

sion seemed to me open to doubt in 1868, but subsequent discoveries compelled me fully to accept it in 1878 (Q. J. G. S. vol. xxxv. p. 138). Since that time repeated discoveries leave no room for doubt about the matter. It is accepted by the late Professor Leith Adams, in his work on the Mammoth (Pal. Soc.), as well as by Mr. E. T. Newton in his valuable memoir on "The Vertebrata of the Forest Bed of Norfolk and Suffolk" (Geol. Survey, 1882), who may be supposed to have 'matured opinions,' and a right, if not "the best right to decide such a point." Its Pre-Glacial age is further confirmed by the discovery of one of its teeth in the gravel beneath the boulder clay of Northwich, Cheshire, as I pointed out in 1878 (Q. J. G. S. vol. xxxv. p. 141). Surely the view which I retracted against the Pre-Glacial Age of the Mammoth, although it be supported by Dr. James Geikie, cannot be said to balance the testimony of these independent witnesses which Mr. Howorth either does not know, or thinks fit to ignore. Whether or no my opinion is sufficiently 'matured' by the 25 years during which I have been working at the Pleistocene Mammals, to count in the controversy, may be left to those interested in such questions.

Mr. Howorth's method of disposing of evidence against his views may perhaps be allowable to an advocate fighting a case in the law courts, but it is not likely to advance the knowledge of the facts. We are not in a court of law, but in a court of science, where the wig and the bands of the special pleader appear to me to be out of place. Into the controversy as to the Glacial Period, or into the last revival of the old diluvial doctrine given up some fifty years ago by its great preacher in this country, Dr. Buckland, I must decline to enter, believing that the only satisfactory method of dealing with such matters is not merely to compile opinions at home, but to test them by years of patient work in the field, after the fashion of our great leaders, Lyell, Evans, and Prestwich.

W. BOYD DAWKINS.

OVERLAP AND OVERSTEP.

SIR,—Mr. Goodchild's article on "Overlap and its related Phenomena," contains a useful suggestion, though I think the ambiguity arising from the use of the term overlap in a twofold sense and the desirability of limiting its application may be stated without importing further confusion into the subject or wrapping it up in the elaborate phraseology which Mr. Goodchild has employed.

In the first place I never myself met with a person who applied the term overlap to a case of thinning out, whereby the higher member of a conformable series comes to rest upon a lower member of the same series in consequence of the alternation of an intervening stratum. If the term has ever been used to express such a relation, I think the precedent may safely be disregarded, since it is obviously unnecessary to confuse such a simple matter as the thinning out of a bed with the more complicated phenomena of overlap.

Secondly, I fail to see in what particular Mr. Goodchild's definition of overlap (p. 226) differs from that ordinarily given (see Jukes'

Student's Manual and Green's Physical Geology), except that he omits all mention of its necessary connection with unconformity and even appears to suppose that overlap may take place without any concomitant unconformity. I would ask Mr. Goodchild whether he could draw a case of overlap (in his sense) without an unconformity existing at the base of the series in which the overlap occurs; the case drawn in his figure (p. 227) is an ordinary one with an unconformity. So far it seems to me that he has only introduced more confusion into the subject than there was before.

His final suggestion is, however, much more to the purpose, and we now come to the point where a confusion does really exist in the minds of geologists. I think it is ordinarily supposed that transgressive and overlapping are convertible terms, but are they? and are not Mr. Goodchild's remarks really directed against the confusion which has arisen, from the want of a proper distinction between them?

If overlap be correctly defined as a relation between two conformable groups of strata, and as consisting in the extension of the higher group beyond the limits of the lower group so as to rest upon some member of an older series, as shown in Mr. Goodchild's diagram; then it is clear that the same term should not be applied to a relation between unconformable strata, such as the transgression of a single stratum across the edges of groups belonging to an older series. This relation is indicated in the accompanying diagram, but



would be better shown in a plan, in which the outcrops of the groups *d*, *c*, *b*, are gradually and successively hidden by the transgression of the group *m* across the edges of their component beds. This is a very different phenomenon from true overlap, and yet the so-called overlap of the Chalk in Yorkshire is exactly a case of this kind; the Red Chalk there is continuous and is not *overlapped* by anything, but is itself *transgressive* across the different members of the Jurassic series.

The difference in the nature of these two relations has, I suppose, been partly perceived by those who would speak of a *conformable* as opposed to an *unconformable* overlap, but such a distinction does not avoid confusion, while it introduces a cumbrous terminology, and I quite agree with Mr. Goodchild that, since the two things are essentially different, it only perpetuates confusion if we apply the same name to both. The only question is whether there is any necessity to invent a new term and whether that already in use, viz. transgression, is not sufficient for the purpose, so long as authors are careful to make the necessary distinction between overlap and transgression. The latter term has, however, acquired another meaning in our language, and I am therefore inclined to

think that its correlative *overstep* will be likely to meet with favour, and its adoption would certainly emphasize the distinction to which Mr. Goodchild has called attention.

It must be remembered, however, that both cases involve an unconformity, and that the difference between them is really this: in overlap the basement member of the upper series has a limited extension, while in *overstep* the basement bed has a continuous extension. It is also worthy of remark that the unconformity between the two series will generally be much greater in the case of overlap than in the case of *overstep*, for in the latter the beds all dip in the same direction, and the existence of an unconformity is usually only made patent by the fact of *overstep*. The real want of the term *overstep* is not in fact brought out by the diagram drawn by Mr. Goodchild, since the unconformity there shown is so marked that the relation of the upper series to any single member of the lower series is not likely to be made a matter of discussion. It is only where both series dip evenly in the same direction that a term is required to express the relation of the upper to the members of the lower series.

May 18th, 1883.

A. J. JUKES BROWNE.

CHALK-MASSSES IN THE CROMER DRIFT.

SIR,—Mr. T. M. Reade is mistaken in supposing that I am alone in regarding all the larger masses in the “Cromer Drift” as reconstructed Chalk. In reference to this, and to his enquiry whether the Old Hythe pinnacle of Chalk figured by Sir Charles Lyell was of this reconstructed character, I refer him (and others) to page 150 of the *Geological Magazine* for 1864, where, in a footnote, Prof. H. G. Seeley observes as follows:—“The figures given in Sir C. Lyell’s Elements, p. 129, are not included pinnacles of Chalk, but only reconstructed chalky drift full of all sorts of rocks.”

It was the perusal of this note which first called my attention to the subject, and Mr. Harmer and I found Mr. Seeley’s statement as to the masses being of reconstructed material correct, examining as we did the numerous masses worked for marl-pits and lime-kilns over the country inland occupied by the Contorted Drift, though in most of them fragments of material foreign to the Chalk, save galls of sand and clay, and were not common. The *sheets interstratified* in the lower part of the Cromer cliff section, such as that near 150 yards long at Runton (where this part, heretofore called the Till, is represented in Mr. C. Reid’s memoir as the “Contorted Drift”), are of Chalk *not* reconstructed, and were brought from Chalk shores, and dropped on the bottom, as I have pointed out; and, as the submergence had then only begun, may very likely have come from some part of Norfolk, but when the masses of reconstructed Chalk were brought, and sunk deep into the substance of the sea-bed, the *whole of this county* was submerged, the highest points in it being formed of this sea-bed. For many years before Mr. T. M. Reade’s paper on this subject, I have repeatedly referred the transport and introduction of these masses to floating ice grounding on the sea-