EXPLANATION

TO ACCOMPANY

SHEET 111 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PART OF

THE COUNTIES OF DUBLIN, KILDARE, AND MEATH.

SUPPLIED FOR THE PUBLIC SERVICE

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The observations made in the course of the Geological Survey are entered, in the first instance, on the Maps of the Ordnance Townland Survey, which are on the scale of six inches to the mile. By means of marks, writing, and colours, the nature, extent, direction, and geological formation of all portions of rock visible at the surface are laid down on these maps, which are preserved as data maps and geological records in the office in Dublin.

The results of the Survey are published by means of coloured copies of the one-inch map of the Ordnance Survey, accompanied by printed explanations.

Longitudinal sections, on the scale of six inches to the mile, and vertical sections of coal-pits, &c., on the scale of forty feet to the inch, are also published, or in preparation.

Condensed memoirs on particular districts will also eventually appear.

The heights mentioned in these explanations are all taken from the Ordnance Maps.

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EXPLANATIONS

TO ACCOMPANY SHEET NO. 111

OF THE MAPS OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PART OF THE

COUNTIES OF DUBLIN, KILDARE, AND MEATH.

Two-thirds of the area included in this sheet of the map lies in the county Kildare, the remainder consists of a part of county Dublin on the east, and a still smaller portion of Meath along the northern margin of the map.

The principal places in the Kildare part are Kilcock, Robertstown, Maynooth, Leixlip, and Celbridge, with the smaller villages of Clane, Sallins, and Prosperous; and in the Dublin part Lucan, Clondalkin, and Rathcoole, with the lesser villages of Saggart and Kill.

General Description.

1. *Form of the Ground.*

The ground included in the limits of this sheet is formed of the N.W. termination of the Dublin mountains, and part of the undulating drift-covered plain that extends northwards and westwards from them. Along the western margin of the district there are several extensive bogs and alluvial flats. The River Liffey runs through the middle of the district, with a winding course of about eighteen miles from S.W. to N.E., having a height above the sea of 232 feet where it enters the map. At the village of Clane the Liffey is 216 feet above the sea; at Straffan bridge it is 197 feet; at Celbridge it is 162 feet; at Leixlip it is 93 feet; at Lucan, 67 feet; and at the "Strawberry Beds," close to Brooklawn, the height of the water is 37 feet above the sea. It appears, therefore, that in the distance named the River Liffey has an average fall of about 11 feet per mile.

A large portion of the northern part of the map is drained by the Rye water, which enters it on its northern margin at an elevation of 251 feet, and after running E.S.E. for the distance of about ten miles, falls into the Liffey at Leixlip.

Part of the Tolka river runs across the N.E. corner of the map, by Clonee and Mulhuddart.

The most striking physical feature in the district is a portion of the Dublin mountains, which occupies its S.E. corner. The loftiest of them is Saggart Hill, 1,308 feet above the sea, with Knockandinny 1,025 feet, a mile due north of it. Mount Seskin, to the E. of Saggart,

is 1,051 feet; and Knockannavea, about a mile E.S.E. of Seskin, is 1,289 feet; and to the S. of Johnville, on the northern side of the range, is an elevation marked 1,049 feet. As the hilly ground slopes to the N. and N.W. there are numerous elevations on it, varying from 608 to 721 feet; it then sinks into the lower land around its base, which has an average height of 350 feet above the sea. The Gammock river, which enters the map on its southern margin, close to the S.E. corner, and flows northwards past Clondalkin, runs at first through a glen between Saggart Hill and Mount Seskin, which is a well marked feature on the landscape. This glen is about two miles from N. to S., and the elevations given in it descend from 757 feet to 444 feet.

The central portion of the district is comparatively level, with a mean height of about 240 feet above the sea, excepting a rise of ground at Rathuffy, which reaches the height of 311 feet above the plain, and, though low, yet affords a commanding prospect on all sides. At the N.W. corner of the map the low hill of Newtown forms a feature observable for many miles around, although its height is only 481 feet above the sea, the land immediately about it varying from 320 to 371 feet in height.

The alluvial flat to the W. of Newtown measures about one mile and a-half from E. to W., by nearly two miles from N. to S.; and the bog which lies to the S. of it is nearly four miles in extent from N. to S., the part within the limits of the sheet having an E. and W. extension of two miles and a-quarter.

The bog, which is to the N. of the village of Prosperous, is of a rude, half-moon shape, the ends pointing northwards, its greatest width being little over a mile, and its extent, following its main curve, about five miles and a-half.

The Robertstown bog, though covering a considerable space at the S.W. corner of the map, is only a portion of a still larger deposit of this kind which occurs in the adjoining districts to the W. and S.

The outline and extent of the alluvial flats of the River Liffey will be at once apparent by reference to the map.

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2. *Geological Formations, or Groups of Rock.*

Aqueous Rocks.

	Name.	Colour on Map.
	Peat Bog, Alluvium,	*Pale sepia.*
	Drift (Limestone gravel),	*Engraved dots.*
Carboniferous.	d^5 Coal Measures,	*Indian ink.*
	d^4 Upper Limestone,	*Prussian blue (dark.)*
	d^3 "Calp" or Middle Limestone, not distinguishable from d^4,	" "
	d^2 Lower Limestone,	*Prussian blue (light.)*
	d^1 Lower Limestone Shale,	*Prussian blue and Indian ink.*
	c Old Red Sandstone,	*Indian red.*
Lower Silurian.	b^2 Bala or Llandeilo Beds,	*Pale Purple.*

Igneous Rocks.

Name.	Colour on Map.
D Greenstone (Diorite),	*Dark Purplish Red.*
Dp Porphyritic Greenstone,	" "
Ds Trappean Ash,	*Dark Purplish Red dots.*
E Quartziferous Porphyry "Elvan,"	*Dark Carmine.*

b^2. *Lower Silurian Rocks.*—These rocks are well exposed in the district, and consist of thin quartzose grits, layers of clay slate often wrinkled and micaceous when near the intrusive igneous rocks, and bands of fine grained felspathic ash, the general colour of all being a pale green or greenish gray. Quartz veins are common through these beds. No portion of these rocks has yielded valuable roofing slates.

As the igneous rocks occurring in the district are all associated with the Lower Silurian deposits, they may be described best in connexion with them.

Quartziferous Porphyry or Elvan.—This is a compact or finely crystalline compound of felspar, of a pale yellowish brown colour, with a little quartz.

Greenstone.—The Greenstone is a dark green crystalline rock composed of hornblend and felspar, which eventually weathers to a gray colour. The same rock in some places becomes porphyritic, when a portion of the felspar appears to have formed distinct crystals in the mass. This is best seen where D.P. is marked on the map.

Trappean Ash.—The ash layers, which pervade the Lower Silurian rocks throughout, appear to consist of felspar, with some chlorite, which forms a glossy looking compound, somewhat unctuous to the touch, and brittle, the particles of these two minerals being cemented together by an admixture of argillaceous matter. These layers can only be detected by close examination when the slates are freshly broken. To the observer they are useful in the detection of the original lines of deposition in the slates, a point which it is often difficult to determine, as the rocks have been subjected to a remarkable amount of contortion.

Mr. Willson remarks that these ashes are sometimes finely conglomeritic when the extraneous fragments are usually particles of the associated slates cemented by a felspathic material.

c. *Old Red Sandstones.*—These rocks are very imperfectly seen. They appear to consist of thick beds of conglomerate, the pebbles being chiefly well rounded fragments of quartz, enclosed in a fine sandy cement of a dark brick red colour, with some purple siliceous close-grained grits. These form the base of the deposit, and above them are beds of dark brick red shales and sandstones, the total thickness of all being not greater than 150 feet.

d^1. *Lower Limestone Shale.*—These are also very imperfectly seen in this district, but apparently consist of dark gray earthy and impure limestones, and beds and layers of dark gray and earthy shale. Some beds are so siliceous as to deserve the name of a compact calcareous grit. In thickness this group may be about 150 feet; but the evidence for it is very scanty.

d^2. *Lower Limestone.*—As is usual in Ireland this rock appears in this district as light gray and crystalline limestone, seamed with veins of carbonate of lime, and full of crinoid fragments. Where it first makes its appearance over the Lower Limestone shales it is distinctly bedded, but in the middle of the district it is frequently quite amorphous, becoming in places metamorphosed into a pale brown crystalline dolomite. It sometimes, however, appears as a light gray compact rock, having dark gray beds through it, more especially where its position indicates that it is approaching to the Upper Limestone. In many instances the Lower Limestone is highly fossiliferous, and fragments of trilobites are common throughout it. Probable thickness about 800 feet.

d^4. *Upper Limestone.*—Most usually very dark gray, compact, and evenly bedded limestone, with a conchoidal fracture, having layers and partings of black or dark gray shales between the beds. Black chert in nodules and thin layers is not uncommon, especially in the upper portion of the group as it approaches the Coal Measures; the beds are then often quite flaggy, and might be called close grained highly calcareous grits rather than limestone. Occasionally through these flags a thick bed of dark gray crystalline limestone may appear, but generally speaking the layers throughout this portion of the group are compact in their structure, earthy and semicalcareous. Possible thickness 750 feet.

d^5. *Coal Measures.*—Black splintery shales, with thin dark gray closely grained grits, some of which in the lower part of the deposit are so very calcareous as to weather to a pale brown rotten stone. Maximum thickness in the area under review a few hundred feet. Posidonomya occurs in great abundance throughout these lower shales of the Coal Measures. G. V. D.

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3. *Relations between the Form of the Ground and its Geological Structure, and General Description of the latter.*

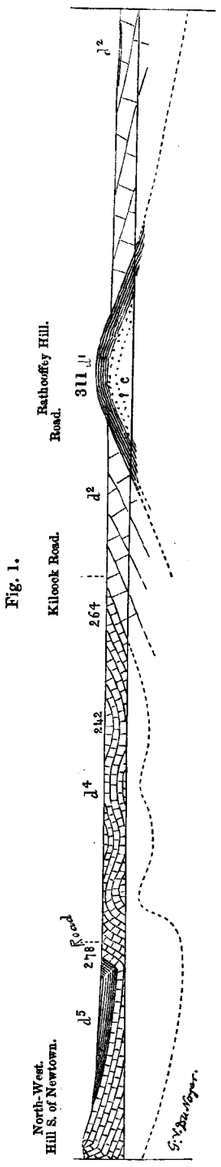
The ground included in this sheet of the map is obviously divisible into two parts. A hilly and steeply sloping district in the S.E. corner, and a gently undulating plain in the remainder of the area.

The hilly ground is formed of the Lower Silurian aqueous and igneous rocks just described; and the plain, of the Carboniferous rocks.

On examining the relations of these two groups of rocks to each other it becomes clear that the present surface of the ground is formed of two, if, perhaps, we may not say three, surfaces, produced at widely different geological periods.

The aqueous rocks deposited during the Lower Silurian period were like all other aqueous rocks originally horizontal. The Elvan dykes and some of the Greenstone masses, if not all, were intruded into these aqueous rocks, either while they remained horizontal, or during the process of their subsequent tilting and elevation. This intrusion took place, however, certainly before the process of denu-

Fig. 1.



Section from Hill near Newtown on the N.W., through Rathcoffey Hill and the Hill of Oughterard to Black Church Inn, and from thence to the Hill of Knockandinny on the S.E.

The formations are distinguished by letters and figures, for explanation of which see pp. 6, 7.

dation had commenced, or, at all events, before it had acted to any great extent. The beds were eventually greatly disturbed and contorted, tilted up so that in some places they even assumed a vertical position, and vast masses of the upper parts of these arched and contorted beds were eventually removed by denudation. In this way a surface was formed that had no relation at all to the original surface of the beds, or even to the surface that existed at the time of the intrusion of the igneous rocks, since those igneous rocks have been themselves eroded and worn down equally with the aqueous rocks, in order to produce it.

The new surface thus formed was that on which, at a long subsequent period, the Carboniferous rocks were deposited. This deposition commenced at some places by the formation of little layers of sand and pebbles, now forming the sandstones and conglomerates known as Old Red sandstone. At other places the limestones rested directly on the lower rocks without the intervention of any red sandstone.

These Carboniferous rocks then are, as a group, utterly unconformable to the Lower Silurian rocks on which they repose.

But it moreover appears probable, from an examination of the country, that not only are the Carboniferous rocks unconformable to the Lower Silurian formation, but also that in the Carboniferous formation itself the upper beds overlap the lower. In the district about Newcastle, for instance, it appears that the Upper Limestone beds gradually overlap those of the Lower Limestone, so as eventually to repose upon the Silurian rocks directly without the intervention of the beds which elsewhere lie between them.

Now, this circumstance proves to us that the surface of the Lower Silurian rocks just now spoken of as that on which the Carboniferous group was deposited was not a level surface, but an undulating and uneven one, with hollows and elevations upon it; and that when the lower beds of the Carboniferous series were formed in the hollows, the elevations still, for a time, remained uncovered by them, but were subsequently covered by the higher beds. It is most probable that large portions of the Lower Silurian ground were actually dry land before the commencement of the Carboniferous period, and that some of the higher points remained dry land during the earlier part of that period, rising as islands from the Carboniferous sea in which the lower Carboniferous beds were being deposited; and that as the whole of the former land slowly and gradually sank down, and the waters continually gained upon the land, the materials deposited in the water spread further and further over that land, so that the highest Carboniferous beds eventually spread not only over the lower Carboniferous beds, but over the higher parts of the Lower Silurian rocks that had hitherto been uncovered.

After the deposition of the whole Carboniferous rocks there again ensued elevation accompanied by disturbance producing inclinations in various directions, and denudation causing great destruction in the last formed beds. This disturbing and destructive action commenced probably in the geological periods known as Permian and Triassic, but was possibly continued or repeated during all subsequent periods up to the Pleistocene.

By these processes a new surface was produced on the Carboniferous rocks. This new surface may possibly have extended more or less over the Silurian ground also, so that the original surface on which the Carboniferous rocks were deposited only remains intact, where it is still covered by the Carboniferous rocks, and perhaps for a short distance where it appears from underneath them along their boundary.

During the Pleistocene period we have proof that the district was again beneath the sea, and deposition took place of the beds of gravel, sand, &c., which we know as the Drift. These beds, where they still remain, of course conceal the surface on which they were deposited just as the Carboniferous rocks conceal the older surface on which they repose.

After the deposition of "the Drift" the ground was again lifted gradually up above the level of the sea, and probably somewhat modified during that action. It is highly probable that the loose materials of the Drift, at all events, suffered from erosion and denudation during that process, and some little additional erosion of the Carboniferous and Silurian rocks may have taken place then. The present surface of the ground was thus finally produced by the aggregate action of similar causes operating at many different geological intervals. Since the last elevation of the land above the level of the sea atmospheric agencies have been at work still further modifying its external form; but these alterations have been insignificant in amount compared with the vast changes produced by the earlier and much more long-continued actions.

The Lower Silurian rocks of the S.E. corner of the district are so greatly tilted and bent that no general description can be given of their structure beyond saying that their strike is generally N.E. and S.W.

The Carboniferous rocks beneath the plain are also bent in different directions, but seem to be traversed by one principal anticlinal curve, the axis of which runs N.E. and S.W. through the village of Prosperous.

The Lower Limestone shale is brought up to the surface along part of that line, and the lower beds rise again towards the foot of the Dublin mountains.

A gently curved synclinal then runs N.E. and S.W. between those and the anticlinal line just mentioned.

An irregular basin or depression in the limestone, bringing in the lower Coal Measures, exists to the W. of Kilcock; while a rudely shaped quaquaversal elevation brings the Lower Limestone up to the surface in the middle of the Upper, a little N.E. of Lucan.

How little the shape of the present surface depends on these undulations of the beds below it, is shown by the valley of the Liffey traversing equally the depression about Celbridge and the elevation N.E. of Lucan; and also by the highest ground in the north-western part of the district, the hill near Newtown, rising over that basin in the limestone which brings in the Coal Measures. J. B. J.

[The greater portion of that part of the county Kildare which comes into this sheet was examined by Mr. A. Wyley, late Government Geologist at the Cape of Good Hope; that portion which closely adjoins the county Dublin on the south was surveyed by Mr. W. L. Willson, at present of the Geological Survey of India, by whom also the Silurian district occurring in the same

county was examined. Mr. Wyley also surveyed the neighbourhoods of Celbridge and Leixlip; but the remaining portion of the county of Dublin was examined by Mr. George V. Du Noyer, who also subsequently re-surveyed the whole of the Carboniferous rocks of the district, and determined their subdivisions as they now appear on the map. The accompanying detailed description has been drawn up by Mr. Du Noyer from his notes and those of the other observers.] J. B. J.

Detailed Description.

4. *Position and Lie of the Rocks.*

The Lower Silurian district, in the S.E. corner of the map, is obviously the first to be described. Small exposures of slaty rocks belonging to this group may be seen frequently in the district, generally having a N.E. and S.W. strike, but dipping in different directions. In the rise of ground to the N.W. of Blackchurch Inn, there are a few quarries, in which, according to Mr. Willson, may be seen clay slate with ashy beds, siliceous ashes, very micaceous slate, siliceo-felspathic slate, with ashy beds and green ashy slate, all dipping either S. or S.E. at from 35° to 50°. To the N. of Athgoe House, and along the northern boundary of the townland of that name, green siliceous slates, sometimes crumpled and micaceous, with occasional bands of hard green* grit, were observed, dipping southwards at from 30° to 50°. In that portion of the county Kildare which adjoins Blackchurch Inn, and along the south-eastern boundary of the townland of Castlewarden North, similar beds to those just described appear, the ashy layers being very abundant, sometimes passing into a highly micaceous grit. The dips here are generally to the S.E. at 45°. The hill of Oughterard is formed of green siliceous and very micaceous slates, with ashy beds; and on the roadside, on its northern slope, these layers are associated with hard flinty calcareous slate, all dipping S.E. at 35°. On the summit of the hill, clay slate and ashy beds were observed, striking N.E. and S.W., vertical. South of these are other similar beds, which, as they are traced across their strike southwards into the plantation W. of the crossroads, flatten so as to dip at only 25° to the S.E. To the N.E. of Oughterard, in the townlands of Clonaghlis and Pluckstown, and still further to the N.E., in the deer park attached to the demesne of Lyons, the slate rocks appear in many places. At the first locality, the dip previously noticed is altered into one to the W. or N.W. at 50°; at the second, the same fact was observed; but on the southern side of the deer park, the beds again dip to the southward, thus showing that the usual southerly dip is occasionally interrupted and the beds thrown into anticlinal curves, the axes of which strike N.E. and S.W. In that part of the county Dublin which adjoins Lyons on the E., in the townland of Lyons, and on the S. side of Newcastle demesne, the slate rocks appear in several small quarries. At the former locality, they are described by Mr. Willson as siliceous and ashy, dipping N.W. at 50°, but curving over in a local contortion to the S.E. at the same angle, within a distance of about forty yards; at the latter, they are

* All these green Lower Silurian grits and siliceous slaty rocks are called "Greenstone" by the people of the country. It behoves, therefore, the inquirer to be on his guard against being misled by this term into supposing that they form the Greenstone of the geologist. The rock Greenstone being a variable mixture of hornblend and felspar, will vary in colour according to the proportions and the colours of the ingredients, sometimes being quite black, and at others gray, and even pale gray. There are then not only many kinds of green stone that are not Greenstone, but some varieties of Greenstone that are not green stone. J. B. J.

light green and siliceous, with mica abundant and thick ashy beds, the dip being to the S. at from 25° to 30°. In the northern part of the townlands of Keatingspark and Tootenhill, there appears green siliceous slate with flags, mica being abundant in the former, and ashy beds occurring in the upper portion of the exposed section; the dip of the beds is to the S. at from 45° to 60°, and they are traversed by a thin dyke of elvan, which appears to follow the strike of the slates although cutting across the beds.

To the E. of Blackchurch Inn, and on the eastern slope of Windmill hill, as well as in the adjoining townlands of Carrigeen and Redgap, which lie to the S.E., the slates are to be seen along the sides of the roads, and in small quarries adjoining them. In mineral character they are the same as those before described, and are, as usual, plentifully interstratified with ash beds; they appear to be bent into anticlinal and synclinal curves, with dips varying from 45° to 60°, the strike of the axes of the curve being still N.E. and S.W. As we proceed up the north-western slope of Knockandinny hill (1,025 feet), we find a tolerably good superficial exposure of the micaceous and ashy slates along the farm road. They consist of blue slates and green grits, the southern end of the section ending in a very coarse conglomerate or breccia, the strike of all being N.E. and S.W., the dip probably being to the S.E. Around the summit of the hill are soft beds of argillaceous slate with ash, blue micaceous slates with ash layers, and ashy slate, all dipping to the S.E. at 40°.

In the townland of Lugg, on the eastern side of Knockandinny hill, as well as on the eastern slope of Knockananiller or Saggart hill, the blue slates and green grits, with ash beds, appear in many places, the general dip being to the E.S.E. at from 50° to 60°. Some portions of the slates are said to be chloritic, and to exhibit ripple marks; in others they are described as felspathic, but everywhere they are intimately mixed up with thin layers and beds of ashy material. The best-exposed section of these rocks is to be seen in the stream course which divides the townlands of Lugg and Glenaraneen, where Mr. Willson describes alternations of blue slate either veined or not with quartz and ash beds, beds of soft greenish chloritic and felspathic slates, also interstratified with ash layers, all dipping E.S.E. at from 50° to 60°, and amounting in aggregate thickness to fully seven hundred feet.

When we cross the glen of the Saggart river, and examine the western slopes of the hills which rise to form the eminences of Crooksling (1,097 feet) and Raheen to the south of it (1051 feet), we still find the dip of the slates and ashes to be to the S.E. or E.S.E. at high angles; and it is apparent that, according to these observed dips, we have here reached much higher beds in the Silurian slates than any of those previously described. We find in this, seemingly the uppermost part of the series to be found in the district, a number of lenticular masses of igneous rocks, which are not only geologically, but economically important, as they make far more durable road metal than the more brittle and more perishable limestone which, with false economy, is generally used for that purpose. These igneous rocks appear on the western flanks of the hills which bound the glen of the Saggart river on the E. The three masses of this rock, which are indicated on the map, are all very accessible, as they come close to the road which runs up the glen of the Saggart river. They are described as compact felspathic green stones; and the slate rocks which are observed in relation with them are described as blue, micaceous, and sometimes felspathic, and as having layers of ash interstratified with them; crystals of iron pyrites are occasionally abundant in these lenticular masses of greenstone, where they appear in the northern part of the townland of Crooksling; and the felspathic slates which appear to underlie them at this locality, dip S.E. at 50°, and are interstratified with ash beds.

The smaller lenticular masses of greenstone which appear to the E. of the Mount Seskin road, in the townlands of Corbally and Lugmore, as well as those seen in the stream which bounds the latter townland and that of Kiltalown,

are well exposed; the former is described as a compact felspathic greenstone, becoming in some places porphyritic, and weathering gray, plates of mica, or a mineral closely resembling it, being frequently observed through the rock when freshly broken.

The porphyritic greenstone here alluded to is supposed to have been intruded into the slates; and it is stated that they are gray in colour, and altered where they approach close to it at its northern extension. To the S.E. of the layer of these trap masses, the slates are plentifully interstratified with thin dykes of trap and beds of ash, the whole dipping to the S.E. at 50°. It appears from these observations, that we still have an ascending section as we proceed to the S.E.

The hill of Knockannavey (1,306 feet), which lies to the S. of the beds last described, is mainly formed of compact felspathic greenstone, which in places becomes porphyritic; this rock can be well seen to the S.W. of the summit of the hill, where it forms small crags; in some places it is described as felspathic trap, in others as compact felspar with crystals of hornblend and felspar (forming thus a porphyry), and as compact and felspathic greenstone. At the southern extremity of the map, it is nearly three-quarters of a mile in width, and its extent on the map is about two miles in a N.E. and S.W. direction. As, however, its actual terminations are not exposed, it is quite possible that its real shape may be somewhat different from that assigned to it on the map.

In the extreme corner of the sheet, portions of two other masses of greenstone are to be seen, the northern one being, in one place, near the road, and porphyritic.

Elvans.—Besides the small elvan vein mentioned in connexion with the slates which appear in the northern part of the townland of Keatingspark, there are three or four other places where this rock may be seen.

The place where it is best exposed is at two quarries on the side of the by-road leading from the cross-roads of Colmanstown southwards up the hill, and at a point on it about half-a-mile E. of Blackchurch Inn.

The appearance presented by this dyke, and the associated green flaggy micaceous gritty slates, is given in fig. 2.

Fig. 2.

Elvan in Silurian slates. Quarry one-fourth of a mile E. of Blackchurch Inn, co. Dublin.

The massive rock on the left on which the figure is lying is the elvan, the rocks on the right being the slate.

The superficial width of the elvan at this place appears to be about two hundred and fifty feet, and it is inclined to the S. at an angle of about 45°, which is also, as nearly as possible, the dip of the slates on each side of it. The actual thickness of the vein, therefore, measured at right angles to the dip, will be about one hundred and sixty feet.

In a note by Professor Oldham and Mr. Willson, this elvan is said to be

"very compact, of a light yellowish brown colour, and containing, near its northern wall, a great abundance of iron pyrites; throughout its mass, scattered crystals of mica can be detected, and in places it is highly felspathic, and contains crystallized quartz." Mr. Jukes, by whom this rock was subsequently examined, remarks:—"Hexagonal crystals of bronze-coloured mica, also of white mica, and crystals of bronzed iron pyrites, appear in this elvan; also very much quartz, occurring as rounded amygdaloidal crystalline lumps, about the size of peas."

From the oxidation of the iron pyrites, this rock has a tendency to become rusty on long exposure to the atmosphere; and this, combined with the excess of an easily-disintegrated felspar which enters into its composition, renders it unfit for any but the roughest kind of masonry; neither does it make a good road material, for which purpose some of the hard green and slightly micaceous grits of the adjoining slates would be found much more lasting.

To the westward of the above-mentioned quarry, this rock appears again in four or five places in the fields and ditch cuttings, and can thus be traced for the distance of over half-a-mile in a direct line, its width, however, not being anywhere else apparent.

The same rock again appears at the foot of the hill on its northern slope, at the distance of two fields to the E. of Blackchurch Inn, and close to the main road. It is noted at this place as a fine-grained granite (or elvan), with crystals of iron pyrites. Its width and the direction of strike is, however, necessarily guessed at, as no more of it is to be seen; but, from the similarity of its composition, it was once thought probable that it was a branch of the other dyke. The slate rocks may be seen, however, at one or two places in the fields between these two localities, so that they are clearly separate here; and it is more probable that they may be wholly distinct.

Towards the east, there is no appearance of the elvan at the surface for the distance of over a mile, till we approach the village of Rathcoole, where its presence is again indicated by the occurrence of groups of blocks derived from it, which appear on the roadside in the townland of Tootenhill, the slates being close at hand to the S.

In the eastern portion of the same townland, and at the distance of two hundred and fifty yards W. of the School-house, another group of elvan blocks were seen, having the slates close to them on the N. in the same way. These groups of blocks confined to narrow limits probably indicate the occurrence of veins of that rock beneath the lines of blocks.

c. *Old Red Sandstone.*—This rock is very imperfectly developed in the district, appearing unmistakably *in situ* but in three places in the distance of three miles. The first exposure commencing on the S.W. is in a small cutting on the boundary of the townlands of Boston and Bishopscourt Lower, at the northern extremity of the latter, and in the county Kildare. The lowest beds are conglomerates, formed of well-rounded pebbles of quartz and brownish purple grits, imbedded in a dark brick red sandy paste, over which are alternations of thick red sandstones and shales, the dip of all being 30° to the W.N.W., and the total thickness, judging from the superficial exposure of the beds, not more than 200 feet. The maximum thickness, however, of the whole deposit at this locality may nearly double this, and as it passes beneath the limestones it may possibly increase, though it does not necessarily follow that it should do so. A small outlying or detached portion of this Old Red sandstone occurs at the distance of 200 yards to the east of the above locality. The only observed dip appears to be one of 35° to the W.N.W.; but this can only be one side of a small trough of rocks left in that form by denudation. Indeed, the Lower Silurian slates appear between them and the main mass of the Old Red, dipping into the hill, or E.S.E. at 60°.

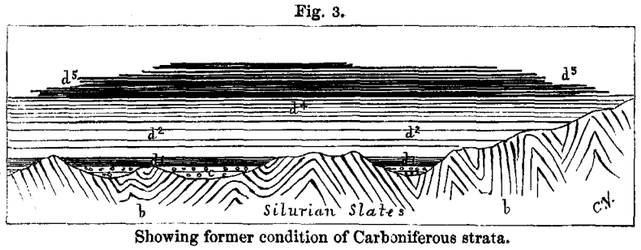
At the distance of two miles to the N.E. from this locality, adjoining the old church of Lyons, a few beds of Old Red conglomerate come to the surface; but their dip is not distinguishable.

Along the foot of the hill, between the old church of Oughterard and the hill of Lyons, large blocks of Old Red conglomerate occur here and there. It is possible that some of them may even yet be absolutely *in situ*, and that they are the relics of a larger deposit, which at one time was spread over the Silurian rocks. It is equally possible, however, that these blocks may be true erratic boulders, and have been carried from some distance by the transporting power of floating ice.

d^1. *Lower Limestone Shale.*—These rocks are also but imperfectly exposed in the district, appearing only in two or three localities to the S.W. of Lyons House, county Kildare. They consist of dark gray thin shaly beds, interstratified with black or dark gray impure or siliceous limestones. The Fenestella appears to be the characteristic fossil; and the dip is to the N.W. at 30°, thus agreeing very accurately with the inclination of the Old Red sandstone. Those beds, as well as the sandstones below them, are represented on the map as thinning out at either extremity in the line of their strike. It must be understood, however, that this appearance is possibly fallacious, and that their deposition may not have been limited to the small space indicated in the map, but that they were subsequently overlapped and partially concealed by the Upper Limestones which were deposited on the Silurian rocks which formed the shore of what we may call the Carboniferous sea.*

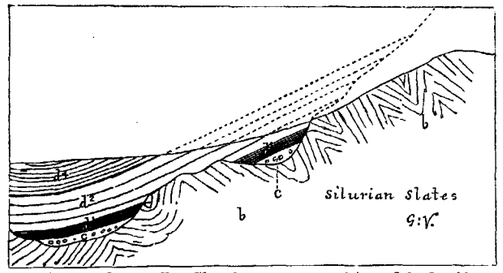
Fig. 3 will explain the former condition under which the Carboniferous rocks were deposited on the Silurian strata, which formed the floor of the sea at that period; and fig. 4 shows the manner in which the whole mass has been since upheaved, contorted, and then denuded.

Fig. 3.



Showing former condition of Carboniferous strata.

Fig. 4.



Imaginary section north of Kill. Showing present position of Carboniferous strata.

The Lower Limestone shales make their appearance a second time at Rathcoffey Hill; they consist of dark gray earthy shales and impure thin lumpy

* See Report on Sheet 119, Chair of Kildare.

and flaggy limestones, the Fenestella being abundant in some of the layers. The dip is here to the N.E. at from 20° to 30°; but, if these be really the Lower Limestone shales, they must curve over and dip to the opposite point of the compass on the southern slope of the hill to enable them to pass beneath the Lower Limestones. At the distance of about two miles to the S.W. of this locality, in the townland of Ballynaboly, and again at the distance of one mile still further to the S.W. of the townland of Ballynagappagh, quarries have been opened in the Lower Limestone shales. The beds present the same characteristics as at Rathcoffey, and dip also in the same direction, but in the farthest quarry at very low angles, 3° being the maximum; so that they probably curve round to the S. and E., and thus terminate on the S.W. the superficial exposure of these beds.

d^2. *The Lower Limestone.*—These rocks are tolerably well exposed over the district, with the exception of that space on the north of the map, adjoining Kilcock, where they are supposed to be present below the drift, because they really come to the surface in the adjoining sheet, No. 101, close to the margin of the map.*

On the western side of the map, north of the demesne of Donadea Castle, this limestone is well exposed in a road cutting adjoining the school and court-house; here it dips N. at 30°, is highly crinoidal, light gray and crystalline, and the beds are traversed by numerous joints having a N. and S. direction.

At the cross roads south of the court-house and adjoining Beech Grove House on the N., a very extensive quarry is opened in these limestones; the dip of the beds is likewise to the N. at from 30° to 45°.

At the distance of about three miles to the east of Donadea Castle, adjoining the cross roads of Balraheen, the Lower Limestone appears in small knolls and quarries; it is gray, irregularly-bedded, sometimes massive, and occasionally sandy, or having a tendency to weather to a sand, probably from containing magnesia. About three miles still further to the east, adjoining Dowdstown, this limestone is gray and compact, and in some places dolomitic, being changed to a pale brown colour and weathering to a sand. This alteration in the limestone is remarkably well developed at the quarry, about one mile to the south of Dowdstown House. Here the rock is dark gray, massive-bedded, and crystalline, but becomes changed to a pale yellowish brown, and decomposes rapidly to a sand of the same colour. The dip of the beds is S.E. at 20°, jointed in the direction of E. 5° N. At the top of the rising ground to the east of this quarry, and at the farmhouse on the by-road to the N.E., the limestone is dark gray and crystalline, and contains many fossils, such as Productæ and Corals.

To the south of this locality, between Windgates House and the cross roads of Barberstown, as well as adjoining Barberstown Castle, the Lower Limestone appears in several places. Here, as it is evidently approaching to the Upper Limestone, its colour is darker than it would be lower down in the deposit. Mr. Wyley remarks that all these beds are highly fossiliferous, and they dip to the eastward at various angles. At Barberstown Castle the rocks are compact, passing from a blue gray to a light or white gray. Heads and tails of trilobites (? Griffithides) are very abundant in the uppermost exposed beds adjoining the village of Clane. On the N., light gray as well as dark gray compact limestones are exposed in the large quarries. The beds are contorted and dip on the E. side of the quarry to the W. at from 30° to 50°; they then appear to be faulted in a N. and S. direction and reversed in dip.

To the south of Clane, adjoining the commons of Moate, there are two very

* See Explanation of Sheet 101.

extensive quarries, in both of which the beds dip to the N. and N.E. at from 35° to 50°. The quarry to the W. exposes beds which if prolonged would apparently pass under those seen in that to the E. They are thick-bedded massive compact limestone, with fossils abundant. The upper beds or those in the eastern quarry are light bluish gray, massive-bedded, with veins of calcareous spar. The fossils are most abundant in the uppermost exposed beds. At the distance of one mile S.W. of this locality, beyond Millicent cross-roads, gray crystalline limestone appears on the roadside; and on the S.E. bounds of the townlands of Millicent South and Fleshtown, about three-quarters of a mile distant from the last-named locality, a quarry has been opened in light gray compact limestones.

Over the entire district included in Sheets Nos. 13 and 18 and the southern half of No. 9 of the six-inch map of Kildare (see Index of the six-inch maps on Sheet No. 111), there are not any quarries opened in the limestones. The evidence, though negative, leads, however, to the belief that the whole of this area is occupied by the Lower Limestone.

South of Maynooth, adjoining Ballygoran House, this rock shows at the surface in several places. Here it has been evidently subjected to much disturbance as it dips here and there in every direction. As a mass, however, it inclines to the eastward, so that as we proceed a short way in that direction we come upon the Upper Limestone.

The rocks at Ballygoran are gray and crystalline; but to the S.W. of the House, on the road, they are of a dark gray colour. As they are traced southwards they again regain their light gray aspect and compact structure.

On the banks of the Royal Canal, adjoining the demesne of Carton, the Lower Limestones occupy a superficial width of only three-quarters of a mile. They are well exposed in the townland of Donaghmore and that adjoining it on the S. Generally speaking the rock is light bluish or clear gray in colour, and either compact or finely crystalline in texture. As we approach the Upper Limestone the beds dip so as to pass beneath it at various angles on either side, but in the centre of the anticlinal they are horizontal. The usual fossils and crinoid fragments are still abundant in them. In Carton demesne these limestones are cut off by a fault, which has a direction of N.W. and S.E., the downthrow being to the S.W.

The superficial width of the Lower Limestones on the downthrow side of the fault cannot be much over 900 yards, or something more than half a-mile; but, on the opposite or upcast side, it is increased to fully one mile. The central beds on this upcast side of the fault are crumpled into every imaginable fold and contortion, forming the picturesque steep banks and cliffs through which the Rye Water winds, in the S.E. portion of the demesne.

In general appearance and structure these beds present the same characteristics by which they have been identified over the central and south-western portion of the district under review.

As these beds are followed in their extension to the N.E. they rapidly contract in superficial width, so that as they pass out of the demesne of Carton they cannot be more than 900 yards across. Passing from the county Kildare into the county Dublin, they appear in two places in the townland of Rathleck, and that which adjoins it on the N.W. The rock is pale gray and compact, and the observed dips are to the N. and N.W., at angles varying from 5° to 15°. Here the superficial width of the limestone is not 600 yards; and at three-quarters of a mile to the N.E. of the quarry, in the townland just named, the Lower Limestone is presumed to sink below the surface and to become altogether covered by the Upper Limestone towards the N.E.

Returning to the south, about the base of the hills between Newcastle House and Oughterard the Lower Limestone appears in a few quarries near Farmhill House. To the north of this house, on the banks of the Grand Canal,

Mr. Willson describes "Brownish earthy limestone, the bedding of which is not distinguishable;" but in a quarry close adjoining, on the W., the dip is 35° to that direction.

At the distance of about three-quarters of a mile S.W. of this, and near the R. C. chapel of Lyons, are two very large quarries. The northern one exposes light gray crystalline limestone, the dip of which is 65° to the N.W. Fossils are abundant in some of these layers. The southern one has been opened in beds so close to the Lower Limestone shales that it is quite possible the lowest exposed beds may be part of that group. The limestones are dark gray and siliceous, having compact shaly beds between them, the dip being to the N.W. at from 25° to 35°. They are slightly contorted in the centre of the quarry.

The large boss of this Lower Limestone, which appears on the east margin of the map, is cut through by the River Liffey between Bloomfield House and Brooklawn, a distance of over a mile and a-half in a straight line. On the north side of the river these rocks are remarkably well exposed in the demesne of Woodlands and on the river bank opposite Hermitage. The beds nearest to the Upper Limestone are compact light gray marbles, and thin black hard slaty shales. These layers are well exposed in the stream and on either side of the glen, in the southern portion of Woodlands Demesne, where they have a wavy dip from S.W. to N.W. at from 20° to 40°. Many of these shales are full of fossils, and trilobites have been found in two localities. The beds below them are light gray and compact, often so amorphous *en masse* as to lose, for a considerable space, all appearance of bedding. This portion of the deposit can be seen on the roadside at the N.E. angle of the demesne and on the north bank of the Liffey, opposite Hermitage, as well as on the road to the S. of this residence; and again further to the W., in the lands of Woodville. Two large quarries which lie to the W. of Diswellstown House have been opened in this light gray compact limestone. They show that the rock is here bedded, the dip being to the N.W. at 40°. Fossils are more or less abundant in them. Layers of black chert are frequently seen in them.

I might mention that the shaly or upper portion of these Lower Limestone beds is exposed in two localities on the S. side of the Liffey, one in the wood to the E. of Hermitage, overhanging the river; the other, in a deep hedge-row cutting to the E. of the farm offices of Woodville.

d⁴. *The Upper Limestone.*—Over the area included in Sheet 111 the Upper Limestone may be seen in many places. At Quarry vale, on the south side of the River Liffey, and to the southward of the boss of Lower Limestone which appears on the east margin of the map, near its N.E. corner, the beds dip from S. to S. 30° W., at angles varying from 10° to 15° only. The beds nearest to the Lower Limestone are black and earthy impure compact flaggy limestones, with black shales. Some of those shales, especially in the uppermost exposed beds in the large quarry on the Lucan road, are full of flakes of mica, which have evidently been derived from the wearing away of the granite of the Dublin and Wicklow mountains while it formed the shore on which the Carboniferous limestones of this as well as the adjoining district to the E. was deposited. The beds are traversed by joints which have an E. and W. direction.

In the demesne of Woodlands, the lower beds of the Upper Limestone are exposed, the dip being to the N.W. at 15°. At the western gate-lodge to the same demesne another short section is exposed in the Upper Limestones consisting of alternations of thick and thin-bedded dark gray compact limestones and shales, the dip being westerly at 20°.

On the north bank of the Liffey, at Lucan, a cutting at the roadside exposes the Upper Limestones, the beds of which are here very sharply and beautifully contorted. When such a phenomena as this is strikingly developed

in rocks the question naturally arises: At what period of their history was the effect produced? The limestone beds, when subjected to this contortion, were perfectly formed and consolidated, as they often present sharp fractures where they have been bent into too sudden a fold, the vacancies thus formed having been subsequently filled by infiltrated carbonate of lime, or by clayey material squeezed in from an adjoining shaly bed. We can only suppose that what we see is the result of great pressure exerted upon strata buried deep below the surface of the earth.*

Some of the shaly beds of the Upper Limestones are exposed near the National School at Lucan and in the stream at Esker House. The rock is thin and compact, and the shales abundant; the whole occurring in long and often-repeated rolls, dipping to the N.W. and S.E. at angles varying from 10° to 50°.

The River Liffey, for a considerable distance above and below the falls known as "The Salmon Leap," cuts through several hundred feet of this limestone, and when the river is low the beds can be easily examined. They are are all thick and thin, evenly bedded, dark limestones, plentifully intermingled with black shales, and dip to the westward at from 5° to 30° throughout the exposed section, which measures fully one mile from end to end; the river, for a portion of the way, running along the strike of the beds.

In the neighbourhood of Celbridge black earthy shales abound in the limestone, as may be well seen in a quarry south of the road between Celbridge and Templemills. Beds of smooth, compact, siliceous-looking limestone, with a splintery fracture, and about two feet in thickness, are here separated by beds of one or two feet thick of black earthy shale. They very closely resemble some of the beds seen at the base of the Coal Measure group in the district to the north, and it was at one time proposed to consider that there was here a little basin of those beds; but it was afterwards thought safer to include them in the Upper Limestone, since there is no actual proof that they are even the uppermost beds of that group. In the quarry above-mentioned the beds dip S.E. at 10°, and form the dips observed in the neighbourhood, as in Killadoon Demesne, where, in the bank of the river, beds of dark limestone and shale dip N.W. at 80°; while half-a-mile N.W. of them similar beds dip S.E. at 50°. It is pretty clear that the Celbridge beds rest in the hollow of a trough, and are probably the highest beds to be found in this part of the district.

Similar beds, composed of alternations of dark limestone and black shale, are to be seen along the road and in the brook N.W. of Castletown Demesne, north of Celbridge, the general dip of which is to the E. and S.E., at angles varying from 20° to 40°.

Shaly beds of a similar character appear N.W. of Leixlip, between Music Hall and Mount Thunder, and may be observed in the banks of the Rye Water, east of the former place. They appear here also to make a small basin, as if they were the uppermost beds of the immediate neighbourhood.

Here and there over the surface of the country, to the south of Lucan and S.E. of Celbridge, the Upper Limestone appears in quarries and road cuttings. To the W. of the Lucan station, on the Great Southern and Western Railway, a few beds of this group are exposed; but they are better seen to the south of this locality, on the banks of the Grand Canal, between Grange Cottage and the bounds of the counties Dublin and Kildare. The quarries in the townland of Ballymacauley expose very black compact lime-

* Limestones will bend from the mere effect of gravitation when placed under requisite conditions. A flat tombstone formed of coarsely crystalline limestone (Ardbrackan stone) in the grave-yard of the old church of Donaghmore, county Meath, seven feet long by about three wide, and about seven inches thick, has been bent out of the horizontal to the depth of fully six inches in the period of a few years.

stones in thick and thin evenly laid beds, and hard black shales, the dip being S.S.E. at 15° to 20°. The large quarries, half a mile to the west of this place, at Collierstown Bridge, expose a set of beds which possibly may be exactly the same or nearly so as those first described, the dip being S. and S. 10° W. at from 15° to 30°. As these latter beds are followed in ascending order to the southwards, they pass up into a series of cherty fetid limestones which, in places, are full of fossils, the most abundant being large Productæ. Black shales are not so common through them, and from their general aspect I was led, at least ten years ago, when I first examined them, to class them as Upper Limestones. Subsequent examination of the ground with Mr. Jukes showed that these fossiliferous beds passed underneath other black shaly beds which were still retained as Calp, and that, therefore, the fossiliferous beds could not be separated as a group superior to the whole of the supposed Calp. They were, therefore, taken as fossiliferous beds in the Calp. These apparent contradictions are now reconciled by our present classification, which unites the Calp and the Upper Limestone together as one group in this part of the country, locally inseparable, however they may be separable as different groups in other districts. These fossiliferous beds of the Upper Limestone may be seen here and there over Peamount Hill; and in the demesne of Castle Baggot to the eastward, the ordinary black compact limestones and shales appear as if coming out from under them.

The fossiliferous limestones just described appear in great thickness between the N.E. corner of the townland of Brownsbarn on the W.S.W., and the quarries at "Red Cow" on the E.N.E.; very many quarries and other exposures of these interesting beds occurring between the two places. To these we may direct attention by naming the following places where they are well exposed:—

At a quarry near the gate-lodge of Corkagh Mills, and one at the gate-lodge of Corkagh House; and those nearly opposite on the south side of the Dublin road; the northern slopes of the rise of ground to the west of Newlands Demesne; at a quarry on the south side of that demesne; and one outside it also on the south; on the by-road north of Newlands Demesne, passing St. Bridget's Cottage. I should mention here that the limestones exposed on this road are for the most part light brown and magnesian with black chert layers, the dips being to the S.S.E. at an average of 20°. Though the bedding is tolerably well seen in this road section I believe that the change produced in the dark gray Upper Limestones is a metamorphism, and not that they were deposited as dolomite. As these beds are crossed to the north they pass down into the ordinary black compact earthy limestones and black shales of the district. The last locality for the fossiliferous beds is at the numerous and extensive quarries in the townland of Red Cow, and on the roadside S. of St. Joseph's Monastery, places which are out of the limits of this map, towards the East.

Throughout the entire of this extent the general aspect of the limestone varies between that of a palish and a dark gray compact rock; it is usually very fetid, and contains layers of chert, while the shales are not so common as in the black beds at the bottom part of the group. Some beds are very fossiliferous, and the Trilobite (Griffithides) is not uncommon in them; others consist almost entirely of crinoid fragments, large Productæ occurring sometimes in layers. Other beds which, from their lithological character and their southerly dip, appear to belong to the upper group of the limestone series, notwithstanding their occurrence so near the limestone boundary, appear in the flat land about half a mile directly to the N. of the village of Rathcoole; they are dark clear gray in colour, sometimes finely crystalline, with a few black chert layers and thin shales. The uppermost exposed beds are dolomitic light brown in colour, and decompose to a soft sandstone or "Rotten Stone." Strange to say, all these beds, even when observed close to the Lower Silurian slates on which they rest, both here and at Newcastle, on the

W., *strike* directly *at* these rocks, all apparently dipping to the S.E. at an angle of about 40°. One would thus be inclined to imagine a fault between them at this locality. As it cannot, however, be distinctly proved, and as the limestones are nowhere observed in junction with the slates, or their relations clearly made out by quarries or other exposures, it has been deemed advisable not to indicate one between them. The question is, therefore, an open one.*

Throughout the long scoop-shaped trough of Upper Limestone which stretches for the distance of six and a-half miles S.W. from Lyons House, having at Straffan a width of only one mile and a-half, there are but few quarries, the boundary as drawn on the map being suggested by the dips in the adjoining Lower Limestone beds. A quarry on the road near the Straffan station, on the Great Southern and Western Railway, is also of use, since the beds, consisting of black limestones and thin shales, dip to the N.W. at 40°. These are presumed to be the lower beds of the group; while adjoining the old bridge near Irishtown House, on the River Liffey, some black shales appear on the bed of the stream which dip S.E., and are supposed to be nearly the corresponding beds on the opposite side of the trough.

To the north of Straffan and W. of Rose Lawn the Upper Limestone beds appear at several places, sometimes dipping to the eastward away from the Lower Limestone, at 70° to 80°. They are supposed to form a trough between Pickering Forest and Windgates, and then to strike to the northwards along the anticlinal of the Lower Limestone. On the banks of the River Liffey, to the southward of Leixlip, as well as at Leixlip bridge, and also at the large quarries on the hill side north of that village, this limestone is well seen, the dip being to the E. and S. at from 6° to 10°.

A quarry on the Royal Canal, N. of Leixlip, shows beds of thick black limestone dipping E.N.E. at 15°. These are close to the River Rye water, and at the distance of about a mile and a-half on this stream, where it issues from Carton Demesne, these rocks are again seen dipping, away from the Lower Limestones which appear in that demesne, at an average angle of 35°. Here the black shales are in great abundance, and the limestones are thin-bedded.

Near Celbridge, both on the E. and W., these limestones appear in quarries and road cuttings. Near the Charter School there are two small quarries, the beds in which are rolling to the S.E. at angles from 3° to 15°.

The same rocks appear near Elm Hall on the north-western side of the district. The hill over Hortland House, on the N., is formed of the top beds of the Upper Limestone; they are dark gray and evenly bedded, with thin shale partings, and are contorted into a sharp anticlinal fold, the dip being to the N.N.W. at from 10° to 20°; and to the S.E., at 85°, or nearly vertical.

In the demesne of Hortland, close to and S. of the house, a quarry has been opened in compact thick-bedded black limestones, with shale partings. The beds undulate, but with a general dip to the eastward at 35°. At the distance of about one mile and a-half, similar beds appear on the roadside near the National School-house of Tirmoghan, and further on to the eastward, in the townlands of Kilmoyorroge and Belgard.

Between this locality and Maynooth these limestones are rarely seen. At this latter place, however, there are some quarries which expose the usual black compact evenly-bedded limestone and shales, which are, at one quarry, very much contorted, though having a general dip to the N.W. at high angles. One very extensive quarry close to Maynooth, on the Dunboyne road, exposes some very thick beds of black compact limestone, much sought after

* I do not think it at all necessary to suppose that there is a fault between the Carboniferous rocks and the Lower Silurian, but simply a total unconformity between the two, and an overlap *in* the Carboniferous group. J. B. J.

for building purposes, and other thinner beds, containing black chert. In many of the shales in this quarry there is a distinct cleavage, which does not extend into the limestones.

d. *The Coal Measures.*—The rise of ground to the N. and E. of the village of Newtown, in the N.W. angle of the map, is formed of beds now believed to belong to the bottom of the Coal Measure series. Their limit, as defined on the map, was determined partly by the form of the ground, and partly by the ascertained dips, either in these rocks themselves, or the limestones below them. In extent they measure about four miles from N. to S., the greatest width being two miles.

The lowest portion of these Coal Measures consists of black splintery shales full of flattened Goniatites and some Posidonomya. These beds may be very well seen in a new ditch cutting by the side of the road that runs eastward over the hill from Cappagh House, where they dip about S.E. at 40°; and also in some new road cuttings to the south of that, and leading to, the townland of Grange.

Two quarries are opened nearer the base of the group, on the slope of the hill S. of Cappagh and E. of Ballynakill House. The lower quarry shows black splintery shales with thin grits occasionally assuming a nodular form; while the other quarry, which is a little higher up the hill, exhibits in the shales two beds of hard compact highly siliceous limestone, if it ought not rather to be called a compact calcareous grit. The dip of the beds is E. at 30° and 40°.

Black shales make their appearance occasionally over all the high ground S. of these places for about two miles. They may be seen in the side of the road that runs S. from the little hamlet of Newtown, where the Roman Catholic chapel stands, occasionally interstratified with grit bands, and appearing to dip eastward at a very high angle.

Before reaching the summit of the hill marked 455 feet, however, we find limestone crossing the road and dipping about E.N.E. at 20°; and a little further on there is a quarry on the east side of the road, which shows beds of thin regularly-bedded black limestone, with small shale partings, the beds of which dip first N. at 10°, and are then violently bent round towards the east so as to dip S.E. at 80°.

Beyond this point, to the southward, no rock belonging to the Coal Measure series is actually seen; but the high ground which, to the east of Newtown, with the chapel and school, is known to be composed of these beds, is continued southwards to the angle of the roads, where there is another place called Newtown; and it is presumed that it is composed of the same beds.

In the low ground around it limestone may be occasionally seen, the beds of which dip generally towards this higher ground.

The Drift.

The whole surface of the country included in the limits of this sheet is covered first with a stiff brown gravelly calcareous clay, which is most generally overlaid by the ordinary limestone gravel. On the flanks of the Dublin Mountains this clay deposit terminates at an elevation of about 460 feet above the level of the sea. Without doubt, however, the drift once covered the surface to much higher elevations than this, but it has been partially removed by subsequent denudation. In most of the quarries in the low ground the top of the limestone beds have been broken up to form a breccia, inclosed in stiff brown gravelly clay, which is sometimes ten to twelve feet thick; and at the quarries near Lyons National School this clay contains fragments of marine shells.

In the N.W. portion of the district a thin deposit of this clayey drift appears over the hill of Newtown to the height of 481 feet.

In the glens on the northern slope of the Dublin Mountains the brown gravelly clay, with limestone boulders and pebbles, often attains to a considerable thickness, probably over 100 feet; but within the limits of this Sheet it is rarely so thick, nowhere probably exceeding 40 feet; while on the flat ground 20 feet is its probable extreme thickness, except in those parts where it is piled up into escar ridges. These are not numerous in this district, the following being the only examples worth mentioning:—

A small escar ridge extends for the distance of over half a mile in a N.W. and S.E. direction on the south of the village of Esker, the main road from that place to Clondalkin running along the top of it. Its highest point is marked 195 feet above the sea; rising from a plain the average level of which is about 180 feet, it therefore forms but a very inconsiderable feature in the landscape.

There is a large escar-like mound south of the road leading from Celbridge to Barberstown Castle, the elevation marked on it being 308 feet.

G. V. D.

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INDEX