

**Appendix.—Geology of the Great Lakes Area.<sup>1</sup>**

The Great Lakes system, forming for a distance of one thousand miles the boundary between the United States and Canada, is commonly thought of as a permanent feature of the continent which has always existed and which will always remain in its present state. To the geologist, however, the existence of these lakes appears unnatural and accidental, their age very youthful, and their present character far from permanent. How and when they originated, what changes have taken place in their outline and drainage, and what future changes may be expected, are questions concerning which much detailed information is available.

Somewhere about a million or a million and a half years ago great ice sheets began to form on either sides of Hudson bay, and increasing in size, spread out in all directions until on the south they reached the mouth of the Ohio river. These continental glaciers scoured off the soil, polished and grooved the bedrock, and by irregularly scattering this eroded material dammed up river channels and disorganized the old drainage systems. The result was the production of thousands of lakes, making the vast territory around Hudson bay one of the great lake regions of the world. The glacial period did not consist of a single advance of the ice sheets. There were at least four separate advances separated by long inter-glacial periods during which mild climates prevailed. The last glacier commenced its retreat from the Niagara region about thirty-five thousand years ago.

The present Great Lakes began with this final retreat of the ice. In front of the melting glacier stood lakes whose outlines can be traced to-day by their old beaches. The region of lakes Superior, Michigan and Huron was occupied by a great body of water to which the name lake Algonquin has been given, while the basin of lake Ontario was covered by glacial lake Iroquois. The history of the drainage changes of these lakes is complicated. The early drainage of lake Algonquin was by way of Niagara river. When, however, the ice had retreated north of Kirkfield, Ontario, the Trent valley channel was opened up and the flow was from the Georgian Bay region to lake Iroquois, robbing the Niagara of most of its waters. The region, however, was slowly rising, owing to the removal of the load of ice which had long weighed it down, and in time the drainage was once more swung around to the lake Erie and Niagara route. During this stage, part of the drainage of lake Algonquin found its way past Chicago to the Mississippi waters. When the ice retreated still farther north, a new outlet was opened at North Bay and the drainage took place by way of the Ottawa river, Niagara once more being robbed of most of its water. Continued uplift of the land, however, raised the outlet at North Bay, and eventually the old channel past Port Huron and lake Erie to the Niagara once again became the outlet channel, a course which has been maintained to the present day.

What changes will take place in the future? If uplift continues along the lines it has in the past, the next great change which may be expected to take place will be a change of the drainage of the upper lakes past Chicago into the Mississippi, thus again robbing Niagara of most of its waters. This possibility, however, is a matter of future centuries and is of no immediate concern. Much more important in this regard is the action of man in artificially diverting part of the flow of the upper lakes by means of the Chicago drainage canal into the Mississippi waters, thus lowering the level of the upper lakes and depriving Niagara of part of its volume.