

to 600 or 700 feet in North Lancashire, and supposed by some to be shown by more doubtful deposits at greater heights.

This comparatively mild period gave place to a sea crowded with floating ice, wherein the Upper Boulder-clay was deposited on the Gravels, and perhaps on the highest islands glaciers were forming and sending off little icebergs into the channels of an archipelago. But the ice of this cold period never attained sufficient strength to plough out of the arms of the sea the sand and gravel of the preceding mild period. It could not therefore have been the agent which swept the remains of the older mammals off the face of the district, but probably belonged to the latest cold period in Britain, and I can only say that that of the Ice-sheet is the earliest of which we have any traces left in Lancashire and West Yorkshire.

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ON SUBSIDENCE AS THE EFFECT OF ACCUMULATION.

SIR,—Will you permit me to make a few remarks upon the critique on “Valleys, Deltas, Bays, and Estuaries,”¹ in the last Number of the GEOLOGICAL MAGAZINE?

The reviewer charges me with attributing to such small accumulations, as those of “a delta, a shingle-beach, or the ice and droppings of a glacier,” the power of weighing down gradually the crust of the earth. Such an opinion would, indeed, be “pushing a theory too far,” even to absurdity.

The accumulation in a delta represents a comparatively infinitesimal portion of the débris, derived from the disintegration of the material, formerly occupying the space that constitutes the area of a valley, and which has been removed during the process of its formation, having been carried down by the river and deposited near its mouth and *in the neighbouring sea*.

It is considered that during the Glacial Period, there were not simply Glaciers in Britain, but that the country was enveloped in a mantle of snow and ice, similar to what now exists in Greenland; and it has been estimated that in some parts it must have attained a thickness of at least 2000 feet. Supposing the weight of this mass was the same as that of a similar depth of water, it would indicate an increase of pressure on the surface of the land amounting to 937 lbs., or about *eight hundredweight and a half* to the square inch.

Dr. Robert Brown (Quart. Journ. Geol. Soc., xxvi., p. 681), states that he can find no appreciable difference between the deposit of the mud, with which in Greenland the sub-glacial streams are loaded, and that of the clay of the Boulder-clay, and it was to such a source I attributed its formation. Though its thickness in this neighbourhood is in places considerable, even after much denudation, as its deposition occurred close to a land-margin, it will probably at all times have been moderate compared with that which lies beneath the waters of the Bay of Liverpool. “The droppings of glaciers,” *i.e.* the scratched and other boulders and pebbles contained in the

¹ An abstract of this Essay was given in the GEOLOGICAL MAGAZINE, Vol. IX. p. 119.

Boulder-clay, though a characteristic feature in the formation, have added but a small amount to its bulk, and therefore can by its weight have had but a slight effect in causing subsidence.

As depression of the land, not only in recent but also in Palæozoic formations, has constantly occurred simultaneously with that of large accumulations, it therefore appears to me that we are at all events justified, if not compelled, to consider that the one is dependent upon the other, unless indeed it may be hereafter proved that there has been some other influence acting during such periods and in the same localities, having as great a power in inducing it as the pressure of such immense masses must occasion.

There may be greater grounds for doubt in attributing that subsidence which has resulted in forming the harbours of Portsmouth and others on the Southern coast, to the weight, not of a shingle beach, but of large accumulations in the English Channel, arising from the rapid waste of the cliffs by marine denudation, and which have been carried by tidal and other currents towards the east, because it is a solitary example, and there are no means of estimating what may be their thickness at a distance of some miles from the land, where the deposit is probably greatest; but at Spithead, where it must be comparatively thin, it was pierced during the erection of the forts to the depth of 54 feet without penetrating through it.

CHARLES RICKETTS.

22, ARGYLE STREET, BIRKENHEAD, *Feb. 18th, 1873.*

MISCELLANEOUS.

NEWBURY DISTRICT FIELD-CLUB.¹

IN the first place the details of the beds shown in the pits were noticed, beginning from the top. The highest part of the section is in brown London Clay, with its marked "basement-bed," here consisting of about ten feet of brown loam, or sandy clay, with casts of shells, and with a layer of flint pebbles at the bottom. Below the London Clay there is a good exposure of the formation known as the "Woolwich and Reading Beds," here about 50 feet thick, and divisible into three parts—the uppermost consisting almost wholly of variously coloured mottled plastic clays, often used for the manufacture of common pottery ware, and about 25 feet thick; the middle of light-coloured sands, more than 12 feet thick, and with a thin bed of pale bluish-grey clay, which, on being split along the lines of lamination, often discloses impressions of leaves; and the lowermost, known as the "bottom-bed," about 12 feet thick, and consisting of dark bluish-grey laminated clay, with green sand, flint pebbles, sharks' teeth, oyster shells, and rare impressions of smaller shells, besides the remains of microscopic animals, found by Professor

¹ Remarks on the Section at Shaw Clay Pit, and its relation to the Geology of the District. A field-lecture given by W. Whitaker, B.A., F.G.S., of the Geological Survey.