arisen from the destruction of an underlying bed. But I am not prepared to admit that *none* of the stools are *in situ*; for it has not been proved. Considering the rottenness, and the very spongy nature of the rootlets even in the Post-Glacial Forest-Bed trees, I am not surprised that, in this much older bed, the author of the memoir has so often failed to detect the “smaller fibres” he has so assiduously looked for, but would not 20 feet in diameter of roots satisfy most men?

One more observation before I conclude. A map is given, p. 57, showing “the Rhine Estuary during the formation of the Cromer ‘Forest Bed.’” The materials on which this is based are of the slightest, which criticism is perhaps applicable to the generality of such maps. Considering that the Forest Bed is at about the same level as the present mouth of the Rhine, and that they are in a direct line about 120 miles apart, that the basin of the German Ocean intervenes, that the rivers on the east coast, including Norfolk, are even in their Post-Glacial beds much below the sea-level, that the bed of the Rhine is far below its modern delta, that the solid chalk is seen now on the Norfolk shore and immediately underlies the Forest Bed in places, and in others is not far off, and the author does not assume “any tilting or disturbance in beds of so recent a date unless such can be clearly proved.” Considering all these difficulties, it would surely have been well—if they occurred to the author—to have discussed them. But I suppose the bringing of the Rhine to Norfolk is the necessary outcome of the author’s view of the mode in which the trees have been deposited. Such unfortunately, on very little provocation, are the liberties taken with physical geography.

VI.—ON “OVERLAP” AND ITS RELATED PHENOMENA.

By J. G. GOODCHILD, Esq.;
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IT must be sufficiently obvious to the readers of the GEOLOGICAL MAGAZINE that any modification of the original meaning of a descriptive term that may serve the purpose of enabling us to convey a specific idea with less chance of ambiguity is a distinct gain to both author and reader. This is especially the case when other specific terms are forthcoming to fill the vacancies in descriptive terminology caused by the restriction in meaning of the term in question, and when it is possible at the same time to supply a suitable generic term sufficiently comprehensive in its meaning to embrace the common characteristics of the whole.

Every now and then local exigencies in the treatment of some special subject require a writer to employ a term in a signification somewhat more limited than it had been customary to give to it before. If the applicability of the term in its modified sense to similar cases of a less general and specific character are perceptible to other workers in the same field of research, it would seem much more advantageous to give the specialized form recognition by employing it, as occasion arises, than to lose the opportunity of

making a useful addition to our stock of descriptive terms by allowing it to revert to its original meaning. This principle is generally admitted to be a good one; nevertheless, in practice it is by no means always observed. Numerous as are the terms already at our disposal, the advance of knowledge is constantly reminding us of the necessity of multiplying rather than of lessening the number of terms of specific signification as occasion requires us to limit the meaning of related terms already in use.

As an instance of a word whose employment commonly gives rise to ambiguity may be mentioned the word *Overlap*. For example, when a writer has occasion to make the statement that a certain stratum "overlaps" another, it is often impossible, without a reference to the context, to discover whether the case referred to is that of a higher member of a continuous series of deposits coming into natural contact with a lower, as a consequence of the local attenuation of a third stratum elsewhere known to occur between them; or whether it refers to a case of true unconformity, where there is no necessary sequential relation between the bed that "overlaps" and the rock it may happen to lie upon. The two cases are, of course, essentially different. It is true that in the first case mentioned the contact of the upper stratum with the lower can be shown to be due to a kind of break in the succession, inasmuch as sufficient time must have elapsed for the accumulation of the stratum that is elsewhere known to intervene. But the group as a whole may have been deposited from beginning to end with no more important interruptions than are incident to the accumulation of any sedimentary deposits of the ordinary kind. The case is simply one of wedge-bedding of greater horizontal extent than usual.

Or the kind of overlap referred to may be a case of essentially the same nature as the last, manifested under a form slightly different; as, for example, where the higher bed referred to extends beyond the lower as a consequence of the deposition of horizontal strata upon a surface that is itself inclined. A wall built up the slope of a hill supplies a familiar illustration of a case of this kind. If the masonry is laid horizontally, then course after course, from the lowest upwards, extends in succession beyond the others, with the result that a particular line of masonry may at one spot form the very top of the wall, and yet be, at the end next the hill, in actual contact with the foundation.

This last case may be regarded as a typical example of what several authors have meant by the word *overlap*. But as, in nature, the several strata are usually found to thin away where their edges approach the bank, instead of ending off against it abruptly as the masonry does, it is perhaps hardly advisable to advocate the introduction of any distinction between the terms employed to denote the approximation of two beds as a consequence of the lenticular deposition of a third, and the unequal extension of strata deposited upon an irregular surface.

As well-known illustrations of typical overlap I would refer to the Coal-measure outliers on the borders of Wales, which extend, in

places, beyond all the Lower Carboniferous strata, so as to lie directly upon the older rocks. Another illustration is supplied by the mountain limestone between the south-eastern border of Westmorland and the district of Craven, which, as it is traced from the neighbourhood of Sedbergh, where the lower members of the formation are very fully developed, can be shown to overlap what is practically the whole of the vast thickness of the Upper Old Red, as well as some of its own lower strata, and to come down into direct natural contact with the Pre-Carboniferous rocks as we advance in the direction of the Craven Faults. To convey a correct idea of this kind of relation of one member of a series to another, it would probably be found difficult to employ any more expressive, and, at the same time, more suitable term than that of *Overlap*.

But it is not always convenient, or possible, to take as the starting-point in a description that part of the district where the downward development of the formation under notice attains its fullest known dimensions. In such a case it might be advantageous to add to our descriptive terminology by employing some other word correlative in its meaning with *overlap*. I would here suggest as a term likely to be of service for such a purpose the corresponding term *Underlap*. The examples above given may be again cited in illustration of its use. I should say that as the Coal-measure strata referred to on the borders of Wales are followed in the direction where deeper-water conditions prevailed in the Carboniferous Period, we find first the stratigraphical equivalents of the Millstone Grit, and then of the Lower Carboniferous subformations successively *underlapping* the strata that, nearer the centre of the Principality, lie directly upon the rock of the various Pre-Carboniferous series. Or, to take a case in the North of England, still more to the point for the present purpose, I should say that the Roman Fell beds of the Pennine Escarpment right and left of Milburn, as they trend on the one hand towards Gamasby, and on the other towards Brough, are gradually underlapped by the Upper Old Red, in just the same way as the Welsh Coal-measures are underlapped by the Lower Carboniferous.

Overlap, and its correlative *Underlap*, as it is here suggested to employ them, thus denote the stratigraphical relations of one part of a formation to another where the original extent of the lower part occupied a smaller area than that of the next higher members of the same series.

If it should, on consideration, hereafter be deemed advisable to re-adjust the signification of the term *Overlap* to the extent here suggested, a vacancy in our terminology will be created, and another term of parallel meaning will have to be provided to denote the corresponding phenomena in the case of true unconformability.

It is by no means an uncommon case to find two groups of associated strata presenting examples of both *overlap* and *unconformity* in one and the same section. On the large scale the Coal-measures of the Welsh Border both *overlap* the Lower Carboniferous strata, and extend *transgressively* across the edges of the rocks older in the geological series. The New Red of Leicestershire behaves in

precisely the same way, so does that of Kirkby Stephen, in Westmorland; or, again, the Mountain Limestone between Sedbergh and the Craven Faults, as already referred to. It is not often that any such striking examples as the last mentioned can be cited, especially where the rocks under description appertain to the higher horizons of the Neozoic division. But among the Palæozoic rocks the perfect distinctness of the two phenomena hitherto included under the one term *Overlap* is constantly forced upon the attention of the field-geologist. For example, the quartz-conglomerates of the Roman Fell Series in the Pennine area, overlap the perfectly-distinct conglomerates of the Upper Old Red; while the Carboniferous rocks as a whole (assuming that the Upper Old Red really forms a conformable subformation of the Carboniferous series) are known to extend, within a short distance, across the denuded edges of strata ranging from the Skiddaw Slate up to the Coniston Grit at Gamasby. In other words, while one of the minor subdivisions can be shown to overlap another subdivision of the same series to the extent of a few hundred feet or so, that series as a whole is transgressive across the edges of the older rocks to an extent that may be stated in miles. In such a case the necessity of employing separate terms to enable us clearly to convey the distinction observable in the field between the one kind of “overlap” and the other will at once be recognized.

The question arises, what term is there that is not already appropriated and whose suitability to the purpose in view would be likely to be generally admitted?

Diagram to illustrate the distinction in meaning between the terms *Overlap* and *Overstep*, and their respective correlatives *Underlap* and *Understep*. In the figure, beds 1 and 2 of series A successively overlap bed 3, while the series A, as a whole, oversteps the various subdivisions of the older group B.

Conversely, 3 underlaps 2, as this itself underlaps 1; and the several members composing the series B understep the formation that lies unconformably across their edges.

In oral descriptions I have found it convenient, in explaining these points upon the ground to my colleagues and others, to speak of this stratigraphical relation of unconformable beds to the various rocks immediately beneath as *Overstepping*. For example, I should say that the Roman Fell Beds in the neighbourhood of Melmerby overlap the Upper Old Red, while the Carboniferous formation—whose basement beds are formed by the Upper Old Red and the Roman

Fell Beds collectively—*oversteps* the older rocks there from the Skiddaw Slate up to the Coniston Grit. In like manner, describing the Pre-Carboniferous rocks themselves—whose dips and strikes, be it remembered, bear no necessary relation to those of the beds that lie unconformably upon their upturned edges—I have used the correlative term *Understep*, and have spoken of the older rocks forming an ascending, or a descending series in this or that direction as the case may be, *understepping* the beds that lie unconformably above.

The convenience of having some such addition to our descriptive terminology will, I feel sure, be fully recognized by others who, like myself, have had various instances of similar phenomena before their eyes for many years. Whether the terms here suggested be ultimately adopted or not, is a matter of indifference, provided that, as soon as the desirability of increasing our stock of words in this direction is once admitted, the terms proposed, whatever they may be, are such as shall enable us clearly to distinguish between the essentially-different ideas that have been confounded under the one term *Overlap*.

REVIEWS.

I.—CONTRIBUTIONS TO THE PHYSICAL HISTORY OF THE BRITISH ISLES.

With a Dissertation on the Origin of Western Europe, and of the Atlantic Ocean. By Professor EDWARD HULL, M.A., LL.D., F.R.S. pp. xvi. 143. (London: Stanford, 1882.)

IN his efforts to picture the physical geography of past epochs, the geologist finds three principal features to restore: (1) those of land and water, (2) those of life, and (3) those of climate. In the present work the author has attempted to delineate the outlines of land and water during the principal geological periods, over the area now occupied by the British Islands. This is naturally one of the most attractive of geological subjects, leading us away from the details, to contemplate the grand series of changes our area has undergone: and, so far as we are aware, in no country has it ever before received such full, careful, and, we may add, sumptuous treatment. Among the earliest and best attempts to sketch the history of past periods were those of De la Beche in 1834 (*Researches in Theoretical Geology*), while his disciples R. A. C. Godwin-Austen and A. C. Ramsay have devoted their lives in great measure to the questions affecting the physical geography of the past. To the former of these two geologists Prof. Hull pays a graceful tribute in his preface, observing that his elaborate essay on the Possible Extension of the Coal-Measures beneath the South-Eastern Part of England, will ever be considered a masterpiece of geological induction. Other geologists have dealt with particular periods, as Prof. Prestwich has with the Eocene strata, Dr. Hicks with the Palæozoic strata (*GEOL. MAG.* 1876), and so on.

The only general attempt to show by map the successive changes in the British Area we call to mind, was that of the late J. C. Ward, in a *Dream on Skiddaw*, reprinted in his *Elementary Geology* (1872). Of ideal pictures of different scenes in the past, we have had many