On the lower Carboniferous beds of the peninsula of Hook, county of Wexford / by Samuel Haughton.

ON

THE LOWER CARBONIFEROUS BEDS

OF

THE PENINSULA OF HOOK,

COUNTY OF WEXFORD.

BY

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THE parish of Hook, county of Wexford, is well known to afford one of the best sections of the lower Carboniferous beds in the south of Ireland; and as no detailed account of it has been published, I have put my notes together, and endeavoured to lay them in a connected form before the Society. From the fact of the strike of the beds running across the peninsula, an opportunity is afforded of studying them at both sides, in the Waterford Harbour and on the sea-side; and it is not difficult to obtain an approximate value of the thickness of each deposit.

There is an uninterrupted series of conformable deposits, extending from the Old Red Sandstone conglomerate on the north, to the Carboniferous Limestone of Hook Light-house on the south, unbroken, save by a few unimportant faults, which do not prevent a correct estimate being formed of the thickness of the entire series. The beds are conformable throughout, and admit of being divided into five distinct groups, which I propose to describe in succession, commencing with the oldest beds of red conglomerate, which rest on the Silurian slates unconformably.

1. OLD RED SANDSTONE AND CONGLOMERATE.

The Old Red Sandstone and conglomerate of this district rest unconformably on the nearly vertical beds of Silurian slates, the line of junction extending in nearly a straight line from Carnivan Head

on the east, to a point half-way between Harryloch and Templetown church on the west. The nature of the junction between the conglomerate and slate is well shown in the face of the cliff at Carnivan Head.

The beds of slate are nearly vertical, and the Red Sandstone and conglomerate beds are inclined at an angle of 10° to the horizon. I propose to place, provisionally, the uppermost limit of these beds at a line drawn from the rocks north of Sandeel Bay on the east, to the boundary of the townlands of Templetown and Houseland on the harbour, or west side. My reasons for fixing on this boundary will be explained in the next section. Within the limits I have assigned, the rocks consist of slightly inclined beds of massive red conglomerate, alternating with layers of red sandstone and red shale. They are quite destitute of fossils; and may be considered as typical beds of the Old Red Sandstone of the south-east of Ireland. I have measured the thickness of these beds in a variety of ways, and estimate it at 1150 feet. The sea must have been shallow during the deposition of these beds, as it is not possible to conceive any action save that of coast waves capable of forming such masses of rolled shingle, alternating as it does with sands and mud, tinged with peroxide of iron, evidently introduced by currents of a less violent character than those which laid down the rolled shingle of the sea beaches, which formed the materials out of which the red sandstone conglomerate was elaborated.

2. PLANT BEDS.

The uppermost portion of the sandstones and conglomerates consists of alternating beds of red conglomerate, red micaceous sandstones, and coarse red shale, succeeded conformably by gray micaceous sandstones, gray conglomerate, and dark gray shale, with yellow and white sandstones alternating with reddish argillaceous sandstones,—the entire series being characterized by the presence of imperfectly preserved remains of plants, which invariably occur in the gray and white micaceous layers of sandstone, and never in the red sandstone and shales which alternate with them. In one locality on the western side, these remains become so numerous as to constitute thin seams of anthracite, from one to two inches in thickness. The fossil plants, although very imperfectly preserved, present a general resemblance to the forms of fossil plants found at Tallowbridge, in beds of similar age, some of which were figured by

me in my account of the fossil plants of the lower Carboniferous period. Some of the most common of the Hook plants are figured in the annexed Plates.

Figure 1 represents the imperfectly preserved exterior of *Knorria dichotoma*, in which the spiral arrangement of the leaflets is traceable, although almost obliterated.

Figures 2 and 4 represent natural casts of the interior of the same plant; and figure 3, a cross section of same, showing the existence of a central axis, as in *Stigmaria*. The central axis was connected with the outer stem by a remarkable series of spirally arranged woody spiculæ, which are shown in figures 2 and 4.

Figures 5 and 6 show smaller branches of the same plant; in these, however, the spiral arrangement of the leaflets is not visible; and it is possible they may be the remains of a distinct form.

The total thickness of these plant beds is 382 feet. The gray and yellow sandstones which contain the plant remains were evidently brought from a quarter different from that which supplied the red sandstones and occasional conglomerate beds which are found with the plant beds. We may suppose these vegetable remains to have been brought from a distance, and deposited with the red sandstones in a sea which was probably growing deeper, and which ultimately became the receptacle of exclusively marine remains.

3. OLDER LIMESTONE.

We find the plant sandstones just described succeeded by a thick series (851 feet) of alternating beds of arenaceous limestone, black shale and sandstone, with red ochreous limestone, followed by flaggy limestones, sufficiently pure to be used for agricultural purposes.

A very remarkable series of beds, consisting of calcareous sandstone passing into limestone, and decomposing into a soft pulverulent mass, full of fossils, immediately succeeds the plant sandstones. In this group of beds, which is about 180 feet in thickness, a peculiar group of fossils, of which some are undescribed, occurs. Two of the most remarkable are figured in Plate II.

Figure 7, *Modiola Woarwoyensis*.—This modiola resembles in some respects the common carboniferous fossil, called *Lithodomus dactyloides* by Professor M'Coy; but is of smaller dimensions, and characterized by fine, well-marked, longitudinal lines radiating from the umbones, but not reaching to the margin. The lines of growth

are well shown. I have called it Woarwoyensis, from the name of the locality, where it is found in abundance, and was first discovered by me, viz., Woarwoy Bay.

Length = 1·33 in.
Breadth (anterior) = 0·49 „
„ (posterior) = 0·52 „

Figure 8, *Sanguinolites Woarwoyensis.*—This species in some respects resembles the *S. sulcatus* of Phillips, to which it is allied. Posteriorly, the ridges are as well marked as in *S. sulcatus;* but the bifurcation is much less distinct, and the species is considerably smaller.

Length = 0·45 in.
Breadth = 1·07 „

The beds in which these fossils occur are characterized by a well-marked group of fossil remains, which occupy a definite position immediately above the plant sandstones. The following are the most abundant of the species:—

Orthis crenistria.
Atrypa fallax.
Reticularia (*Sp.*)
Productus caperatus.
P. antiquatus.
Modiola Woarwoyensis.
Sanguinolites Woarwoyensis.
Actinocrinus (*Sp.*)

The beds just described are succeeded by thick beds of yellowish sandy limstones, alternating with gray flaggy sandstones and shales, which are literally covered with fragments of fishes' teeth; and these beds are again succeeded by others containing abundant casts of fucoids. The total thickness of the fish teeth and fucoid beds is 71 feet.

The remainder of the older limestone beds of this district which underlie the dolomite beds, are composed of flaggy limestones, with black shaly partings, and alternating layers of blue shaly limestone.

The total thickness of the series, including the two groups already mentioned, is 851 feet. About the middle of the series, a band of fine shaly limestone occurs, under Loftus Hall, which contains an extraordinary abundance of two varieties of Carboniferous Trilobites, viz., *Phillipsia gemmulifera* and *P. quadriserialis.*

The entire group is terminated on the south, and overlaid by a band of dolomite limestone, extending from the rocks at the south point of Patrick's Bay on the east to a point about 300 yards S. W. of Duffin's Well on the west or harbour side.

The older limestone, like the newer limestone which lies above the dolomite, is marked by a profusion of fine fossils, of which the commonest are—

Fenestellidæ.
Milleporidæ.
Favosites megastoma.
Lithodendron pauciradiale.
Syringopora geniculata.

Spirifer clathratus.
,, attenuatus.
,, plebeius.
Leptæna analoga.

Orthis filiaria.
O. crenistria.
Athyris concentrica.
A. squamosa.

*Orthoceras attenuatum.
*Euomphalus pentangulatus.
*Pileopsis vetusta.
*P. tubifer.

*Phillipsia gemmulifera.
*P. quadriserialis.

The fossils marked with an asterisk were not found in the limestone above the dolomite, and appear to indicate a shallower sea than that which subsequently existed.

We may suppose that the depth of the water, during the deposition of these beds of flaggy limestone and calcareous sandstone, was greater than during the period of the plant beds, or Old Red conglomerate; but the presence of such fossils as Trilobites, Modiola, &c., leads us to conjecture that the depth of the water was moderate, probably not exceeding 70 feet.

4. DOLOMITE BEDS.

The limestone beds of the Hook peninsula are divided into two nearly equal portions by a very remarkable band of dolomite, quite unfossiliferous, or presenting only traces of nearly obliterated fossils, with some obscure remains, which are either casts of fucoids or of annelid burrows. I estimate the thickness of this belt of magnesian limestone at 385 feet; it is conformable, both above and below, to the flaggy limestone which preceded and followed it. I think it probable that this band of dolomite corresponds with the lower magnesian band described by Mr. Wyley in his account of the lower

Carboniferous limestone of Kilkenny and Carlow.* It resembles it in physical characters, in the absence of fossils, although interposed between limestone beds remarkably fossiliferous; and it occupies the same geological horizon,—Mr. Wyley's dolomite lying 1100 feet above the base of the lower Carboniferous limestone, and the dolomite of Hook being about 900 feet above the uppermost plant beds of the Yellow Sandstone series. They are also comparable in point of thickness, the dolomite of Kilkenny being 200 feet thick, and the Hook dolomite 380 feet.

5. NEWER LIMESTONE BEDS.

The beds of limestone which rest conformably on the dolomite, and extend southwards to Hook Lighthouse, are 981 feet thick; they resemble closely the upper beds which underly the dolomite, and are composed of flaggy limestone, with alternations of black calcareous shale, the unequal weathering of which gives rise to a fine development of beautiful fossils on the exposed surface of the thin-bedded limestones. A remarkable series of limestones, containing fish teeth and spines of large size, of the genera Psammodus and Ctenacanthus, accompanied by myriads of *Orthis filiaria*, rests upon the dolomite, and occasional fine specimens are found throughout the entire series; the large size of the fish teeth, and their perfect preservation, coupled with other circumstances, lead us to believe that the water, which had been gradually deepening from the period of the deposition of the red conglomerate, had now reached its greatest depth, and had become the residence of creatures accustomed to provide their food in regions of the ocean remote from land. The following list, although far from perfect, contains the most common forms of fossil remains found in the limestone beds above the dolomite:—

Turbinolia fungites.
Favosites megastoma.
Fenestellidæ.

Palæechinus ellipticus.
Actinocrinus triakontadactylus.
Poteriocrinus punctatus.

Psammodus porosus.
Ctenacanthus.

Cyrtia laminosa.
Athyris concentrica.
Athyris squamosa.
Spirifer speciosus.
Sp. clathratus.
Productus Scoticus.
Orthis crenistria.
O. filiaria.

* Geol. Soc. Dub. Journal, vol. vi., p. 169.

It would be easy to add to the foregoing lists; but I have been more anxious to give an exact account of the species found, whose locality is certain, than to give a larger list, with a less precise determination of locality. In the lists already given the precise position of each is certain, and this circumstance gives a value to the catalogue which it would not otherwise possess.

It is necessary, in conclusion, to say a few words on the geological age of the entire group and its subdivisions. The occurrence of such fossils as *Athyris concentrica*, *Athyris squamosa*, *Spirifer clathratus* (which I believe to be only a variety of the *Spirifer disjunctus*, or *S. Verneuilli*), is sufficient to determine the position of the limestone beds as belonging to the lower portion of the Carboniferous system. The plant beds are the Yellow Sandstone of Dr. Griffith, or the Upper Devonian of the Geological surveyors. One of Mr. Griffith's divisions is lithologically absent, viz., the Carboniferous slate; but it is represented palæontologically by the entire limestone group. It is not possible to identify, bed by bed, the series here described with any system of subdivision proposed for the lower Carboniferous system; but I think no person, considering the district fairly and fully, can avoid coming to the conclusion that any line drawn in it must be arbitrary, and particularly so one separating the lower portion as Devonian from the upper as Carboniferous, when not a single characteristic Devonian fossil has been found in it, nor, so far as I am aware, in any other part of Ireland.

Too much importance has been attached to systems and system-makers hitherto in Geology; and many of the controversies waged, respecting Silurian and Devonian groups, have had their origin, or, at least, owe their continuance, to a desire on the part of the controversialists to extend, beyond their due boundaries, merely local subdivisions and names. The group of rocks described in this notice is a continuous whole, and should be viewed as such. The plant beds, on which the difficulty of classification has principally turned, ought, in my opinion, to be classed with the Carboniferous system, as they contain forms of plants, such as Knorria, which are recognised in Germany and elsewhere as eminently characteristic of Carboniferous beds.

I have already pointed out what I conceive to be the relative positions of the Limestone groups, and the lower Limestone subdivi-

sions of Kilkenny. I now append a Tabular View showing this relation; and add, in another column, the corresponding beds described by me as the lower Carboniferous beds of the Menai Straits:—

Comparative View of Lower Carboniferous Rocks in Wexford, Kilkenny, and Carnarvon.

WEXFORD.		KILKENNY.		CARNARVON.	
	Feet.		Feet.		Feet.
1. Old Red Sandstone.					
Conglomerates alternating with red sandstones, ...	1150				
		Lower Limestone.			
2. Yellow Sandstone.					
Alternating beds of red and white, or yellow sandstones, with red conglomerate, ...	382	1. Lower shales, alternating with sandstones,	450	1. Yellow sandstone with plant remains, alternating with crystalline limestone and red shale, ...	204
Lower Limestone.					
3. LOWER DIVISION.					
Arenaceous in lower beds, and shale partings in upper beds, .	851	2. Dark gray limestone, with shale beds and partings, ...	650	2. Nodular red and calpy brown limestones, highly fossiliferous, ...	390
4. DOLOMITE.					
Gray, splintery, and coarsely crystalline, dividing into rhombic fragments, ...	385	3. Lower Dolomite, . .	200		
5. UPPER DIVISION.					
Alternating limestone and black shale, thinly bedded, . . .	981	4. Shaly, fossiliferous nodular limestone, . .	330		
		5. Upper dolomite and cherty limestone, . .	250	3. Pink crystalline limestone, with bands of chert, ...	526
		6. Middle Limestone,		4. Red conglomerate and associated coarse limestones and sandstones, ...	450
		Black marble, ...	820		
		7. Upper Limestone.			
		Thick-bedded, massive, crystalline, gray limestones, ...	1500		
				5. Red shales and marl beds of the coal-measures, ...	160
TOTAL, ...	3749	TOTAL, ...	4200	TOTAL, . . .	1730

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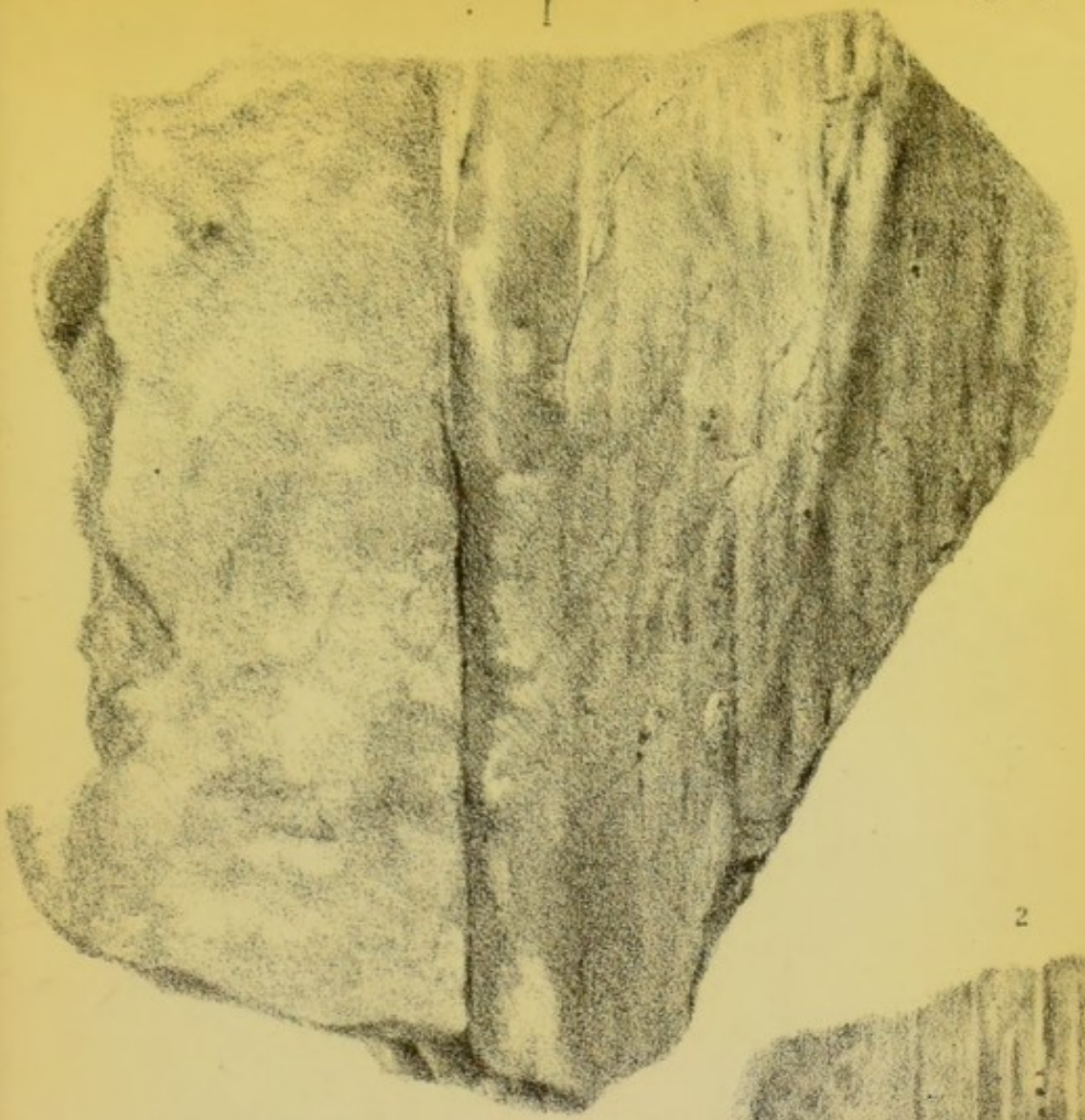

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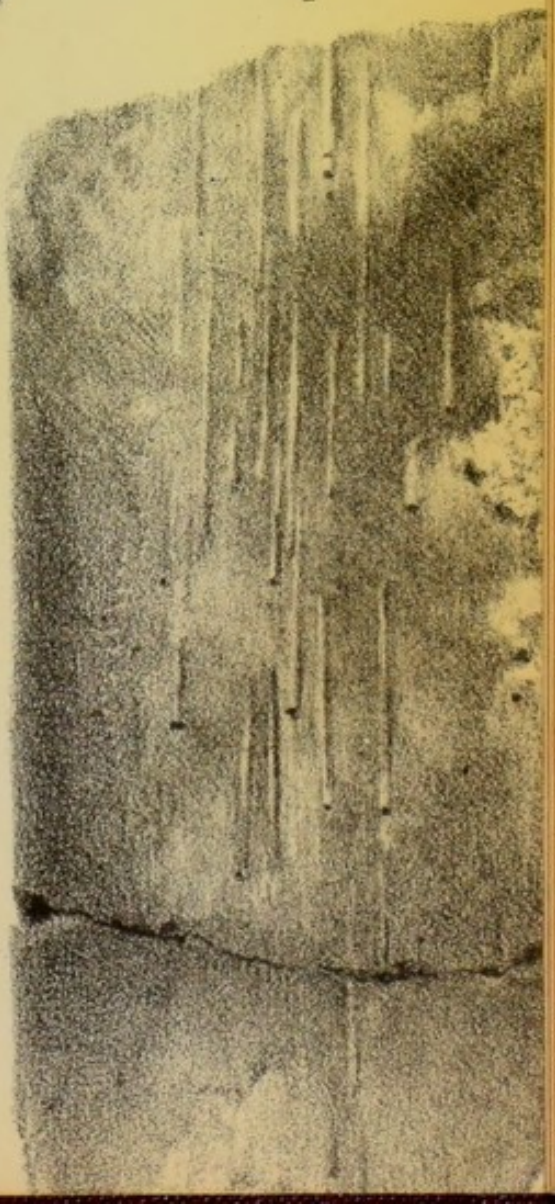

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