

emptying its waters by the Mohawk and Hudson rivers into the Atlantic.

However, this outlet is not possible as shown by Mr. Croll, for the Mohawk river passes over metamorphic rocks at Little Falls, Herkimer county, at an elevation above Lake Ontario of about 125 feet, without the possibility of an adjacent buried channel through the ranging hills, through which the Mohawk Valley is cut. The origin of the Onondaga basin, then appears to have been by a river valley extending from the Adirondack Mountains westward and opening into the Ontario basin northward of Cayuga lake, having formed along the course of the basin now occupied by drift material and Onondaga lake, and perhaps that also of Oneida lake.

Most of the other lakes, especially those having a more or less meridional direction, lie in great valleys, and are only closed up ancient river valleys.

All of these lakes, except Genesee and Cayuga, are at a considerable elevation. One of the deepest of these elevated lakes is Strauswater, 613 feet above Lake Ontario and 320 feet deep. This lake as well as Owasee have northern modern outlets over rocky barriers. They lie in valleys several hundred feet deep (300 feet or more), and evidently emptied into the Susquehanna river in some former geological times. The valleys of these lakes, as well as several river valleys in the region, now having northern outlets, such as those of Onondaga and Butternut Creek, all radiate from adjacent or common points as they extend northward, evidently showing a former southern discharge. However, it is exceedingly difficult to determine how much of the valleys are of preglacial, and how much of interglacial or postglacial date, for there are evidently three periods of erosion—the valleys produced in the interglacial and modern epochs coinciding.

Thus far no apparent outlet of the great ancient Ontario basin has presented itself.

However one other route at first appeared possible:

BY THE SENECA LAKE, CHEMUNG AND SUSQUEHANNA RIVERS.

The features favoring this suggestion are: 1. The greatest depth of Lake Ontario north of Seneca lake. 2. The depth of Seneca lake, which is 612 feet or 423 feet below the level of Lake Ontario. 3. The direct continuity of Seneca Lake valley with that of the Chemung at Elmira, and of the latter valley with that of the Susquehanna at Sayre.

Aside from the morainic accumulations, there is nothing to prove the former exist-

ence of the glacier, except the smooth polished or rounded surfaces of the rocks, which have no more to do with the general outline of the cross section of the valley than the marks of the cabinet maker's sandpaper have to do with the shape and size of the article of furniture whose face he has gone over with that material.

The most important work of glaciers is the scratching and grooving of surfaces. This may, however, be done by dry rubbing, and therefore isolated scratched stones or patches are no evidence. The underlying rock surfaces may lose their sharpness, owing to contained detrital material beneath Alpine glaciers, and this is the result of water more than ice.

The only characteristics of ice action are striation and polishing. All floating ice shod with stones frozen in them will scratch surfaces over which they rub. The only glacial lakes which are formed are those where pre-existing valleys have been closed by morainic matter, but the water will soon reopen these dams by running over them.

Such are the deductions of the late Director of the Geological Survey of California, a man who has had opportunities for studying the action of glaciers better than probably most other geologists in America. So far, Prof. Whitney's investigations are applicable to our great lakes. Mr. George J. Hinde, F. G. S., one of the few geologists who has written from a Canadian stand point, is an uncompromising glaciologist. Because he has seen scratches in the northeastern end of Lake Ontario, and also others in a similar direction at the western end of the lake, therefore he asserts that Lake Ontario was excavated by a glacier. Dr. Newberry accepts his statements as proof, but considers that a preglacial valley determined the direction of the continental glacier. Mr. Hinde also asserts his belief that the buried valley of the Niagara river (by way of St. David's), as also those at Dundas, are of glacier origin. It has been proved incontrovertibly that the Dundas Valley is a buried river channel. Also the Valley of Owen Sound and the St. David's Valley are both beds of preglacial or interglacial rivers. Let us analyze the direction of the ice scratches in the neighborhood of the western end of Lake Ontario. I have not seen any, out of very many sets, that is parallel with the axis of either the Dundas Valley, except possibly one polished surface in the valley, or the axis of the lakes, but always at considerable angles to it. In the region of Kingston the prevailing scratches are S. 45° W., and some others S. 85° W., neither of which directions are parallel with