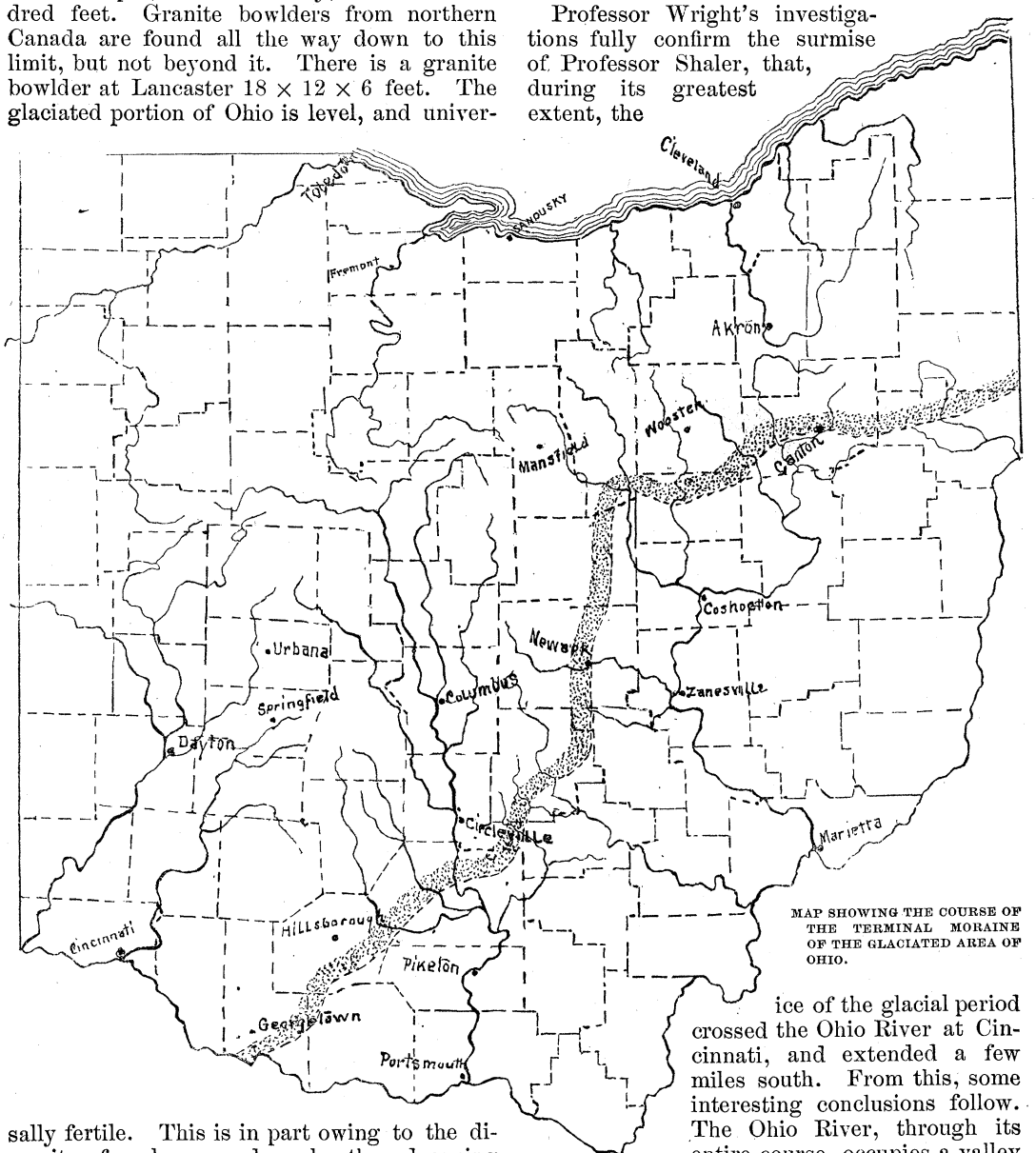
GLACIAL PHENOMENA IN OHIO.

PROF. G. F. WRIGHT of Oberlin read a paper before the Boston society of natural history on the 7th of March, giving the results of his work last summer in determining the exact southern boundary or terminal moraine of the glaciated area of Ohio. The course of this boundary-line is shown upon the accompanying map, and is a continuation of that traced by him and Professor Lewis the previous year across Pennsylvania.

The terminal moraine in Ohio is not everywhere so prominent in its features as it is south of New England, through Cape Cod, the Elizabeth Islands, and Long Island; but the southern boundary of the glaciated region is everywhere very sharply defined, and the limits of the ice can be traced with nearly as much certainty as the shores of the ocean. At various places in Stark, Holmes, Fairfield, and Ross counties there are vast piles of glaciated material at the very limit of the glaciated region. All that portion of Ohio north and west of the line above described is covered with the material which was ground up underneath, and transported by the moving ice. This consists of unstratified fine clay, containing scratched stones and fragments of rock of various kinds from the north. The average depth of this

accumulation (which Dr. Newberry calls 'the grist' of the continental ice-sheet) is about sixty feet; though in places at the very border, as at Adelphi, in Ross county, it is two hundred feet. Granite bowlders from northern Canada are found all the way down to this limit, but not beyond it. There is a granite bowlder at Lancaster 18 × 12 × 6 feet. The glaciated portion of Ohio is level, and universally fertile. This is in part owing to the diversity of rocks ground up by the advancing ice, and in part to the fact that it was pulverized by mechanical action, and is spread evenly over the surface. South of the line the country is cut up into gorges; and, as a rule, the soil is shallow and comparatively sterile. Scratched stones are entirely absent, and granite is found only in the river-valleys. The crop-reports show that the average production of wheat per acre is nearly twice as large in the glaciated as in the unglaciated portion of the state.

Professor Wright's investigations fully confirm the surmise of Professor Shaler, that, during its greatest extent, the



MAP SHOWING THE COURSE OF THE TERMINAL MORAINE OF THE GLACIATED AREA OF OHIO.

ice of the glacial period crossed the Ohio River at Cincinnati, and extended a few miles south. From this, some interesting conclusions follow. The Ohio River, through its entire course, occupies a valley of erosion, having, for more than a thousand miles, cut a gorge from three hundred to five hundred feet deep through the horizontal strata of the coal-formation. During the extension of the glacier into Kentucky, this cañon of the Ohio must have been filled with ice at Cincinnati, forming a barrier in the

river nearly six hundred feet in height. This would form slackwater in the Ohio all the way up to Pittsburg, submerging the site of that city to the depth of two hundred and fifty or three hundred feet, and setting the water back far into the valleys of the Alleghany and Monongahela Rivers.

In the extensive gravel-deposits of Ohio, south of the glacial line, no paleolithic implements have as yet been found; but they may be confidently looked for. When they are found, the investigations of Professor Wright and his associates will have important bearings in determining their age; for, in many respects, Ohio affords unrivalled opportunities for determining the amount of erosion which has taken place since the ice of the glacial period withdrew. So far, the evidence points to a later date for the glacial period than that which is advocated by some. The erosion which has taken place since the glacial period is surprisingly small. The streams running over the glaciated surface occupy very shallow valleys. In those rivers whose course was changed by glacial action so as to produce waterfalls the gorges are never more than a few miles long. The period cannot have been extremely long, or these streams would have done more work.

THE WEATHER IN FEBRUARY, 1883.

DESTRUCTIVE floods on the Ohio and tributary waters occurred from Cincinnati and Louisville southward. The water rose higher than ever previously recorded, and property was destroyed estimated as worth $30,000,000. Warnings were issued by the signal-office ten to fifteen days in advance; and merchants had ample time, in most instances, to save their property. The following table exhibits some of the principal facts: —

STATION.	Date water reached the danger-line.	Highest water above danger.		Date water left the danger-line.	Estimated loss.
		Am't.	Date.		
		Feet.			
Pittsburg, Penn.	5	4.8	5	9	$50,000
Marietta, O.	–	–	13	–	50,000
Maysville, Ky.	–	–	12	–	–
Cincinnati, O.	8	16.3	15	22	1,500,000
Lawrenceburg, Ind.	–	–	14	–	–
Vevay, Ind.	–	–	15	–	–
Jeffersonville, Ind.	–	–	16	–	100,000
Louisville, Ky.	8	20.4	16	25	367,000
New Albany, Ind.	9	–	–	–	1,000,000
Shawneetown, Ill.	–	–	–	–	250,000
Cairo, Ill	13	12.2	26	Above at end of month.	–
Memphis, Tenn.	21	Still	rising	28	–
Vicksburg, Miss.	24	"	"	28	–

The last column contains losses only so far as reported. The injuries due to sweeping away of homes, to imperilled health and comfort, and to business delayed, cannot be estimated, but are known to have been very extensive. A very full report is given in the Monthly weather-review of the signal-service.

The month has been colder than the mean for the region west of the Mississippi River. The mean temperature was from 8° to 16° below the normal on the Rocky-mountain plateau; it was slightly below the normal in the north, east of the Mississippi; and above the normal in the south. In the whole country east of the Rocky Mountains the temperature was 0.5° below the normal. The lowest temperature reported was −57°, at Fort Washakie, Wyoming. The rainfall of the Pacific during the winter has not been sufficient to assure a medium wheat-crop in that region. The deficiency was over 4 inches in central California and Oregon in February, and there were larger deficiencies during the previous winter months. This important crop, therefore, depends largely upon the spring rains, which in this region are usually very light. On the other hand, there has been a large excess of rain in the lower lake-region and Ohio valley, the excess in the latter region being 3.86 inches.

Ice dangerous to navigation is slowly drifting south to latitude 43°, between longitudes 45° and 48° W.

The chart on the next page shows the mean distribution of air-pressure and temperature, with the prevailing wind-directions in the United States and Canada. This chart shows very high pressure over nearly the whole country, it being from .1 to .2 of an inch above the mean, except in Florida and southern California. The areas of low pressure traced to the Atlantic have all passed over the St. Lawrence valley, and in no case has the centre of any depression passed to the south of the Ohio valley or middle states.

The total number of storms that have been traced in the United States during each February since 1877 is given below. The mean velocity of the storms, as published in the annual reports of the chief signal-officer, are added for comparison.

Year.	No. of storms.	Mean velocity, miles per hour.
1877	11	26.5
1878	8	27.8
1879	6	33.3
1880	14	39.6
1881	9	43.8
1882	11	42.5
1883	10	36.4
Mean	9.9	35.7