

outside chalk ridges, and one inside Weald Hill. And that these three ridges of hills were as much *formed* by rain and rivers, as the statue is formed by the sculptor. I thought that this was quite simple. Mr. Mackintosh's receipt is more simple still. He first brings in fire to make "longitudinal cracks during axial elevation," then water in the form of currents "deflected and reflected so as to hollow out the curvilinear 'coves' by which the 'capes' are separated. But suppose it could be shown that powerful currents operating at a considerable, not 'too great' a depth, are incapable of scooping out the depressions bounded by escarpments, it would not be more inconsistent with uniformity to suppose a cyclically-recurring intensification of the action of currents caused by sudden upheavals of strata (here we have fire and water together) than to admit occasional strides constituting breaks in the otherwise continuous series of (organic) changes."

This seems so probable that if I remain of the same opinion still, it can only be from being convinced against my will.

In the same number of your Magazine, page 568, Mr. Hull says, "I adopt, though with some hesitation the views of Professor Ramsay, Dr. Foster, and Mr. Topley, regarding the subaërial denudation of the Weald." If Mr. Hull will do me the *honour* to read the chapter on the Weald in "Rain and Rivers," I think that he will do me the *justice* to say that the above-named gentlemen have "adopted" *my* principles, first published in 1853, and again in 1857.

GEORGE GREENWOOD, Colonel.

BROOKWOOD PARK, ALRESFORD,  
6 December, 1867.

#### THE VALLEYS OF LANCASHIRE.

SIR,—My friend and colleague Mr. Hull in the last number (page 568) has again brought forward and endorsed his views as to the formation of the valleys of Lancashire. As I have now for some time been at work in North-East Lancashire and the adjoining parts of Yorkshire, my silence would imply that the country on which I am engaged bears evidence in favour of his views, whereas the facts, so far as my experience goes, tend towards an opposite conclusion.

He says "Most of the valleys are really double valleys, the smaller being alone due to river denudation, *and the evidence of this lies in the fact* that, the larger, or primary, valleys are filled with terraces of Marine Boulder-clay, and are really plains of marine denudation in their earlier stages." (The italics are mine.) The fact I can corroborate with pleasure, but I must differ from him in the inference. I find myself obliged to go further than my friend and state, that in the district, with which I am acquainted, the Boulder-clay lies also in the "secondary" valleys, and in water-courses of every size and at different levels (even in some of the narrow cloughs down the hill-sides), in short, in many of those "channels and furrows," which Mr. Hull admits to have been formed "by the action of frost, rains, rivers, and glaciers." In fact many of the brooks of this part of Lancashire are simply re-excavating and enlarging fossil

water-courses, and following in the footsteps of their pre-glacial pioneers.

With these facts before me I see no escape from the inference, that, *in this district at least*, the Glacial Sea, so far from *forming* the "primary" valleys, in which it left the Boulder-clay, had not even the power to *obliterate*, in those valleys, many *minor* features formed by previous subaërial action.

R. H. TIDDEMAN.

GEOLOGICAL SURVEY OF GREAT BRITAIN,  
CLITHEROE, December 12th, 1867.

#### SEA-CLIFFS AND ESCARPMENTS.

SIR,—In combating the notion that escarpments have been originally sea-cliffs, Mr. Whitaker has stated so fully and forcibly the well-known fact that their bases are rarely or never at the same height above the sea-level for any distance, that there would at first sight seem to be little room for anything more on the subject. Mr. Whitaker's observations, however, having been confined to the Tertiary and Secondary rocks of the South-East of England, it may perhaps be well to shew that his remarks apply equally to the escarpments of other districts. I also note that one of your correspondents still holds that depression would convert most of the principal escarpments of the Centre and North of England into sea-cliffs; and another, while he admits that the bases of escarpments are not strictly horizontal, seems to think that their deviations from a level line are either so small, or so very gradual, that they might be converted into sea-cliffs by inequalities of depression by no means beyond the limits of probability. Vague statements, like the latter, are easily made; but, before they can carry any weight with them, they must undergo the test of facts, and figures; and for this end I have drawn up the following table shewing the details of two cases.

ESCARPMENT SURROUNDING THE RIVELIN VALLEY NEAR SHEFFIELD.

NORTH SIDE OF VALLEY.			SOUTH SIDE OF THE VALLEY.		
Height of base above sea-level in feet.	Distance from starting point in miles and chains.	Difference between height of base at each point and mean height of base.	Height of base above sea-level in feet.	Distance from starting point in miles and chains.	Difference between height of base at each point and mean height of base.
1000		+ 300	1000		+ 300
1075	0·40	+ 375	1075	0·42	+ 375
1000	0·60	+ 300	1000	0·76	+ 300
900	1· 0	+ 200	900	1·35	+ 200
800	1·15	+ 100	800	1·72	+ 100
775	2· 0	+ 75	800	3·50	+ 100
700	2·45		700	3·65	
600	2·48	— 100	600	4· 5	— 100
500	3·40	— 200	500	4·18	— 200
400	3·60	— 300	400	4·25	— 300
325	4· 0	— 375	325	4·36	— 375

Let us now see what will be required to make this line a sea-cliff, or, if it were once a sea-cliff, to convert it into the present escarpment.

\* Fault between these points.

† Between these points the base is up and down between 800 and 850.