

such is the case at Halesfield. Should it be so, it would establish the fact of there being two systems of faults in point of age affecting the Coal-measures in this Coal-field, which has not, I think, been pointed out by any previous writer upon the subject. I had not supposed that my conclusions were different from those of most other geologists; but I have fallen into the error of supposing that Mr. Randall thought in any way differently on the general subject. The reference, however, to a local exception, is equally new to me; and therefore I should be obliged for information on the subject. It will be necessary to show that there are faults in that neighbourhood which affect the older Coal-measures, without affecting the younger, which fill the denuded valley. I take this opportunity of saying that I am indebted entirely to Mr. Scott for the lines showing the denudation of the several groups of Coal-seams from near the Hem pit northwards.

DANIEL JONES, F.G.S.

#### ON THE SUBMERGENCE OF THE WEST COAST OF BRITTANY.

SIR,—In connexion with Mr. Lebour's paper on the submergence of the western coast of Brittany (see above, p. 300), and the Rev. T. G. Bonney's reference to M. Quenault's book treating of the subsidence of the coast of Normandy (see above, p. 384), I beg to call your attention to the elaborate and conscientious collection of "physical and historical evidences of vast sinkings of land on the north and west coasts of France and south-western coasts of England within the historical period," by Mr. R. A. Peacock, C.E. (8vo., Spon, London, 1868.) Although the western coasts of Brittany (comprising Is) are not specially treated of, yet a vast amount of relative information is afforded by Mr. Peacock's work, and some of M. Quenault's labours, alluded to by Mr. Bonney, are given in detail at pages 131–133.

Mr. Peacock's "collected evidences prove that within the last nineteen centuries, and even so late as the beginning of the fifteenth century, large tracts of land and sea-bottom have sunk, even more than a hundred feet at some places, along the coasts of Western Prussia, Holland, and Belgium, from the Elbe to near Nieuport; along the coasts of North Somerset, and of Devon and Cornwall, north and south; in the bed of the English Channel; amongst the Channel Islands; along the coasts of Normandy and Brittany, from the Seine to Portrieux; on the north coast of Brittany, from about Lannion to the north-west angle of Brittany; around the Isle of Sein, on the west of Brittany; and probably also along the French coast in the Bay of Biscay. Whilst possibly the land around Rochelle has risen a few feet since the commencement of the twelfth century." (Phil. Mag. for May, 1869.)—Yours, etc.,

RUSTICUS.

#### TERRACES OF NORWAY.<sup>1</sup>

SIR,—I have endeavoured to follow Mr. Marshall Hall's advice (GEOL. MAG., July). But I found that there were many Aardals in Norway. I have been to that a little north of Stavanger. I found plenty of terraces, and my walk up the valley ended at a magnificent

<sup>1</sup> See GEOL. MAG., 1871, Vol. VIII., p. 75.

waterfall. But I believe that it was called Hjaa Foss. I could not hear of Mr. Hall's Mörk Foss, so I presume that I have been to the wrong Aardal. Half the bridge below Hjaa Foss had been swept away, which brought me to a full stop. So as I sat and gazed on the fall, I transferred my deck-load of luncheon to the hold, and then retraced a walk of loveliness, such as of itself alone would have repaid me for my journey from here by Hull to Stavanger.

In my letter (GEOL. MAG., April) I have agreed with all Professor Kjerulf's facts, and with all his theories, except that I think that the level of the terraces depended, not on the level of permanent "water-surfaces," but on the level at which the river which carried the materials overflowed on to the *land*. I do not, however, think with the Professor, that we need suppose the rising of the land which placed the *marine* terraces above the overflow of the river to have been *sudden* and "with several shocks." As the land rose gradually, the river gradually deepened its channel, and not only ceased to overflow and deposit on its Delta, but in floods cut away the banks which it had formerly built, which it drove to the hill-side in the form of two parallel terraces. The existing slopes of the sides and ends of these terraces, on which the Professor founds his theory of "sudden shocks," are not the slopes at which they rose from the sea thousands or millions of years ago. These slopes have been receding from atmospheric erosion during all this period, and they are receding now. But they retain universally the angle at which their incoherent materials will rest—an angle not very unlike that taken by the sands of an hour-glass. For these materials, like those of the Scottish Kames, the Irish Eskers, and (query) of every terrace on earth, are simply sand and pebbles; and where they are accidentally bared of herbage, you sink ankle-deep in going up or down the slopes.

The Delta which the river is forming now at Aardal is not at the level of the sea, or even of the unflooded river, but, like every other Delta in the world, above both. The great universal mistake is to suppose that Deltas formed by rivers in the sea, or in lakes, cease to rise when they reach the water-level. Can any one point to a Delta at the level of the sea or of a lake? Deltas universally rise by overflow of the rivers above the water-level, and they continue to rise as long as the land and water maintain the same relative level; though all Deltas slope downward to the end at the water's edge. All alluvial flats formed on land by the annual overflow of rivers are just as level as the Deltas which are formed above the sea-level or lake-level.

On the new Delta at Aardal there are a number of terraces at different levels, and the boundary of any one which is not overflowed by any particular flood is swept by the escaping flood-water. Six terraces may be counted on the left bank of the river at the bridges. These may probably, by unusually high floods, be cut back against the hill-side in the form of one high terrace, and then supposed to have been thrust up at one "shock." The correspondence of terraces in number, on opposite sides of the river, will often vary from this destruction of terraces by unusual floods.

As I have said in the last chapter of "Rain and Rivers," amid the apparently hopeless irregularity in all Deltas, there is this one *general tendency*, that the entire overflow is from a central channel or channels, and the entire escape of the overflow to the sea is by the two side channels. These two sides and the sea-side form the triangle, or Greek Delta, from which these formations receive their name. Besides the earlier deposit of the heaviest materials, this side-escape of the flood-water causes the slope downward from centre to side of Delta deposits. Inland deposits frequently slope the contrary way, from side to centre. For besides that the flood-water has no side-escape, but returns to the river over the same surface which it has traversed, the erosion of the hill-sides and of old terraces tends to heap from the side to the centre. Sometimes, however, channels are cut by the return water. In this case, a slope from centre to side may be observed even in inland alluviums.

The Rev. Mr. Bonney, in your May number, applies my theory for the formation of *inland terraces* (GEOL. MAG., May, 1867) to the formation of *marine terraces*, to which it is wholly *inapplicable*. I agree with that close observer and accurate thinker, Professor Kjerulf, in thinking that inland and marine terraces result from causes totally distinct.

BROOKWOOD PARK, ALBESFORD,  
3rd August, 1871.

GEORGE GREENWOOD, Colonel.

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### MISCELLANEOUS.

WE understand that there will shortly be published a Geological Atlas of England, by Mr. W. Stephen Mitchell, M.A., LL.B., F.L.S., F.G.S. The Atlas will contain the following Maps:—1. Cambrian (of Survey); Lower Cambrian (of Sedgwick). 2. Lower Silurian (of Survey); Middle and Upper Cambrian (of Sedgwick). 3. Upper Silurian (of Survey); Silurian (of Sedgwick). 4. Old Red Sandstone; Devonian. 5. Carboniferous Limestone; Yoredale Beds. 6. Millstone Grit; Coal Measures. 7. Permian (of Survey); Pontefract Group (of Sedgwick). 8. New Red Sandstone; Rhætic (Penarth). 9. Lias. 10. Lower Oolite. 11. Middle Oolite. 12. Upper Oolite. 13. Wealden; Neocomian. 14. Gault; Upper Green Sand; Chalk and Chalk Marl. 15. Eocene. 16. Crag. 17. Alluvium. 18. Bone Caves. 19. Metamorphic (?). 20. Igneous.—The Maps will be printed in colours, each Map exhibiting only the range of one formation, and the names of places on the formation. In some few cases, where it is requisite, as a clue to the locality, to introduce the names of places near, but not on the formation, these will be printed in a different type. The Maps (11½ in. by 9¼ in.) are based on a photographic reduction of the last edition of the Greenough Map, which is published under the direction of a Committee appointed by the Geological Society. In all cases where, through researches more recent than this last edition, any changes have been adopted in the grouping of the beds, this Atlas conforms with the latest alterations. The revision of the proofs of particular Maps has been kindly promised by W. Boyd Dawkins, Esq., M.A., F.R.S., W. Whitaker, Esq., B.A., F.G.S., H. Bauerman, Esq., F.G.S., J. W. Judd, Esq., F.G.S., Charles Moore, Esq., F.G.S., W. T. Aveline, Esq., F.G.S., and others.—Letter-press will accompany each Map, giving in a tabulated form the subdivisions of the formations, the origin of the names of the groups of beds, their lithological characters, thickness, range, etc., with a historical notice of the various classifications that have been at different times employed.—The Lists of Fossils will be arranged on a new plan, showing in a tabulated form for each formation the genera that first appear, those that last appear, and those that are numerically abundant in that formation. Separate tables give the characteristic species. These lists are prepared expressly for this work by R. Etheridge, Esq., F.R.S., F.G.S., etc., Palæontologist to Her Majesty's Geological Survey of Great Britain.