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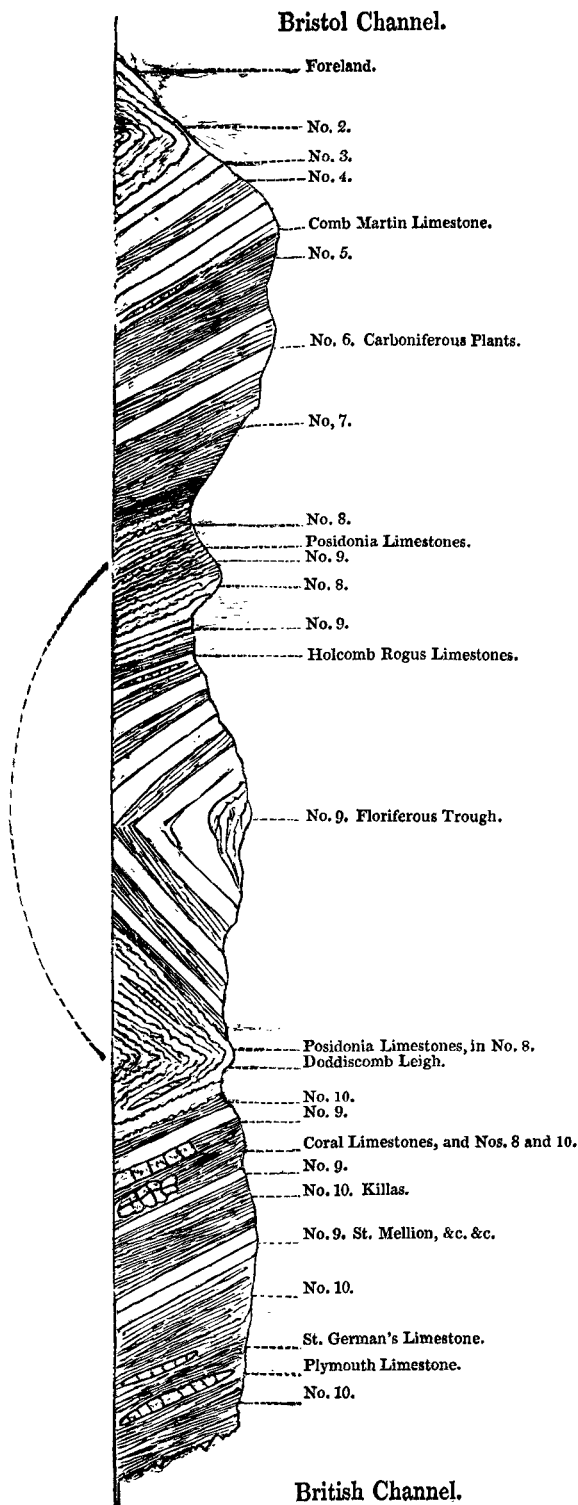
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X. *On the Geology of Devon and Cornwall, with reference to a paper read before the Geological Society on December 4th, 1839.* By the Rev. D. WILLIAMS, F.G.S.

To the Editors of the Philosophical Magazine and Journal.

GENTLEMEN,

AS I do not consider the substance and spirit of my paper on Devon and Cornwall, which was read at the meeting of the Geological Society on the 4th inst. is fairly reported in the *Athenæum* of the 7th, I request you will favour me with an opportunity of righting myself with your readers, and of reporting progress since my communication which was published in your last October Journal (vol. xv. p. 293). I feel assured that I am not intentionally misrepresented in the *Athenæum*; the abstract however imputes to me (as I hastily read it before I left London) that I hold mineral characters to be everything and organic evidences nothing, in determining the relative ages of strata. Now it was very distinctly read by the Secretary, Mr. Darwin, that I did not consider the law proposed by Dr. Smith to be of any value in classifying the rocks of the earth in remote localities, if it did not suppose a final and universal extinction of genera and species; and in as much as some plants and animals would probably be enabled by the Creator to survive mutations which would be death to others, I considered that a classification of the older rocks should be regulated by some per-centage test, such as Mr. Lyell had applied to the tertiaries, rather than by a more restricted rule. I quote from memory, not being able to refer to either the *Athenæum* or to my paper. I stated that I unequivocally believed in the extinction of genera and species, severally at distant epochs, and therefore did *not* believe that the *Posidonia* and *Goniatite*, which I discovered in some trashy lentiform limestones in Devonshire, were specially created for the mountain limestone alone, when I knew it could be proved to demonstration, that those *Posidonia* limestones of Devon, and all their associated rocks, not only bore no lithological resemblance to any of the mineral types of any portion of the great English coal-field, but that they underlaid the coral limestones of South Devon, and the whole of the slates of Cornwall. I exhibited sections evidencing the actual supraposition of the Cornish killas on the floriferous series, No. 9, and the Coddon grit, No. 8, and I pointed out the localities. In all fairness then it remains for gentlemen to disprove those facts, instead of requiring me to show what I believe to be an impossibility, viz. the identity of the plants I found in the great floriferous outlier on the south and



south-west of Callington, with those which had been procured from the fine culm shales near Bideford. I believe it to be an impossibility, on account of the same coarseness of the matrix in the great outlier, as exists everywhere, that I have seen, in the rocks of the floriferous series generally, where I have never met with clearly defined specimens, except in the finer culm-shales just mentioned. All I am prepared to prove then is, that about St. Mellion and Pillaton, between Callington and Plymouth, *plants in the same imperfect condition are found in precisely the same slates and shales, which are parted by thick beds of the same sandstone, and in intimate association with that singularly characterized and unique formation the Coddon Hill grit; there is the same triple association of the same rocks, and in the same order of succession*, that we witness in the base line of the floriferous series along the north and south borders of the trough, and where on earth could they come from if not from the same sources which supplied the constituents of the same rocks elsewhere in the same county? The only deviation on the S. and S.W. of Callington from the normal types of the floriferous series elsewhere, is frequent intercalations in it of undoubted killas, and beds of a composite or neutral character, constituted of moieties of killas and Coddon Hill grit, or of killas and floriferous, round the confines of the outlier, seen not only in repeated alternation, but in other instances, their wedge-shaped extremities interlocking into each other like the teeth of a rat-gin. Here, as elsewhere along the confines of these two vast formations, Nos. 9 and 10, whether we advance towards the floriferous area on the one hand, or towards the killas on the other, we distinctly observe the one becoming thinner and evanescent as the other augments into unity and fulness.

Nature has manifestly conducted her operations of deposition and elevation in this region on a vast scale, and if her works be not regarded in their just proportions, we never shall arrive at the truth: thus as we explore the confines of Nos. 9 and 10, we are startled almost at the vastness of the ties and adjustments by which they are indissolubly united, till we reflect that they are only in a ratio to the magnitude and dimensions of their respective masses; that it is only the same transition and alternation on a larger scale, that we observe throughout Exmoor between the several members from No. 2 to No. 9, on a smaller; for while I hesitate as to the diameter of No. 9; No. 10, I repeat, is upwards of eight miles, measured according to Professor Playfair. Thus again, if we take a *coup d'œil* view of this country from one channel

to the other, we have nothing more than one great wave (of probably some far extended undulation) consisting simply of two convex arcs inclosing a central trough, apparently the result of the same system of forces acting on a vast floor of matter, successively and regularly accumulated; either an overlying mass, or a fractured section of an original continuation of the Cambrian and Silurian deposits; for if we compare the precipitous and vertical cliffs of Nos. 2, 3, 4 and 5, of Exmoor (in echellon arrangement beetling over the deep tide way of the Bristol Channel) with the carboniferous limestone and secondary rocks of the opposite coast of Wales, we have all the evidences of an enormous fault.

But what are the results if we compare the positive testimony afforded by gradation, alternation, succession, and conformable supraposition, with that afforded by organic remains? The Petherwin fossils near Launceston, and those of the coral limestones of South Devon, I include without doubt or hesitation in a lower horizon, or subdivision of the floriferous series, No. 9, *above* the Posidonia limestones; so that if we suppose the ratio of extinction of vegetable species not to have been governed by the causes which effected that of marine zoophyta and testacea, the exceptions afforded by the Posidonia limestones are but as dust in the balance of organic evidence; and in this respect alone, geologists will involve themselves in inextricable difficulties and contradictions, if they reject the maximum and rely on the minimum amount of organic evidence. I repeat the fact, that the lower floriferous, and Coddon Hill grit series are overlaid in the south by the slates of Cornwall, which comprise in their ascending terms, first, the St. Germans, and lastly, the Plymouth limestones; so that it appears to me, that the great consecutive series from No. 2 to 10, evidences a transition of organic type, in progress, as it were, from the *grauwacké* *towards* the carboniferous limestone; that the latter, or its coal-field, is not represented here at all, but that the coarse slaty and red arenaceous beds which overlie the Plymouth limestones, extending thence to Rame Head on the south, probably do appertain to the early period of the Old Red Sandstone proper.

The relations of the floriferous, No. 9, to the coral limestones, and killas, No. 10, are explained with the greatest clearness and simplicity at and around Chudleigh; to aid my brief description I refer your readers to the accurate and faithful sections of Mr. De la Beche. (See Report, Plate IV. fig. 7 and 8). But why that able observer should assign a different position to the many other groups of coral limestone

of South Devon, is to me unaccountable, because they are all manifestly of the same age and order with the Chudleigh limestones, viewed stratigraphically, zoologically, or mineralogically, and are seen under precisely the same associations, for I do not remember a single exception to the fact of the floriferous, Coddon grit, and killas, being either interstratified with, or underlying and overlying them : so that nothing can be predicated of the Chudleigh, that may not equally be affirmed of the coral limestones everywhere, if the parallel ridges immediately north and south of Chudleigh be the same floriferous, No. 9, and to doubt it is to doubt the plainest evidence of the senses : the controversy is at an end, for we trace them here continuously, from the culm-field ; and I ask any fair and indifferent geologist merely to compare the rocks on the right bank of the Teign near Chudleigh-bridge, with those on the left, where a cutting for the road to Newton affords a good section of the west extremity of the Ugbrook ridge ; and if he does not pronounce their perfect identity, the same dull olive-coloured sandstones parted by the same black shales, I will no longer advocate what I know to be the truth, and allow error to maintain the ascendancy. No one doubts that chalk is chalk, or oolite oolite, or lias lias, elsewhere ! The Chudleigh reef of limestones, which is lost under Haldon to the eastward, and cuts out near the Teign to the west, is a great alternation between the two floriferous ridges just mentioned, the three sequents dipping together at about the same angle to the south ; while a careful examination of the coral limestones shows them to be based here immediately upon thick *black culmy* beds, and higher up to be parted by Cornish killas, beds of Coddon Hill grit and volcanic ash, with *plants*. The Creator has been so explicit here, that his works cannot be misinterpreted, if the laws recorded on these tables of stone be read without prejudice or control.

On discovering in the month of May last, at Doddiscomb Leigh, five miles north of Chudleigh, the Posidonia limestones (as everywhere else), included in the Coddon Hill grits, and together constituting the anticlinal axis of the south border of the trough to the east of Dartmoor (thus manifestly underlying the Chudleigh series, a fact confirmed by good cuttings and natural sections along the west bank of the Teign) the scales fell from my eyes—every difficulty and apparent anomaly vanished as if by magic, and the structure of the entire region, from one channel to the other, was presented to my mind's eye in all the grandeur of its simplicity ; from Plymouth to Linton it was a simple series of successive

emergence. A thousand embarrassing facts on the west of Dartmoor, and elsewhere, at once were reconciled, and the rocks appeared before me, like a cloud of witnesses, to testify that the floriferous series was overlaid by the Cornish killas, and requiring me, as it were, to restore each to his rightful throne.

My long section exhibited at the Geological Society did not perhaps show the south anticlinal axis sufficiently prominent or distinct, for I see by my maps that the Coddon Hill grit, commonly dipping *south*, occupies nearly two miles of country from north to south; and that at and about Doddiscomb Leigh, it is in the same parallel with the great line of fracture on the W. of Dartmoor which ranges by Launceston to Bos-Castle; and that this line continued through Dartmoor will intersect it at Amicomb Hill, between Fur-Tor and Yes-Tor, which Mr. MacLauchlan has determined to be the highest points of elevation in the West of England. Any omission in my section, however, I request may be imputed to my deficiency in tact in getting up a section, and not to any imperfection in the evidences afforded by the country; but in reply to the objection urged by Mr. Murchison, I may state, that the Posidonia limestones being only insulated patches in the Coddon Hill grit, and therefore part and parcel of the mineralogical axis, are quite as likely, in the southern fall, to dip away from the trough, as to dip into it; my section, however, gives the floriferous rocks as the most prominent of the anticlinal, which I still think is very near the truth, and may be explained by supposing them to arch over the subordinate Coddon Hill grits; or still better by the fact, that in the N. of Devon the Coddon grits are divided into an upper and lower, by great wedge-shaped masses of the floriferous rising into prominent hills, viz. south of Barnstaple, and north of Bampton, so that the lower range of these grits may not be exposed here at all.

All I have to say further is, that since the day I picked up the master-key at Chudleigh and Doddiscomb Leigh, I have not met with the least difficulty or embarrassment; nor do I anticipate anything hereafter but additional confirmation, from the conviction that nature will not be, as she has not been, permitted to deny herself; and I again earnestly invite Prof. Sedgwick and Mr. Murchison, or Mr. Weaver, to review the country; for after all, there are no gentlemen to whom I would sooner refer this question than to themselves.

I have the honour to remain, Gentlemen, &c.

Bleadon, near Cross, Dec. 16th, 1839.

D. WILLIAMS.