On the Geology of the Quantocks.

BY MR. J. H. PAYNE.

THE Quantock Hills form part of the extensive series of Schistose Rocks, so well known as occupying a very extended area in the counties of Devon and Cornwall, as well the extreme north-west of the county of Somerset, separated, however, from the main body of these rocks by a fertile valley. The range is about twelve miles long, by four to six miles broad, extending in a direction from north-west to south-east. The water-shed it is very difficult rightly to determine, there being no river or stream of any size. Each little valley seems to claim for itself the right to drain its own domain. We may describe it, however, as tending principally southward. Three principal heights may be noted, viz., Will's-neck, 1,270 feet; Cothelstone, 1,066 feet; and Douseboro or Danesborough, 1,022 feet, above low water mark. The Rev. David Williams, in a paper read before the British Association,* divided the whole of these rocks of the West of England

* I believe in 1836, but it does not appear in their transactions.

into a group of ten divisions, the Quantocks belonging to the lowest five of the series, and the Cannington limestone being placed the very lowest in the scale. It is now, however, ascertained, that, as regards Cannington, Mr. Williams was in error; and without attempting at present to unriddle the "puzzle" as my late friend Mr. Baker called it, yet the discovery of shells in this limestone is sufficient to upset previous theories as far as I am acquainted with them, and to leave a fair field of geological research still open there to the physical geologist. Neither, indeed, would I pin my faith to much of Mr. Williams's generalizations. Murchison, De la Beche, Phillips, and not forgetting Professor Sedgwick, have combined to topple down his "synopsistic" column, and at present, I think, we must throw his groupings aside altogether. A very prominent feature as are the Quantock Hills in our county, the stranger on a nearer acquaintance will not be disappointed, for few districts offer greater attractions to the lovers of nature, whether as regards varied scenery, or the magnificent prospects from their summits. Seen from a distance, they present, with the exceptions of the heights I have mentioned, a gently undulating outline, and from the south-eastern extremity are divided into distant ridges, spread out in the form of a fan, having one extremity at North Petherton, and the other at West Monkton, with a gradual slope to the alluvial lands below. On the eastern side, lateral branches spread out from the main range, thus forming the beautiful valleys called Coombes: on the western side the descent is much more rapid. Of themselves, from the general cultivation, few opportunities are offered for satisfactory sections, but we may compare the quarry sections with those presented by the cliffs on the shore of the sister district, and by these means arrive at

our conclusions. These rocks being sedimentary, the range owes its present elevation to igneous action in ages long gone by, probably before the disturbance of the Somerset coal field, and which we now know was before the deposition of the lias. In their present form, then, we may consider them as amongst our very oldest monuments of the power of the Almighty Worker, with whom a thousand years are but as one day.

The QUANTOCK HILLS may be divided according to their geological character into three parts :—First, the northern part, being of the same class as the Linton sandstones, conglomerates, &c. (No. 3 in Rev. Mr. Williams' grouping), comprising rocks which may be described, generally, as coarse calcareous slates, gritty, gravelly, with great beds of sand-stones and shales. These are placed erroneously by Mr. W.; for they are the oldest rocks of the Quantocks.* Secondly, that portion occupying the middle and largest part of the range, comprising rocks next in age, which may be termed the Ilfracombe beds ; being of a finely arenaceous slaty character, very fossiliferous at Buncombe Hill, with compact and shaley limestone bed, of a sub-crystalline texture. And Thirdly, the remaining part, containing the quartzoze schists, or slates, of Mr. Williams' group No. 2, but which are now placed above his group No. 5, in accordance with the opinion of the high authorities who have since examined them.

I shall confine myself now to facts derived from observation, and put the conclusions aside for the present. Commencing our survey then at St. Audries and West Quantocks-head, we find reddish gritty sandstone beds, and red slaty shales between, the dip being about 22 deg. N.N.W.

* This is very satisfactorily proved in Mr. David Sharpe's paper, published in the Transactions of the Geological Society, February, 1853.

In another quarry of much the same character on the road leading to Bicknoller, south of St. Audries, the *anticlinal* of these beds has been discovered within a few days by Mr. J. D. Pring, of Taunton, and we are now enabled to complete a section of the whole range, the publication of which, in the present volume, has been superintended by that gentleman, to whom I am also indebted for other valuable information.

The sandstones in this quarry are of a reddish grey colour, and very hard. The two dips may be clearly observed, viz., the northern at an angle of 20 deg. north-west, and the southern at about 10 deg. south-east. North of Doddington, the sandstones are of a purer gray colour, having a mixture of red only at certain points. Mr. Pring notes the discovery of the cast of a Terebratula in the hard *grey sandstone* of this part, and having on the same specimen traces of the fine lined corals of the Fenestella family, and Encrinital cates. Save this one solitary specimen, the whole of this part has proved to be non-fossiliferous, and further evidence is certainly required before we can pronounce it to be otherwise. By Doddington we enter on the middle part. The beds now vary from those we have been examining by being more flag-like with dove and greenish coloured slates between. On the north-east of Crowcombe, near Fire Beacon, we find, in a quarry, beds composed of greenish and purple tinged sandstones, much cleaved, and the dip imperfect and southerly. It has a talcose appearance, and bears no trace of fossil remains. Clay slate lies between these beds, and which looks very much like *soapstone*, though it is not in the least *steatitic*, but contains a large proportion of silica and alumina, and a small trace of magnesia. Passing on to the northern escarpment of Will's-neck hill, is a hard, light, greenish

looking slate, opening with purple stains, and also some red purplish sandstones. The former have a chloritic appearance, though chlorite is not found, on analysis, to be present. It is of an extremely indurated nature, and contains a large proportion of siliceous matter, the dip about 22 deg. too South and thick bedded. Along the newly-cut road from Will's-neck to Ely Green are red and grey sandstones, but from the shallowness of the cutting no perfect dip could be observed. A mile or more west of Cockercombe, we find the slates laminated, and assuming a rich claret colour, but, to all appearance, without the substrata of sandstone, or of any organic remains. The slates of Asholt, Lower Asholt, Buncombe Hill, and Cothelstone, occupying a cross line south-east to south-west, all appear of the same character, viz., laminated, with slightly glossy separations, and of a reddish grey colour. At Asholt the dip is south-east, about 30 deg.; in the Western part this variety appears to be non-fossiliferous, but at Buncombe Hill and in the direction of Asholt fossil remains are to be found in abundance, as will presently appear.

Beyond Buncombe Hill the banks by the roadside shew the red sandstone beds, without a trace of any organic remains. At Plainsfield, Mr. Williams met with brachiopoda and gasteropoda, and he further remarks that the Old Red here supplied him with a few fossils, *as well as at Will's-neck.* Mr. Pring says, "I have searched very carefully at two different times, and I failed to discover anything save a doubtful-looking pebble stone, with an apparent cast, and another with a faint trace of an Encrinite, and may not Mr. Williams' Will's-neck fossils be in the debris stones instead of in the rock?" I leave the question for future decision; I think, however, it is worth careful attention, and to those who may be inclined to become explorers I would

say a word as to the extreme care necessary in determining what is and what is not a true *cast* even, of a Devonian fossil. My late most valued friend Mr. Baker shewed me several supposed casts of these fossils, collected by himself, but on their being submitted to the inspection of the Geological authorities of London, they were pronounced nothing of the kind. At Cockercombe we light upon a different variety of slate to any we have yet noticed, described by Mr. Williams as a "vivid pea-green crystalline slate," the colour being due to Manganese; it is, however, a true clay slate.

Returning to Cothelstone below the hill, or rather, on its slope in the park, we find the slate to be of the greenish blue variety, containing occasional casts of encrinites. Further east, in a quarry by the road-side, we observe a sage-colour clay slate, having a steatitic appearance, and which has been analysed by Mr. Draper, of Taunton, with the following result, viz. :—

Silica.....	74
Alumina, ...	18·5
Lime.....	6·0
Magnesia	1·0
	99·5

The odd decimal 5 he describes as containing iron.

In the sandstone of this quarry may be found small encrinital impressions; the dip of the strata is about 20 deg. southerly. At Buncombe Hill, near the four cross roads, eastward, the slate varies in colour from slight olive to purplish, and contains abundance of fossil shells, the most abundant being atrypa with orthides and spirifera. A few encrinital casts also occur, and the coral Fenestella. The slate here is finely laminated: dip southerly, 30 to 35 deg.

I yesterday visited this little quarry, and I was perfectly astonished at the great abundance of fossil remains to be found there. Though I was only there some ten minutes, yet I collected nearly 1 cwt. of specimens. They require the greatest care in extracting and handling, being exceedingly friable, and appear embedded in a ferruginous, clayish powder. Mr. Draper made a hasty analysis, with a result as follows, viz.:—

Silica	70
Alumina and Oxide of Iron	27·5
Magnesia and a little Lime	2·75
	100·25

In a lane westward of Lydeard Cross, on the road to Broomfield, we may observe ferruginous-like and soft yellow sandstones, with an abundance of beautifully-formed disks and casts of small encrinites. In a specimen 4½ inches by 2, there are 1,800 appearing on one side of the specimen only. The slate also of this neighbourhood contains impressions of encrinites, but fewer than in the sandstone. To the south-east of Enmore we get a flesh-colour sandstone appearing, the dip of the slate being south-east by 22½ deg., and no trace of fossils. At Boomer and from the north of North Petherton, towards Goathurst, the colour changes to almost a greyish purple hue, and the sandstone becomes more siliceous: dip 15 deg. north-east, without a trace of fossil remains. We pass now to the southern part where we have the quartzoze schists or slates. At Edgborough or Adsborough, we find a siliceous, argillaceous slate, slightly tinged with green, with large veins of quartz intersecting, at an angle of about 60 deg. south, the slates dipping about 45 deg. south. The cutting at Green Dragon Hill offers an excellent view; the slate is more finely

argillaceous than at Edgborough or Adsborough, and the colour more of a purple hue. Passing round by Durston, at full a quarter of a mile from the extreme south-east end of the Quantock range, Mr. Pring has discovered a small bed of argillaceous slate and sandstone of a reddish colour, and which he supposes to occupy an area of about 20 acres, and which is entirely omitted in the Ordnance Geological Map. Further north to West Monkton we find a similar rock to that at Thurloxton, but containing perhaps more gritty, hard, sandstone beds. Exposed in the road to Cheddon Fitzpaine, we observe a remarkable change to a hard siliceous slate of an olive green colour, and gradually passing at Hestercombe to the whet-stone grit, and in the public road west of Hestercombe, dipping at the high angle of 70 deg. or thereabouts. Near this spot we meet with the celebrated granite, or rather syenite dyke, discovered by Mr. Horner in 1814, the slates becoming more close and hard as we gradually approach it, the effect of igneous action. Mr. Horner thus describes his most interesting discovery :—" In passing through the village just named (Cheddon), I observed in the street a small block of stone, differing in appearance from any I had found previously, and, upon examination, I found it to be granite, a rock I had searched for before without success, and, indeed, this is the only place where I saw an unstratified rock in the whole district, the porphyry and green stone which accompany this formation in Devonshire being wholly wanting here. On enquiry, I found that this granite, called by the country people 'pottle-stone,' came from an old quarry, not far distant, in the grounds of Hestercombe, belonging to Mr. Warre. My informant brought out of his house a whetstone, which he said came from another quarry close by the pottle-stone. It was a greenish com-

pact stone, very like some horn stones, or some of those close-grained siliceo-argillaceous compounds, which it is very difficult to name." On going to the quarry, Mr. Horner found it almost overgrown with brushwood, and he goes on to say that he there found it *in situ*; it is small grained, and consists of dull flesh-coloured feldspar, with green mica, and a small quantity of quartz.

Through the kindness of Miss Warre, I examined this quarry yesterday, and found the junction of the slate with the granite. I took sections and specimens, but I have not had sufficient time to give full attention to the matter so as to lay the result before you to-day. Near the junction, the slates are much disturbed and broken, and there may be observed an indistinct blending, as it were, of the slate and granite. North and south the slate assumes a felspathic appearance, and fragments of it seem united by a granitic cement. Extending our examination towards Broomfield, and a little to the south, we get a laminated slate of a deep grey colour, and by the old and now abandoned Broomfield copper mine, true killas may be observed. The slates at the mouth of the adit dip almost perpendicularly, with a tendency south, however. Here we may observe fine white quartz, with sulphuret of copper. Near Old mill* by Broomfield, we get a gritty, argillaceous flagstone of a purplish hue. The beds dip about 30 deg. south, and the quarry offers an admirable section, being nearly 30 feet in height. Returning by way of Kingston, we find in the lane leading to Tarr farm a purplish slate, occasionally verging to green in colour; and we may observe here a most remarkable example of angular contortion of the strata, the dip being upwards of 70 deg. south, and covered by horizontal beds of red, argil-

* See Ordnance Map.

laceous sandstone conglomerate. In this southern district we note a total absence of all organic remains. The whole of this series of rocks owe their origin to sedimentary deposits: those, then, who are acquainted with the present formation of coral reefs in the Pacific ocean, will not be surprised at the limestone beds we meet with in the Quantocks, for we may describe the whole Quantock range as the bed of an ancient ocean, and the spots of limestone as being the coral reefs of that ancient sea, and the lasting monuments of the labours of those wonderful little zoophytic creatures, whose remains are plentiful in these spots, for many of these beds yield beautiful corals. We may remark that invariably we find the beds of coral limestones on the slope of the hill. I have met with *favosites reticulata* in the reddish limestone of Adscombe, Over-Stowey, and Doddington; it is also found in the very dark indigo colored beds, as well as *acervularia goldfussi*, named by M. Milne Edwards, near the old mine at Doddington, and *alveolites suborbicularis* in the limestone beds of the same neighbourhood. The *favosites polymorpha* is a very prevailing coral at Over-Stowey, Asholt, and Doddington, as well as in the darker coloured beds of Blackhill and Higher Heathcombe. About one mile east of Buncombe Hill, Mr. Pring has discovered a small bed of limestone, altogether omitted from the Ordnance map, and which I have not yet seen. Specimens of *favosites polymorpha* were secured there, and its general character is much like the Cothelstone bed; only this latter has failed, as yet, to yield any organic remains. Encrinital impressions are common in the shales of all the beds. Generally the upper beds are of a dark indigo-coloured variety, then becoming, through various shades, a deep red. Near Ely Green *favosites* appear, but no encrinital remains. At Over-

Stowey we find the red limestone much used for burning into lime. The black-hill Quarry affords the darkest of these limestones, and is rich in remains. I shall have much pleasure in presenting a slab from a large block that I have, to range with other specimens of these limestones of the Quantocks which are already in your museum; at Asholt and Merridge the colour is of a purple hue. The limestone bed of Cannington Park is of a very different appearance to any we observe in the Quantocks, and I cannot consider it as being analagous; indeed, I have very little doubt in my own mind, that we shall succeed in placing it as a true mountain limestone, and having geological reference to the Mendip range, rather than to the Quantocks. Full four years since, I broached this subject to Mr. Baker, but his opinion, and that of those who had gone before him, was so contrary, that I gave it up for the time. It is satisfactory to me, however, that my discovery of shells there, now three years since, sufficed, at least, to shake the long formed opinion of our most excellent friend, and for him to record, at any rate, that we were not to rely upon previous theories respecting it. Holwell Cavern I have omitted mentioning, as Mr. Crosse's admirable paper may be referred to, being published in our Transactions. It would be wrong hastily to try to give you any general deductions from the facts I have stated; I consider it much better to leave doing so until our knowledge of the district is more extensive and matured. One thing, however, I am satisfied of, viz., that the Quantocks are true *Devonian* rocks, and that the unmeaning and most unsatisfactory word "*Grauwacke*" should be given up as applying to them.

Before I close, I would refer to an attempt we are making, to illustrate the geology of our county, by a collection

of all the various rocks to be found in it, and I trust that each of us, as far as his power goes, shall assist in this collection. It is astonishing what may be done, even by those who know but very little of geology. Care should be taken, however, to label each specimen as found, with a description of *where* and *in what position*.

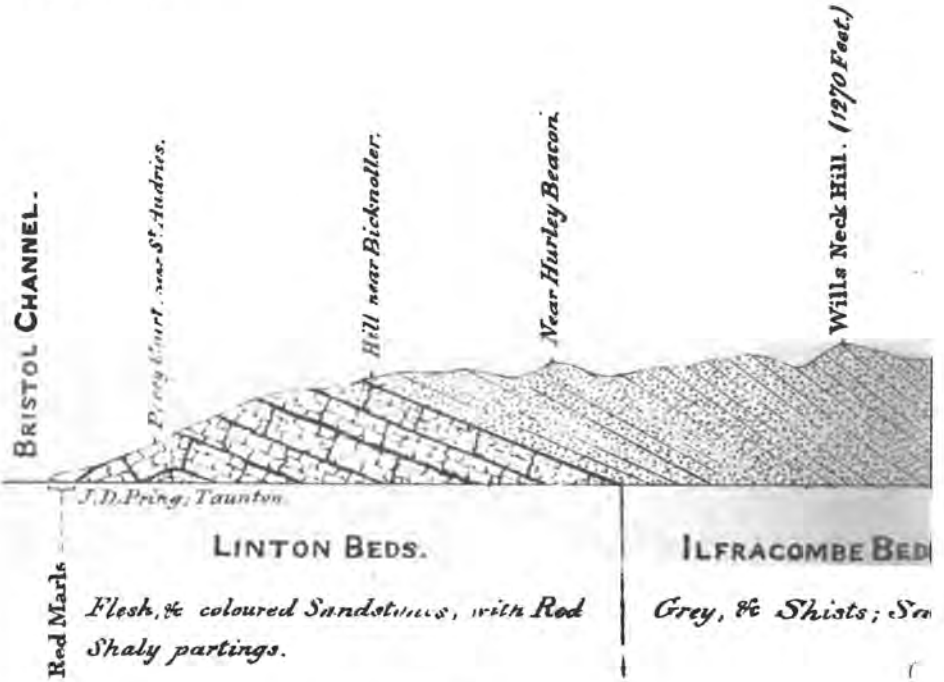
PHYSICAL GEOLOGY is by no means the least interesting division of our science, and though generally skipped over as the "hard name" part of the story, yet it is the most *useful* branch of the subject. Conscious as I am of the many errors of omission, yet, I shall be satisfied, if the present paper be the means of inducing others to give their attention to this romantic and beautiful part of our county, for—

"Nature never did betray
"The heart that lov'd her."

GEOLOGICAL SECTION OF THE QUA

(As divided by J.

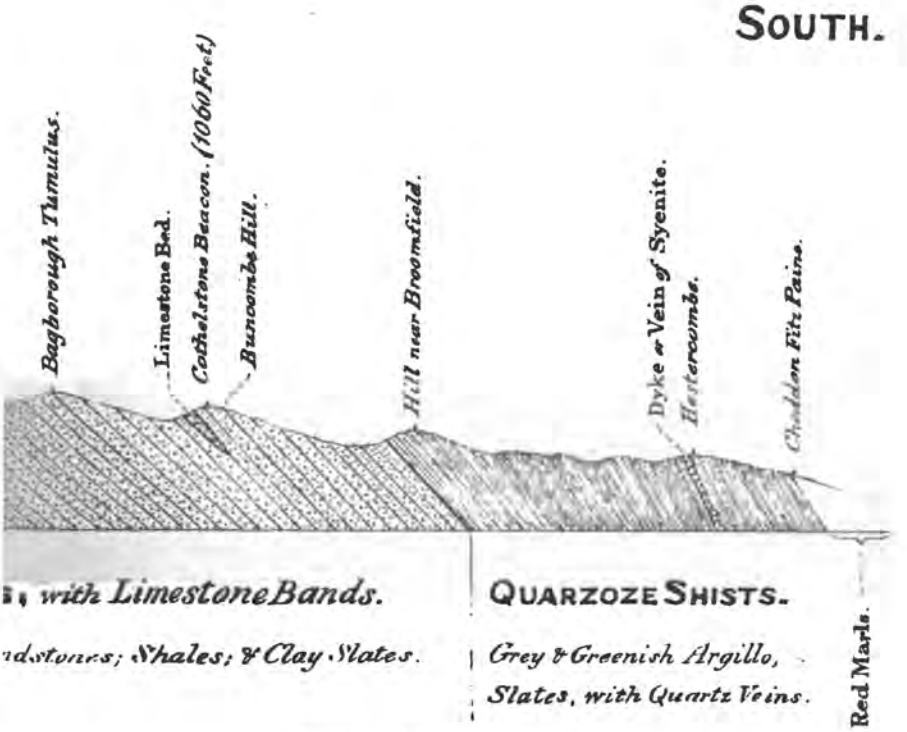
NORTH.



Horizontal Scale, 1½ Mile to an Inch.

ıNTOCK HILLS, SOMERSET.

D.Pring.)



Vertical Scale, 1800 Feet to an Inch.