

Latest Changes produced by Glaciers in Scotland.

We may next consider the state of Scotland after its emergence from the glacial sea, when we cannot fail to be approaching the time when Man coexisted with the mammoth and other mammalia now extinct. In a paper which I published in 1840, on the ancient glaciers of Forfarshire, I endeavoured to show that some of these existed after the mountains and glens had acquired precisely their present shape,* and had left moraines even in the minor valleys, just where they would now leave them were the snow and ice again to gain ground. I described also one remarkable transverse mound, evidently the terminal moraine of a retreating glacier, which crosses the valley of the South Esk, a few miles above the point where it issues from the Grampians, and about six miles below the kirk town of Clova. Its central part, at a place called Glenarm, is 800 feet above the level of the sea. The valley is about half a mile broad, and is bounded by steep and lofty mountains, but immediately above the transverse barrier it expands into a wide alluvial plain, several miles broad, which has evidently once been a lake. The barrier itself, about 150 feet high, consists in its lower part of till with boulders, 50 feet thick, precisely resembling the moraine of a Swiss glacier, above which there is a mass of stratified sand, varying in thickness from 50 to 100 feet, which has the appearance of consisting of the materials of the moraine re-arranged in a stratified form, possibly by the waters of a glacier lake. The structure of the barrier has been laid open by the Esk, which has cut through it a deep passage about 400 yards wide.

I have also given an account of another striking feature in the physical geography of Perthshire and Forfarshire, which I

* Proceedings of the Geological Society, vol. iii. p. 337.