

*carinifera*, *Siliquaria anguina*, *Cerithium vulgatum*, *Lima perversum*, *L. trilineatum*, *Buccinum macula*, *Pleurotoma rugulosum*, *Mitra eburnea*, *M. plicatula*, *Dentalium strangulatum*.

There is a sufficiency of Lusitanian features in this assemblage to make it referable to that older condition of the North Sea known as the Crag Period; instead of associating such a fauna with that of Sternberg and Grafenberg, one object of my paper was to show that there was no blending.

The mystification as to Cassel arises from the same cause as it did at the Bolderberg; there is an admixture of fossils, but it is purely accidental, owing to the lowest beds of one series (Kainozoic) having been superimposed upon the uppermost beds of another (Tongrien). This last has not been misunderstood by M. D'Orbigny (see Von Koenen, p. 505), in whose geological scheme it is the latest and uppermost marine assemblage of the great Nummulitic Period, and of its Germanic sea area.

M. D'Orbigny's only misconception consists in his placing his "Tongrien" as a "sous-étage" of the "Falunien." Into this he was misled by the German authors. It is an error which may be turned to good account by others, as showing how unsafe it is to methodise from a bag of fossils gathered from the remanié beds of one locality.

Yours truly,

ROBERT GODWIN-AUSTEN.

CHILWORTH MANOR, GUILDFORD,  
November 19th, 1867.

#### MR. WHITAKER ON "SUBAËRIAL DENUDATION."

*To the Editor of the GEOLOGICAL MAGAZINE.*

DEAR SIR.—I most unwillingly request of you to allow me space to reply to some observations of my colleague, Mr. Whitaker, contained in his paper "On Subaërial Denudation," published in the number for October last; and calculated to convey a very erroneous impression of my views on this subject. Owing to a variety of circumstances, I had not read this paper, nor was I aware that any personal allusion to myself was contained therein, until a friend called my attention to the passage a few days since. In that passage I find myself represented (p. 453) as "*a strong believer in the sea, and nothing but the sea,*" as objecting to reasoning on logical principles, and the writer concludes with the following:—"One should not be surprised at the advocates of the marine formation of valleys and escarpments looking down on logic, and scorning syllogisms, . . . unless *they follow and overcome those prejudices* which contracted views of nature and magnified opinions of the experience of man may have begotten," etc. What may be the meaning of "following" and "overcoming" a prejudice, is a question which may well be left to those who alone are conversant with logical reasoning.

If my critic had only taken the trouble to refer to my paper in the GEOLOGICAL MAGAZINE (Vol. III, p. 474) on "The Denudation of the Valleys of Lancashire," and to another paper to which refer-

ence is there made in the *Popular Science Review* (for October, 1866), which he was bound to do before he undertook to give an exposition of my opinions, he would scarcely have represented me as being "a believer in the sea, and nothing but the sea" as an agent of denudation. So far from this being the fact, I state in the former paper, with regard to the scooping out of the valleys of the Lancashire Hills, that they have been formed by rivers "in the great majority of instances" (page 474), and again (in page 477), I add, "the more I consider this subject, the more I am satisfied, that in the great majority of instances in this region, the extent and limits of river action are capable of the clearest demonstration. 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.

In the paper in the *Popular Science Review*, I adopt a two-fold view of denudation, under the heads of "Vertical Denudation," and "Horizontal Denudation;" the former term including the formation of "channels and furrows, either branching or lying along parallel lines, as in the case of mountain chains," by the action of frost, rains, rivers, and glaciers. Under the term "*horizontal*" denudation, I include the formation of plains and terraces by wave action, either of the sea, or large lakes.

If my critic had glanced at the same paper he would also have seen that I adopt, though with some hesitation, the views of Professor Ramsay, Dr. Foster, and Mr. Topley, regarding the subaerial denudation of the Weald; and, without any hesitation, those of Mr. P. Scrope regarding the formation of valleys and escarpments in the region of Auvergne; and after this statement I am quite ready to leave it to the judgment of your readers whether or not I am to be regarded as "a believer in the sea and nothing but the sea."

A believer in the sea I certainly am; both in its power of forming valleys and escarpments, and this from the evidence of my own eyes. I have seen along the coast of Cantyre, channels several hundred feet in length, with steep walls scooped out of tough gneissose rock by wave action, and caves hollowed out of porphyry and other rocks, like part of a railway tunnel, many yards in length, and I care for no *à priori* arguments which are intended to prove that after such exhibition of the power of wave action to cut narrow channels in the rock, the formation of valleys by such an agent is an impossibility. Knowing the variety of agencies which nature employs in the formation of the features of the earth's surface, and believing that each special district requires the application of special principles, I altogether repudiate *as of universal application* some of the general axioms laid down by Mr. Whitaker with such show of authority; knowing from my own experience that some of them are contrary to fact. I shall just remark on one or two of them here. He says:

(1) "Escarpments always run along the strike, whilst sea-cliffs rarely do so." The "rarely" is a saving clause, as there are many

examples; but has it not occurred to the author, that towards the close of the Drift period, most of the principal escarpments of the centre and north of England which run along the strike, must have been sea cliffs when the land was from 200 to 400 feet lower than it is.

(4) "If escarpments have been formed by the sea, there ought to be at their foot some resultant, a beach or other marine deposit; but this is not the case (except where masses of Boulder Drift end near the bottom of a ridge)," etc. To this I reply that these "masses of Boulder Drift" are very often level terraces of marine origin, and to all intents and purposes sea-beaches, or beds; but besides this, there are true sea-beaches at the foot of escarpments, as for example, in the Vale of Gloucester, at the foot of the Cotswold Hills.

I would also remark, that it is surprising to me, how any one who believes in the formation of Professor Ramsay's "Planes of Marine Denudation," can question the power of the sea to produce escarpments, as some escarpments are only the lines along which the sea left off its work in the formation of such planes.

In conclusion, I will only express a very strong conviction that we shall never arrive at true views of the operation of nature in sculpturing the surface of the earth, unless we take into consideration the effects of all possible agencies, and give them their due place in the great work. I remain, yours truly, EDWARD HULL.

3, HAMILTON PARK TERRACE,  
GLASGOW, 18 Nov., 1867.

#### ON CLIFFS AND ESCARPMENTS.

*To the Editor of the GEOLOGICAL MAGAZINE.*

SIR,—I know very little about escarpments in the soft newer formations, but as I have seen a fine cliff cut by the Atlantic in the hard, older rocks that occur in the west of Ireland, and also in the Boulder-drift, perhaps I may be allowed to make a few remarks on Mr. Whitaker's notes on cliffs in his "Comparative table of the distinctive features of Escarpments and Cliffs."<sup>1</sup>

##### "CLIFFS."

(a) "Rarely run along the strike,<sup>2</sup> but at all angles to it, and cut through many formations in succession."

##### REMARKS.

(a) It rarely happens that a sea-cliff can keep to the out-crop of a bed, for it is highly probable that the beds were not raised to their present position horizontally. However, it does occur sometimes, although the beds may not be perfectly horizontal; as, for instance, on the westerly coast of Aranmore, Galway Bay, where a bed of shale for miles forms the base of a perpendicular cliff: also on the coast of Clare, where a thin bed of limestone in the Coal-measure shales acts in a similar way. At the base of a drift-cliff, there is often a bed of stiff clay; just as it will often occur at the base of a drift-cliff formed by a stream.

<sup>1</sup> GEOL. MAG. November, 1867. Vol. IV. p. 491.

<sup>2</sup> Ought not this to be out-crop, or basement?