

in the Liza, Langdale, and other valleys, and high up in the hills, as at Harrison's Stickle, where a tarn has been formed by a little *moraine*, acting as a dam, as shown by Professor Hull.

In Wales, also, valley-glaciers existed after the submergence beneath the Glacial sea. Thus in Cwm-llafar, under the brow of Carnedd Dafydd, and Carnedd Llewelyn, Professor Ramsay has shown that a narrow glacier, about two miles in length, has ploughed out a long narrow hollow in the drift (which "forms a succession of terraces, the result of marine denudation, during pauses in the re-elevation of its submersion) to a depth of more than 2,000 feet."\*

The proofs of this great submergence, succeeding the era of "land-ice," are constantly accumulating. Since 1863, when Professor Hull first divided the thick glacial deposits of Eastern Lancashire and Cheshire into an Upper Boulder Clay, and Lower Boulder Clay divided by a Middle Sand and Gravel, the whole of which are of marine origin, these subdivisions have been found to hold good, by himself and Mr. A. H. Green, over 600 square miles of country around Manchester, Bolton, and Congleton; by Mr. De Rance over another 600 square miles, around Liverpool, Preston, Blackpool, Blackburn, and Lancaster, and also in the low country lying between the Cumberland and Welsh mountains and the sea.

In Ireland, also, the same triplex arrangement appears to exist. Professors Harkness and Hull have identified the "Limestone and Manure Gravels" of the central plain, as referable to the "Middle Sand and Gravel," and the "Lower Boulder Clay" rests on a glaciated rock-surface along the coasts of Antrim and Down, and is overlain by sand, which, in 1832, was discovered by Dr. Scouler to be shell-bearing. At Kingstown the three deposits are seen resting on a moutonné surface of granite, scored from the N.N.W.

In Lancashire and on the coast of North Wales, between Llandudno and Rhyl, Mr. De Rance has shown that these deposits often lie upon the denuded and eroded surface of another clay, of older date, which he believes to be the product of land-ice, the remnant of the *moraine profonde*, and the equivalent of the Scotch "Till." He also shows that the Lower Boulder Clay never rises above an elevation of fifty or eighty feet above the sea-level; and that the Middle Sand and Shingle rests directly upon the rock, or on the surface of this old Till.

Near Manchester the Lower Boulder Clay occasionally rests upon an old bed of sand and gravel. It is extremely local, but its presence has been recorded in several sections by Mr. Edward Binney, who

\* Professor Ramsay, "The Old Glaciers of North Wales." Longman, 1860.