4. *On the TELLINA CALCAREA BED at CHAPPEL HALL, near AIRDRIE.*
By the Rev. HENRY W. CROSSKEY.

[Communicated by Dr. J. Bryce, M.A., F.G.S., &c.]

ONE of the most perplexing cases in Scotland, upon any theory of the formation of Boulder-clay, has been the alleged occurrence at Chappel Hall, near Airdrie, of a bed of clay containing *Tellina calcarea*, intercalated between two masses of true Boulder-clay.

The facts relating to the discovery of these shells have been recorded by Mr. Smith in a paper read before the Geological Society, April 24th, 1850. The present paper will simply examine the question whether the superincumbent matter was, without doubt, the true Till.

By the true Till is meant that formation covering so large a part of Scotland, possessed of the following characteristics, and to which it is proposed that the term "Boulder-clay" should be entirely restricted:—

(1) The clay contains a large proportion of striated stones, even pieces of soft shale having been so firmly and yet gently held that they have been polished and striated without being broken.

(2) The stones on the whole are not far travelled, a small proportion being traceable to the more distant mountains, and the greater part to the flanks of the nearer ridges.

(3) There is no stratification, although there are occasional patches of sand.

(4) The colour as well as the general character of the enclosed stones is determined by the mineral character of the district.

(5) It is closely compact, and hard to be worked, even with the axe.

The true Boulder-clay thus appears to represent a force extending from a distance, and yet acting with local intensity, having a grasp upon the more remote heights but exercising in each immediate place of deposition its greater strength, with a heavy pressure compacting the mass of rude material, but acting with slowness and persistency rather than with spasmodic and sudden efforts.

Upon this Boulder-clay rests, through the Clyde district, a bed of finely laminated clay, probably formed from the fine mud always borne along by rivers issuing from ice-regions, at the period when the land was sinking and the Boulder-clay had not become a sea-bottom.

The well-known shell-bed of the Glacial epoch rests upon this laminated clay, in every normal section on the west coast. The Glacial shells in the west are never found within the Boulder-clay proper; they are invariably above it, and separated from it, not merely by an epoch of time, but by a difference of condition.

The occurrence, however, of a *Tellina calcarea* bed in strata interposed between two thick beds of Boulder-clay has been described at Chappel Hall, and the ascertainment of its exact character becomes a question of considerable importance in its bearings on the whole geology of the district.

Mr. Russell (the original discoverer of the shells) reports that the shell-clay occupied a kind of basin in the Lower Till, the section being the following :—

	ft.	in.
I. Clay (supposed to be true Boulder-clay)	14	0
II. Clay, finer, containing smaller stones, with <i>Tellina</i> <i>calcareo</i> , <i>Cyprina Islandica</i> , and a large <i>Balanus</i> in the deepest part, but rapidly thinning out	2	1
III. Boulder-clay, resting on Carboniferous beds		

With great kindness, Mr. Russell sank a fresh well, seven yards from the old one, and the following section was exposed :—

I. Surface soil	1	0
II. Upper clay	5	3
III. Boulder-clay, not pierced through	9	6

The following observations were made :—

1. There were decided distinctions between the upper and the lower clays. The stones were most finely polished in the lower bed; but in the upper, only a few stones had slight indications of striation, and these were nearly obliterated. The upper clay itself was looser and more easily worked than the lower. The line of division was so marked as easily to be traced by the workmen engaged in the operation, who found a great difference in the labour required.

2. The Lower Boulder-clay of the well is exactly similar to that observed in an old brick-field about a mile and a half distant, forming the base on which a fine brick-clay rests, from which shells have been taken by Mr. Russell.

3. The junction between the two clays was recognized by Mr. Russell as the exact position at which he had found the original shell-bed.

4. The beds in the well dipped to the N.E., towards the shell-bed, in such a way as to form exactly the basin within which it rested.

Taking these observations into consideration, and remembering that the new well is within seven yards of the old, with a rapid dip of the strata towards it, it will appear at least doubtful whether the shell-bed was intercalated between two Boulder-clays (in the true sense), and very probable that it rested upon the old Boulder-clay, in the normal position of the corresponding beds through the Clyde district, and was covered by that Upper Drift which is perfectly familiar to local students.

As regards this upper clay, indeed, the whole aspect of the country shows how easily it might have been the wash from a ridge of true Boulder-clay, which rises above it, and against the slope of which it rests.

There are within sight numerous isolated hills of Boulder-clay, rising like towers to heights of twenty and thirty feet, and long ridges of the same material sweep round and form large basins. In the immediate neighbourhood also is a large fault, forty-four fathoms to the N.E., another, of seventy-five fathoms, to the S.W.,

with a cross fault to the N.W., which has manifestly helped to protect certain patches of Boulder-clay, and expose others, giving an unequal activity and various directions to the denudation which during the rise of the land took place to so large an extent over the whole district. The undulations in the Boulder-clay are often exceedingly rapid and deep, within very limited areas.

At the same time there is evidence that the land was uplifted by a force acting upon different points with different degrees of intensity. A series of shell-beds may be traced from the half-tide mark opposite Dumbarton, by Dalmuir, Jordan Hill, to Airdrie, occupying levels which gradually rise until at Chappel Hall they reach the height of 526 feet.

Recollecting, therefore, that the shell-bed in question is on the slope of a ridge of Boulder-clay, and that the denuding and elevating forces were both unequal, it is evident in what way the old Boulder-clay may have been carried over the shell-bed, its stones in the process losing their striations and much of their smooth polish, at a period long subsequent to its own original deposition.

As regards the whole case, it is submitted that while there is no evidence whatever that the Chappel Hall fossils were *in* the Boulder-clay, in any sense which would make that clay a marine formation, it is also not proved that they occupy any position different from that held by the common shell-beds of the Glacial epoch in the west of Scotland.

FEBRUARY 8, 1865.

Captain William Arbuthnot, 25 Hyde Park Gardens, W.; Robert Bell, Esq., Professor of Geology in Queen's College, Canada West; William Henry Leighton, Esq., 2 Merton Place, Chiswick; and Viscount Milton, F.R.G.S., of Wentworth Park, and 4 Grosvenor Square, W., were elected Fellows.

The following communications were read:—

1. *On the SOURCES of the MAMMALIAN FOSSILS of the RED CRAG, and on the DISCOVERY of a NEW MAMMAL in that Deposit, allied to the WALRUS.* By E. RAY LANKESTER, Esq.

[Communicated by Prof. T. H. Huxley, F.R.S., F.G.S.]

(PLATES X. and XI.)

I. THE SOURCES OF THE MAMMALIAN FOSSILS OF THE RED CRAG.

THE very remarkable deposit extending over a small area on the east coast of England, and known as the Red Crag of Suffolk, from time to time furnishes fresh remains of a very various Mammalian fauna. Indeed, so diverse are the forms which occur in this small deposit (whose total number of Mammalian fossils does not exceed