

Three or four others, according to C. H. Hitchcock, exist in Vermont and New Hampshire.

The moraines made on this final retreat bring to light the fact, as observed by Chamberlin, that the movements of the ice-sheet in the region of the Great Lakes became largely resolved into movements along lake-basins. They thus bear testimony to the preglacial existence of the basins of the Great Lakes. The Kettle moraine (KK) is concentric with the outline of the Green Bay trough, a western arm of Lake Michigan; a Michigan moraine borders the Lake Michigan basin; and a series of Erie moraines, as mapped by Leverett, are approximately parallel with the western part of the Lake Erie basin. Besides, there are indications of a Saginaw glacier movement, along the trough of Saginaw Bay on the west side of Lake Huron, as an outlet for the ice of the Lake Huron basin. There were thus brought to view more or less distinctly, as melting went forward, the outline of a Green Bay, Michigan, Saginaw or Huron and Erie glacier.

Lake Ontario and Lake Erie, during the time of maximum ice and long after retreat began, were crossed by the ice in a southward direction, the glacial scratches south of Ontario having the direction S. 8° – 20° E., and those south of Erie mostly S. 20° – 30° E. But the evidence of a lake-basin movement — really an Erie-Ontario movement — is sustained by scratches at the east end of Ontario, and over the region at the west end of Erie. In the latter region, the deep moldings in the limestone of Kelley Island have the courses S. 60° – 80° W. (Newberry); and west of the lake the same directions prevail. This westward flow in the Erie basin, first pointed out by Gilbert, and later sustained by Chamberlin and Leverett, must have been dependent in part on a like movement in Lake Ontario, for the supply of ice required a general westward slope in the ice-surface to the eastward; and the Adirondack ice-region was its probable source. Chamberlin and Leverett also bring forward evidence from the moraines (see map, Fig. 1548) that Lake Erie was rid of its ice before the more northern Lake Ontario.

The movement along the troughs of Lake Michigan and Green Bay, suggested by the moraines, as Chamberlin points out, proves, if a fact, that the ice over the troughs had the slope at surface requisite for movement and transportation. The length of Lake Michigan is 335 miles; and hence, if the mean slope was but 30 feet per mile, the height of the ice-surface at the north end, above that at the south, would have been 10,000 feet; and two thirds of this if the rate were but 20 feet per mile. With such evidence of a southward movement there is no satisfactory proof that a subsidence was in progress to the north, although the retreat of the ice had even reached the Canadian borders.

The Iowa-Minnesota series of moraines appears to indicate a like movement, and a like northeastward rise in the slope of the ice-surface. With the retreat of the ice from Minnesota, the ice disappeared from much of the more northern Lake Winnipeg region; and Lake Winnipeg, receiving waters from melting ice on its eastern and northern borders, as well as from