

boulder-clay is red ; over the coal-fields it is black or dark blue, in the Silurian tracts, among pale shales, it is fawn-coloured, thus evincing even in its colour its local origin. From this local character, therefore, the deposit obviously cannot have been brought from a distance, but must have been produced in each district where it occurs.¹ The mode of its formation, however, was for many years one of the obscurest problems in geology, which cannot be said even now to have been completely solved. After much study of the question in Northern Europe and in North America, it is now generally admitted that the almost universal striation of the boulders, their local origin, and the tumultuous unstratified character of the whole deposit prove the till to have been ground up by a moving mass of land-ice. As the ice crept downwards, it pressed these loose materials along, crushing them against each other and upon the bare rock underneath, and producing thereby the smoothed, polished, and striated surfaces so characteristic of the boulders and of the *roches moutonnées* all over the country. When the ice-sheet melted away, the underlying accumulation of debris was left lying

¹ That arctic bergs probably had nothing to do with the formation of this deposit is indicated by the absence of far-travelled stones in the clay. After many years of exploration, I have never succeeded in detecting in the Scottish boulder-clay a single stone which might not have come from rocks not many miles away. I have been in the habit of taking percentages of the stones at different localities in a district, and the result has invariably been to establish the prevailing local character of the deposit, and to point out the direction from which the ice moved. In the course of a ramble from Berwick-on-Tweed to the mouth of the Humber, Sir A. C. Ramsay and I did not meet with traces of Scandinavian rocks till we had reached the mouth of the Tees, and they became more and more common the farther south we went, showing that the trend of the Scandinavian ice across the floor of the North Sea lay towards the eastern or south-eastern coast of England. Fragments of granite, gneiss, mica-schist, and other Norwegian rocks are not infrequent in the boulder-clay of East Anglia.