

old valleys. A characteristic of the former drainage is the filling of the ancient channels, above which the modern streams flow upon the accumulation of drift. The ancient valleys are relatively much shallower but broader than the modern, with sides more sloping and other marks of greater antiquity than the modern streams, where they have cut new channels in place of reopening the buried valleys.

7. *Reversal of the Drainage of the Upper Ohio and other rivers.* Among the earlier studies on buried valleys were those of Dr. J. S. Newberry, Dr. T. Sterry Hunt, and Mr. J. F. Carll. To Mr. Carll belongs the credit of first working out the reversal of the drainage of western Pennsylvania, where he discovered that the upper Allegheny and some other streams flowed into the Erie basin before the Pleistocene period. In 1881 the writer, following Carll, pointed out that there is evidence that the whole upper Ohio river, above the Beaver tributary, flowed to the Erie basin. This hypothesis was amplified by Dr. F. Max Foshay, and later the observations have been extended by Prof. T. C. Chamberlin and Mr. Frank Leverett, confirming the change in the direction of the drainage. The streams south of lake Erie generally drain a much smaller basin than formerly. So in New York, the upper waters of the Susquehanna, and of its tributaries, drained to the north into the Ontario basin, by way of the Finger lakes, which now occupy the old river courses, partially closed up by drift deposits and by terrestrial warping or deformation towards the north.

8. *Closing of the Valleys into Lake Basins.* The old Laurentian valley was more than a hundred miles wide, but it was interrupted by the deposition of drift in many places, most notably between Georgian bay and lake Ontario. To some extent the modern St. Lawrence river is flowing over a drift-filled valley. This obstruction has caused the modern drainage to be changed from the old directions and often to pass over rocky barriers. But in addition to the drift obstruction, we find that the recent terrestrial uplift has been greatest toward the northeast, producing barriers and forming basins. The warping has been measured and is found sufficient to account for all the rocky barrier below the outlet of lake Ontario. Moreover this northeastern elevation has caused all the