

feet; and that of the south side, according to J. B. Taylor, at Marquette, a height of 588 feet; at Kimball, 90 miles east of Duluth, of 568 feet; and at Maple Ridge, 25 miles east of Duluth, of 532 feet. The observations, especially those on the north side, are not numerous enough to give the mean height, but it is not far from 550 feet. The outline of Lake Superior, which these shore-lines indicate, is shown on the map, as laid down by Taylor.

East of Georgian Bay, on the Nipissing Strait at North Bay, Ontario, Taylor obtained, on the south side, the terrace height, 618 feet above the level of Lake Superior, and on the north side, 538 feet.

At the south end of Lake Michigan, the height of the upper shore-line is only 45 feet; at Mackinac Island, in northern Michigan, 205 feet; southwest of Huron, 267 feet.

These heights of the upper shore-lines of the lakes — Superior, Huron, Michigan, and Erie — are widely different, yet they are supposed to have been the heights of the upper shore-line of one great lake, named by Spencer Lake Warren, after G. K. Warren.

The mean height of 550 feet above the lake, or 1152 feet above sea level for the shore-lines of Lake Superior is not the height to which, in the Champlain period, the copious waters of the period raised the surface of the lake; but that which was given the region at the epoch of elevation which closed the Champlain period. So great a height for Lake Superior without a barrier at the outlet to Huron and Michigan was an impossibility. Lower shore-lines exist which mark successive levels in the waters of the Lake Warren region during the progress of the elevation; and an upper series of these, about Huron and the more western lakes, is the Algonquin beach of Spencer.

There are various opinions as to the actual height of Lake Warren above sea level, and as to the discharge of its waters. Discharge by Lake Nipissing into the Ottawa and St. Lawrence has been suggested. The uncertainties involve the condition of Niagara Falls.

The present heights of these shore-lines above the sea for the four western lakes — supposing the shore-lines assumed to be cotemporaneous to have been actually so — are 1100' to 1200' for Lake Superior; about 787' for Mackinac Island, between Huron and Michigan; 850' for southwest Huron; 630' for the south end of Michigan, and 775' for the south side of Erie. As to actual Champlain heights, that is, heights before the elevation at the close of the Champlain period, no good basis for a conclusion is known except for Lake Ontario, which was at tide level.

*Supposing* the height above sea level of the water plane of the combined four lakes to have been 600', the Superior shore-lines would have had less height than now by 550'; the Mackinac and Huron by 187' and 230'; the south Michigan by 30', the south Erie by 175'. But with the water plane at this level, Niagara, if in the course of discharge, would have had a fall of 600' — a condition not in accordance with any observed facts.

Again: if the water plane of these lakes were about 300' above sea level (not far from the present height of Lake Erie above the level of Lake Ontario), Niagara Falls would have been like the modern Niagara in height, but possibly a third higher, and certainly of many times greater volume and power, owing to the northern drainage from the melting ice-plateau.