

and tenacious. The higher portions are frequently loose in texture, but alternations of hard tough clay and more friable material may be met with in the same deposit. In general, boulder-clay is unstratified, its materials being irregularly and tumultuously heaped together. But rude traces of bedding may not infrequently be detected, while in some cases, especially in the higher clays, distinct stratification may be observed.

The great majority of the stones in boulder-clay are of local origin, not always from the immediately adjacent rocks, but from points within a distance of a few miles. Evidence of transport can be gathered from the stones, for they are found in almost every case to include a proportion of fragments which have come from a distance. The direction of transport indicated by the percentage of travelled stones agrees with the traces of ice-movement as shown by the rock-striæ. Thus, in the lower part of the valley of the Firth of Forth, while most of the fragments are from the surrounding Carboniferous rocks, from 5 to 20 per cent have come eastward from the Old Red Sandstone range of the Ochil Hills—a distance of 25 or 30 miles—while 2 to 5 per cent are pieces of the Highland rocks, which must have come from high grounds at least 50 miles to the northwest. The further the stones in the till have travelled, the smaller they usually are. As each main mass of elevated ground seems to have caused the ice to move outward from it for a certain distance, until the stream coalesced with that descending from some other height, the bottom-moraine or boulder-clay, as it was pushed along, would doubtless take up local débris by the way, the detritus of each district becoming more and more ground up and mixed, until of the stones from remoter regions only a few harder frag-