

FORMATION OF THE LAKES.

There are no lakes in the Southern States except in Florida, which is comparatively new land more recently raised up out of the ocean depths and not yet thoroughly drained off, and some bayous or lagoons along the Red and Mississippi rivers, which are overflows or tenants of former beds of those rivers. But lakes are very numerous in the Northern states and throughout Canada, being most plentiful in Minnesota, where they are estimated at from 5,000 to 15,000. Prof. Winchell the state geologist giving 10,000 as a conservative figure. Michigan follows a close second, the range of estimates being about the same, but the state geologist has estimated that the number is less than 10,000. The contrast between no lakes in the South and many in the North, says the Detroit (Minn.) Journal, was very remarkable until observation showed that these lakes are all confined to the area that was covered by the ice during the glacial epoch, and investigation has demonstrated that they were all formed, with perhaps one exception, by that wonderful invasion.

The greater number of the smaller lakes are "kettle holes" dug out by torrents of water that poured down from the edges of the melting ice. The next larger number are in valleys scooped out or ground out by the moving ice, and as the ice reached depths varying from a thin sheet at its southern edge up to 10,000 feet on the highlands of Canada, its power to "grind" rocks must have been enormous. Such lakes are generally the longest in the direction that the ice moves, mostly from north to south. Lakes Chautauqua, Canadaigua, Seneca, Cayuga and Champlain, in New York, are notable examples of this class of formation.

A third class of lakes are ponds shut up by surrounding moraines, or those occupying former valleys, the outlets of which were filled up by the "drift" of the ice. Lake Erie is a notable example of this last class of formations, it being only a large "mill pond," with an average depth of less than 90 feet. Nearly all of these lakes are much smaller than formerly, and many have become entirely extinct by being filled up with washings from the surrounding land, by marl deposits or grown over by

vegetation. Probably every reader knows of lakes that are now being thus grown over. In the Champlain (ice melting) epoch all of our rivers were torrential flooded back and made temporary lakes, which were the origin of many of the smaller prairies of Southern Michigan, notably Coldwater and Girard in Branch county. As an example, the Kalamazoo river was nearly a mile wide in places; near Ostego in Allegan county, it met an obstruction and for a time flowed southward to South Bend where it united with the St. Joseph and flowed to the Mississippi through the Kankakee and Illinois.

Probably Lake Superior was the only one of the Great Lakes that existed before the glacial epoch. There is an outline of its northern shore near the close of the earliest, the eozoic era, and it appears as a complete lake all through the long paleozoic era. But in the great changes of the mesozoic era it seems to have got lost and there is no trace of it at the beginning of the geozoic era; but it is quite likely that it again appeared before the glacial epoch. Probably nothing but great valleys with large rivers, existed where the other four large lakes now are. The Helderberg limestone series that now constitute Mackinac Island, and in places extend up now 200 to 300 feet, formerly extended both north and south much farther, completely separating Lake Huron valley from both Lake Superior and the great valley that now constitutes Lake Michigan. Before the ice age Lake Superior emptied into Lake Michigan valley some distance west of Mackinac Island and flowed south through the valley now occupied by the Thames river London, Ont., into the Erie valley, which was very broad, but the most shallow of all of these great valleys. A mighty river ran through this Erie valley in those days of torrential rains, but just before it reached the locality of Buffalo it turned north and emptied into the Ontario Valley at its west end near Hamilton.

The ice ground out all these great valleys much deeper than they were before, especially Michigan and Huron, carrying the arterial southward with the other drift. It receded or melted back from an east-of-south direction in the vicinity of Southern Michigan, of course filling all of these great valleys with water south