

smoothed striated surfaces were produced.⁹ This "glacial drift" spreads over the low grounds that were buried under the northern ice-sheet, resting usually on surfaces of rock that have been worn smooth, disrupted, or crumpled by ice. It is not spread out, however, as a uniform sheet, but varies greatly in thickness and in irregularity of surface. Especially round the mountainous centres of dispersion, it is apt to occur in long ridges ("drums," or "drumlins"), which run in the general direction of the rock-striation, that is, in the path of the ice-movement. It may be traced up many valleys into the mountains, underlying the moraines of the later glaciation. In other valleys, it has been removed by the younger glaciers. In most glaciated countries the boulder-clay is not one continuous deposit, but may be separated into two or more distinct formations, which lie one on the other, and mark distinct and successive periods of time.

In those areas which served as independent centres of dispersion for the ice-sheet, boulder-clay partakes largely of the local character of the rocks of each district where it occurs. Thus in Scotland, the clay varies in color and composition as it is traced from district to district. Over the Carboniferous rocks it is dark, over the Old Red Sandstones it is red, over the Silurian rocks it is fawn-colored. The material of the deposit is generally an earthy or stony clay, which in the lower parts is often exceedingly compact

⁹ As already suggested, the materials of the till may have consisted largely of a layer of decomposed rock due to prolonged pre-glacial disintegration (pp. 597, 724). It is difficult to explain by any known glacial operation the accumulation of such deep masses of detritus below a sheet of moving land-ice. Another problem is presented by the occasional and sometimes extensive preservation of undisturbed loose pre-glacial deposits under the till. The way in which the "Forest-bed" group has escaped for so wide a space under the Cromer cliffs, with their proofs of enormous ice movement, is a remarkable example.