of Mother Earth ever having been afflicted with St. Vitus' dance to this extent, I do not see how it is possible that such startling inequalities in elevation or depression can have gone on in *solid rocks at the surface* without shattering them to pieces.

Will you also allow me to tell Mr. Mackintosh that I have tried to explain how subaërial agency *may* begin the work of escarpment-making on p. 87, of the Geological Survey Memoir on the country round Stockport, Macclesfield, Congleton, and Leek.—A. H. Green.

Monk Bretton, Barnsley,
December 9th, 1867.

REPLY TO MR. W. BOYD DAWKINS, ON THE THAMES VALLEY DEPOSITS, &c.; AND TO MR. A. H. GREEN, ON THE OUSE VALLEY AT BUCKINGHAM.

Sir,—Before replying to Mr. Dawkins' criticism, I must acquit myself of any undue use of the letter to me to which he refers. I wrote him in reply to it, pointing out privately what I have now done publicly; and asking him, as I valued his palæontogical evidence, to correct what I considered to be a hasty error in his geology. All that I received was a letter, refusing in indignant terms to do this, and challenging me to make out my case. Not the faintest intimation was given me of the mistake in places which Mr. Dawkins now says he made, notwithstanding that I had pointed out to him that Mountnessing and Ingatestone had nothing to do with the valley of the Blackwater, and the position of the Glacial clay near Witham had been shown by me a year previously, in sect. nine of my paper, at page 348 of your third volume.[1] He must have been hurried indeed, if he ran his finger up the Wid to Ingatestone and Mountnessing, instead of up the Blackwater to Witham, when the latter is not only fifteen miles distant from them, but is in another Ordnance Sheet. It was only upon this failure to get corrected, or even qualified, in an unobtrusive way, what I consider to be a fundamental error, that I sent in the note to my paper then awaiting its turn for reading at the Geological Society.

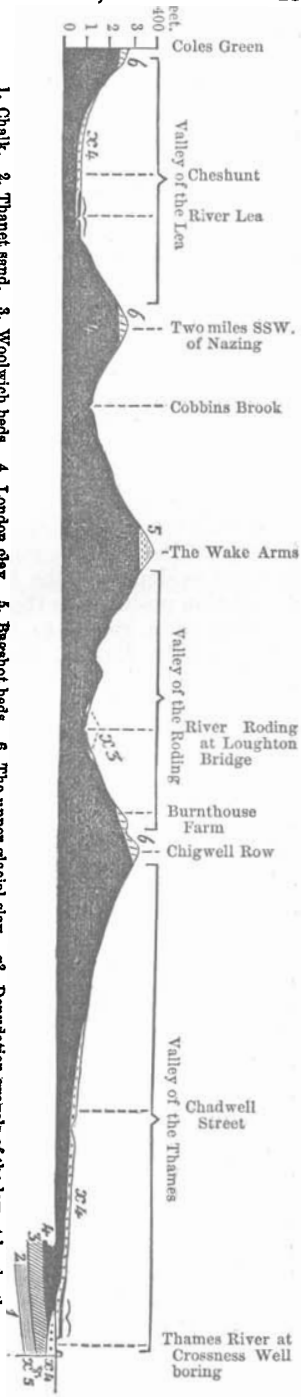
With respect to the brick-earths of Grays and Crayford, I have given so many sections in illustration of their position in the memoir that accompanies my maps in the Geological Society's library, that it would only be unduly occupying your space to endeavour to illustrate the subject here. They must await the investigation of impartial observers, who will study and master, not one, but the whole of the highly complex features of the Eastern Thames valley. All that I would invite Mr. Dawkins, and it seems Professor Morris also, to do, is to show that the gravel of the lower terrace, which, with a thickness of fifteen feet, *passes under the greater part of the Grays brickearth*, be not a part of the same sheet which occupies the valleys of the Darent and Cray, and to which

[1] See Little Braxted, which is in the Blackwater valley, and only one mile from Witham Station. As the Glacial clay comes near to Witham, it may very probably be at Witham station, but if so, is not visible, in the Railway section the only bed seen being the gravel.

the brickfield at Crayford forms a higher terrace, as shown in my section at page 409 of the twenty-third volume of the Quarterly Journal Geol. Soc.

While Mr. Dawkins reserves a doubt whether the brick-earth of Dartford Heath and Hill-house be identical with that of Crayford, it is not worth while attempting to show that it is inferior to the Thames gravel; otherwise, I think means could be found to satisfy even himself of that fact.

Mr. Dawkins' position generally is — first, That the chief part of the deposits of the Thames valley are older than the Glacial clay of the northern heights; and the rest, viz., what he and Mr. Fisher term "Trail" (but whose existence as a formation I do not admit), is synchronous with that clay; and—secondly, That the main features of the country around the Thames area were sketched out before the Glacial clay period. With respect to the first of these propositions, I ask Mr. Dawkins either to show that section four at page 398,[1] and section thirteen at page 409, of the twenty-third volume of the Quarterly Journal, and the section I now give are incorrect; or else to explain by what condition of things such a structure as they display could on his hypothesis come to pass. Those who know the Thames valley are aware that a large arm of the chief deposit in it, the gravel, runs up the valley of the Lea. Now the accompanying section shows the relation borne by this gravel to the Glacial clay, both in the Thames and Lea valleys; as well as the struc-



1. Chalk. 2. Thanet sand. 3. Woolwich beds. 4. London clay. 5. Bagshot beds. 6. The upper glacial clay. z^3. Denudation gravels of the lowest level; these have a considerable development in the Roding Valley. z^4 and z^5. Thames gravel. — Marsh clay, which between Grays and London is underlain by a forest growing on z^4 and z^5. — N.B. The mapping shows that the detached tracts of Bagshot beds (of which one is intersected above) were islands in the early part of the upper Glacial sea, and had the Glacial clay deposited around them, becoming, as submergence proceeded, eventually enveloped in it. Length of section 20 miles. The elevations are only approximate.

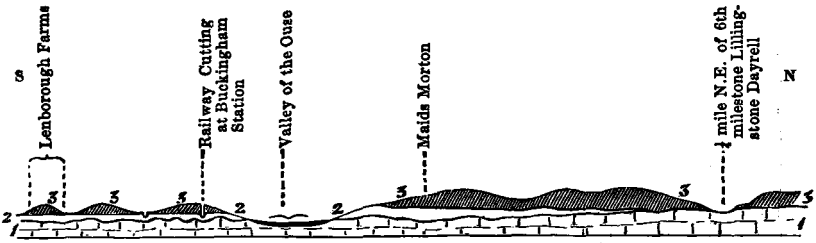
[1] By oversight the elevation of Upminster Hall and Cranham Church is made too great in this section, but this has no bearing upon the structure displayed by it.

ture of these valleys, and that of the Roding, where the southernmost outliers of the Glacial clay occur, being those nearest to the common point of inosculation of the three valleys. Unless this section be wrong, I submit that if the posteriority of the Thames gravel (x4 and x5) to the Glacial clay be doubtful, then the posteriority of the implement gravel at Bedford to the same clay must be doubtful also; for, so far as this relative position goes, the two gravels are identical—what I contend being, that though both are posterior to the Glacial clay, the Thames gravel is much older than the Bedford, in the latter part only of which contention Mr. Dawkins agrees with me. Palæontological evidence is a valuable auxiliary to Geological position, but cannot override it; and if the two clash, the latter, I submit, should prevail. My own belief, however, is that they never *really* clash, and that the present case, where the Palæontology, as deduced by Mr. Dawkins from the Mammalian remains and the physical Geology, as deduced by myself, so strictly agree is an instance of this. I also ask whether this section can be reconciled with the other of Mr. Dawkins' propositions, viz., that the main features of the country were sketched out before the Glacial period? Is it not evident that the three valleys have been formed by a great denudation posterior to the Glacial clay? So far from limiting my meaning of a valley to the stream itself, I contend that all the valleys of the East of England, with one or two exceptions, have been formed subsequently to the Glacial clay; but I point out that this clay occupied depressions or erosions of greater or less extent, some of the smaller of which (as in the case of parts of the Roding and Wid valleys), have been incorporated into existing valleys that chance to traverse them, quite irrespective of their original character; and thus give in these parts an illusory impression of the valley having been formed before the Glacial period. I have been especially desirous to call to the attention of geologists the great contrast presented, in this respect, by the valleys in strata newer than the Trias south of Flamborough Head, to those of the same strata north of that point.

In reply to Mr. Green, I beg your readers to compare the section he has given in his letter to you with that which he gives in the Memoirs of the Geological Survey for sheet 45 (which is that objected to by me in my paper), and judge for themselves what similarity there is between them, for there appears to me to be scarce any. If the suppositious (or dotted) line be omitted, I see little in his section sent you to object to, beyond its incompleteness; and I ask your readers to judge what ground it affords for the assertion, made in reference to the section given in Memoir 45, across the Ouse, "that a valley existed in the stratified rocks, previous to the deposition of the drift, which has been filled up with gravel, and then partly hollowed out again."[1] I subjoin a section shewing what I submit to be the true structure across the Ouse at Buckingham. In it I represent the Great Oolite and Cornbrash as presenting an eroded surface to the Glacial beds, which I submit

[1] Memoir for sheet 45, p. 34.

to be the cause of those features attaching to the Cornbrash upon which Mr. Green relies. The irregularity of the Pre-glacial surface is indicated by the outcrop at Lillingstone Dayrell of the older rocks, without the intervention of the bed No. 2, the gravel; that bed coming in again in great force under Whittlebury, three miles beyond the northern end of my section. It is impossible that the



1. The Great Oolite and Cornbrash concealed except where the valleys cut down to it. 2. Gravel and sand with boulder beds (the Middle Glacial), being bed No. 1, of Mr. Green's section. 3. The Upper Glacial clay — Valley deposits, alluvium, etc. N.B. The Oxford clay may come in at the South end of the section under No. 2, but if so it is wholly concealed.

The junction-line of 2 and 3 should be level instead of undulating as made by the engraver on one side of the Ouse.

Base-line about 200 feet above the sea. Vertical scale about 500 feet to the inch. Length of section six miles.

Post-glacial valley system should not frequently encounter these irregularities of Pre-glacial surface, which are thus made use of to found an argument for the Pre-glacial origin of our present valleys in the South. The main charge that I bring against this part of Sheet 45, and the Memoir accompanying it, is that both omit all reference to that which, having regard to its superficies and original thickness, is the greatest Tertiary formation of England, in point of magnitude—the Glacial clay. But few of your readers may be aware that, although the gravel given in Mr. Green's section is copiously illustrated, and this, as well as the valley beds, and even the alluvium, are described in the memoir, not the least allusion, either in map or memoir, is made to the Glacial clay. The result is that, not only this part of Sheet 45 E, but the greater part of Sheet 52, nearly half of Sheet 46 W, and part of Sheet 53, are delineated in a merely conjectural manner. Had this great formation not been thus ignored, I cannot conceive that the Geological surveyors would have failed to recognize that the valley of the Ouse, from the source of that river above Buckingham to its debouchure upon the Fen country, was, as Mr. Prestwich had shown it to be about Bedford, formed subsequently to the Glacial clay.

S. V. Wood, Jun.

P.S.—In his letter Mr. Dawkins says, in reference to the brick-earths in the Railway cutting immediately to the North of Mile-end Terrace, and half-a-mile from Hill-house (which I have mapped as a part of the Dartford-heath brick-earth, and treated as identical with those of Crayford, Erith, and Ilford, which Mr. Dawkins regards as synchronous), that "the fact that they contain nearly all the testacea now living in our rivers, and none of those extinct

in Britain, and no bones of mammals, proves them to be much newer than the neighbouring deposits containing older forms of life." Now, since writing you I have heard from Mr. Prestwich that he found the land and freshwater shells of the Erith beds in this cutting in the year 1850 or 1851, and among them, he thinks, the *Cyrena fluminalis*. Mr. Whitaker, also writes me, in reply to my enquiry, that he thinks he found the *Cyrena* in the cutting West of Dartford Station some years ago, but cannot speak with any certainty, not having his note books of that date with him.

S. V. W., Jun.

SUBAËRIAL DENUDATION.

Sir,—I did not intend to answer communications objecting to arguments and statements in my paper; but one of the letters in your last number demands a few words.

I am sorry that I should have misrepresented the views of my friend and colleague, Mr. Hull, and thereby given him any annoyance; but, at the same time, I am glad that the name of another able and tried geologist may be added to the roll of those who allow that great things have been done by subaërial denudation, though he does not go so far as some of us.

I read his letter on "River-Denudation of Valleys," soon after it appeared (Geological Magazine, Vol. III., p. 474) but did not refer to it in my paper, as it seemed to me to uphold marine rather than subaërial denudation. My mistake arose from taking certain statements of Mr. Hull's, which had reference to some valleys of a certain sort, as applying to valleys generally.

I have not seen his paper in the "Popular Science Review," and I do not hold myself bound to wade through journals of that kind, in search of original articles on geology.[1]

There is another geologist to whom justice was not done in my paper (p. 450)—the Rev. O. Fisher, who, I believe, first published the second of those arguments against the marine formation of escarpments that Sir Charles Lyell admits to be unanswerable (p. 449).

The remarks of your correspondents seem to me to divide themselves, for the most part, as follows:—(1). Some show that, as might be expected (man being fallible), I have overlooked sundry small matters; (2) some make statements of a kind that I have not denied or objected to at all; (3) some have been already answered in my paper; (4) some are simply exceptions to rules that I have stated to be *general, not universal* (and according to the old proverb "the exception proves the rule"); (5) some are founded on a strange misunderstanding of the arguments of subaërialists; (6) some are statements that I cannot agree to, and which I can only meet by

[1] Mr. Hull's criticism (Geol. Mag., Vol. IV., p. 567,) of a sentence in the first part of Mr, Whitaker's paper, "On Subaërial Denudation," (p. 453) should have been omitted, as the sentence objected to was corrected at the end of second part (p. 493), a month before Mr. Hull's letter appeared—by the insertion of the word "us," after "follow" (line 15, p. 453).—Edit.