

# EXPLANATION

OF

SHEET 137

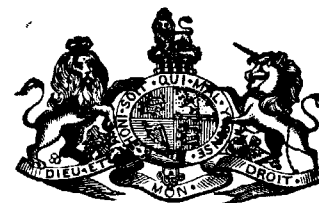
(FORMERLY QUARTER SHEET 40 N.E.)

OF THE

# M A P S

OF THE

## GEOLOGICAL SURVEY OF IRELAND.



DUBLIN :

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1859.

EXPLANATION  
OF SHEET 137, OF THE MAPS  
OF THE  
GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

1. *Form of the Ground.*

THIS sheet of the map includes parts of four counties—a portion of Kilkenny on the S.W., a part of Carlow on the S.E., a part of the Queen's County in the centre and on the N.W., and a small piece of County Kildare in the N.E. corner. The principal places are Castlecomer in the County Kilkenny, and Carlow and Leighlin-bridge in County Carlow.

The two chief physical features are the high table-land of Castlecomer, and a part of the valley of the River Barrow; the first occupying more than half the map on the western side, the latter running in a nearly straight line from N. to S. between the eastern foot of the table-land and some undulating and rather hilly ground which runs along the eastern margin of the map.

The surface of the water of the River Barrow has a height of 152 feet above the sea at Carlow, falling from a level of 164 feet near the northern to that of 130 feet about the southern margin of the map. From this, the lowest level, the ground rises in gentle but irregular undulations towards the east, the summits of these elevations not having a greater absolute altitude than 250 to 300 feet, except in one or two points near the south-eastern corner of the map. In that direction there is a hill about a mile and a-half N.E. of the village of Nurney, which is 557 feet high, and another about a mile beyond it, of 625 feet, while about a mile and a-half S.E. of Nurney there is one 676 feet high.

To the west of the River Barrow the ground rises slowly at first, but afterwards more rapidly, with one bold continuous sweep up to the table-land of Castlecomer, forming a long line of nearly level heights of about 1,000 feet in absolute elevation, running in a nearly straight line N. and S. right across the centre of the map.

The steepest and boldest part of this upward slope is a little S.W. of Carlow, over Clogrenan, where there is a height of 1,102 feet within less than two miles, in a direct line, of the water of the Barrow. This is the highest point in this map, but it is but very slightly elevated above the general level of the ground for some miles N. and S. of it, until after we pass Towlerton House, on the road from Carlow to Castlecomer, when the table-land begins to decline towards the north and become more broken. From this bold eastern margin the table-land declines also towards its centre, in which direction it is furrowed by numerous steep and winding valleys, traversed by the rapid waters of the River Dinin and its several

tributaries, so that the highest points are hereabouts not more than from 500 to 600 feet above the sea. From these, however, it again rises towards the N.W. into heights of 900 and 1,000 feet, forming another bold and continuous margin towards the west, though not quite so lofty as the one on the east.

The whole of the Castlecomer table-land, except the extreme N.W. corner, is drained by the double River Dinin,\* of which the two branches unite at Dysart Bridges, two miles S. of Castlecomer, where their waters have an elevation of 324 feet above the sea. The main or northern River Dinin is 350 feet above the sea at Castlecomer, and it falls to 250 feet where the united waters leave the district included in the map (near its S.W. corner), on their way to fall into the River Nore above Kilkenny.

The surface of the table-land has thus a rather basin-shaped outline, its highest portion forming an encircling rim, which is slightly worn down at its N.E. corner, and altogether broken through on the S.W., where the drainage of the table-land makes its escape. The views from some points on the lofty margin of the table-land are very extensive. That from the heights above Clogrenan into the fertile and well-wooded valley of Carlow, backed by the whole range of the Wicklow mountains, with Lugnaquilla for their centre-piece, is peculiarly beautiful. Almost equally so is the prospect from the heights to the west of Castlecomer, which embraces Lugnaquilla, Mounts Leinster and Blackstairs on the east; the Comeragh, Knockmealdown, and Galty mountains on the south; and the Keeper and Slieve Phelim mountains on the west.

## 2. Relations between the External Form of the Ground and its Internal Structure.

These relations are very simple, and sufficiently obvious. The whole of the Castlecomer table-land is formed by a series of dark, sometimes black, shales, interstratified with sandstones and flagstones of various shades of gray, which series, from its occasionally containing beds of coal, is spoken of collectively as the Coal Measures.

The Coal Measures rest upon a great series of limestone beds some two or three thousand feet in aggregate thickness, also interstratified in some parts with beds of black shale, and spoken of collectively as the Carboniferous or Mountain Limestone. This limestone occupies the valley of the Barrow, and the sloping, undulating ground on either side of it.

The Coal Measures of the Castlecomer table-land have, if we disregard the minor flexures and dislocations, a basin-shaped arrangement. They may be roughly likened to a set of gradually diminishing bowls or basins placed one inside the other, so that the uppermost and smallest bowl occupies the centre, while the edges of the lowest and largest rise up to a greater elevation round it.

The upper surface of the limestone underneath the table-land, of

\* In old maps the river which runs by Castlecomer is called the Deheen, the other river only being called Dinin.—G. H. K.

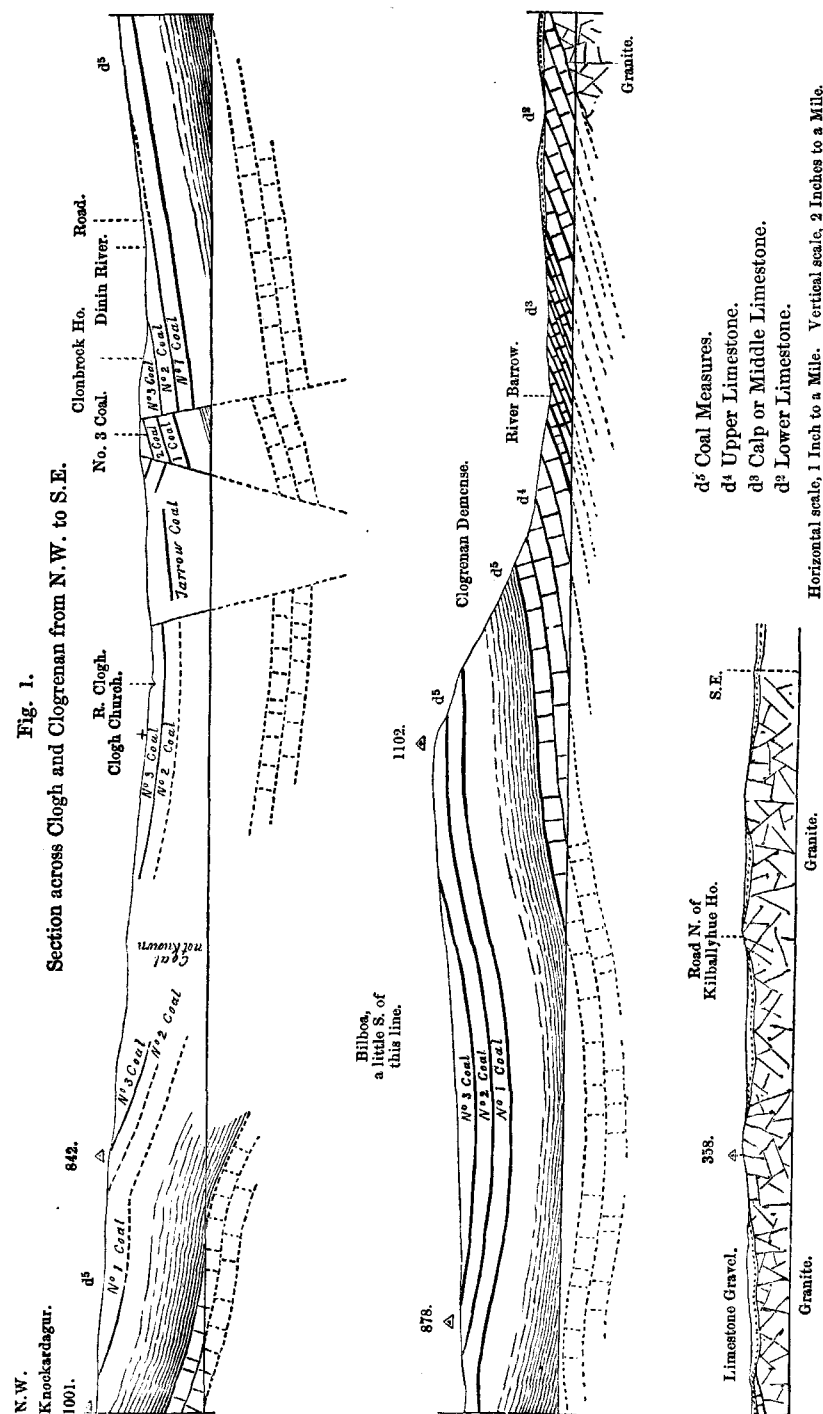
course, partakes of the same form, so that it would be found to be at the greatest depth from the surface in the centre of the basin, while it rises up to the surface all round on the outside of it. The depth of the limestone under Coolbaun, between Castlecomer and Newtown, would be about 1,850 feet, or more than a thousand feet below the level of the sea, while it rises on the outer slopes of the table-land to an elevation of about 250 feet above the sea level.

After rising out from underneath the Coal Measures towards the east, the upper beds of the limestone terminate as they successively reach the surface, and allow the lower ones to rise up from underneath them, bed after bed rising up towards the surface as we go eastward, till at length the lowest bed of the series in this district comes out, and the granite appears from underneath it (see figs. 1 and 2).

The granite, accordingly, is to be found along the whole of the eastern side of the map. It is, however, greatly covered and concealed by loose gravel, sand, and boulders, formed partly of its own debris, and partly of fragments of the adjacent limestone which have been swept over it, so that a few knolls and knobs of it only are to be seen *in situ*, except in quarries and road cuttings. This limestone gravel is still thicker and more universally spread over the low ground occupied by the limestone, so that the rock can very rarely be seen, except in quarries and artificial excavations. Enough, however, is observable to show us that if excavations were to be made, the base of the limestone would be found to rest directly on the granite; and it is known from an examination of other parts of the country, as well as from the absence of all signs of igneous action in the limestone, that the bare granite existed as the bottom of the sea in which the limestone was deposited.

*Denudation.*—On examining the section (fig. 1), especially in the part crossing the valley of the Barrow, we should be struck with the fact that all the beds of limestone, when they rise up to the surface of the ground, terminate abruptly. The Coal Measure beds in the hill above Clogrenan have the same abrupt termination. Is it possible that this abrupt ending of the beds, wherever they reach the present surface, could be their original termination at the time of the formation or deposition of those beds? No one could suppose so. It is plain, on the contrary, that these beds, having been deposited formerly in an old sea, spread much further to the east than where they now end; the higher beds of limestone having once stretched out over those below, and the shales and other beds of the Coal Measures having been continued over the limestones, not only across the present valley of the Barrow, but far to the eastward over the granite country, until they approached the shore or margin of the ancient sea in which they were deposited. We may, perhaps, suppose that the Wicklow mountains rose as an island from that sea, and that the Limestones and Coal Measures spread to the east until they ended successively, from below upwards, in the gradually shallowing water as they approached the coast of that island. Their beds, too, would necessarily be then horizontal, or nearly so.

Since the time, therefore, when these beds were thus tranquilly deposited, they have been acted on by two destructive forces. The one force was an elevating and disturbing one, acting from below, tilting the rocks into their present inclined position, and breaking



them with the dislocations and faults which traverse them. These dislocations become apparent in the Coal Measures in consequence of the mining operations, but are doubtless just as numerous everywhere else. The other more gentle but not less effective force acted from above, and was the result of the breakers and currents in the water as the rocks slowly rose up to its surface, and of the atmospheric agencies of wind and water after they were lifted above it and formed dry land. This force, which is that known as Denudation, removed from time to time all the great mass of the Coal Measures which have been swept off from the limestone, and the huge thickness of both that has been removed from the granite, and gradually wore the rocks down till the present surface was attained.\*

It naturally occurs to us to ask when this great denudation took place. We have in this district no direct evidence on this point except that we know it took place some time between the close of the Carboniferous period of the Earth's geological history, and the commencement of that comparatively recent Tertiary time which is known as the Glacial period. Agencies of erosion were doubtless at work during nearly the whole of that vast interval; but if we may be allowed to reason from analogy, we must suppose that the greater part of this denudation took place during Palæozoic time, before the commencement of the Secondary epoch, when the New Red sandstone was deposited. We know at all events that over the whole of England, and over the north-east of Ireland, denudation had occurred before the formation of the Triassic rocks, quite as great as any thing that took place in the district included in our map, because we have in many places the New Red sandstone resting on the denuded edges of the Carboniferous rocks, and stretching across those on to the rocks that rise up from below them.

After this great denudation had taken place, we are left in the dark as to the geological history of our district until the Glacial period before alluded to. It may have been always dry land during that interval; or if below the sea, either no deposition from that sea took place, or if there did, those deposits were again removed. At some time during the Glacial period, however, the country was again below water, and depressed more than a thousand feet below its present level. Some slight modification of the outline of the ground may then have been caused by a little additional denudation, but the principal action was to accumulate here and there upon the present surface considerable masses of clay, sand, gravel, and boulders of the subjacent rocks, most of them probably already lying loose and ready for transport. During this process large quantities of limestone blocks were swept up even on to the Castlecomer table-land, to heights of at least 800 or 900 feet above the sea; and large quantities of limestone gravel were carried over the granite country, while blocks of granite were occasionally transported on to the limestone or the Coal Measures. As the depression of the country

\* Nothing is said here as to a still earlier action of Denudation, which must certainly have occurred before the limestone was deposited; otherwise, the granite could never have formed the bare floor of the old carboniferous sea, but must have remained covered by the mass of rocks underneath which it originally cooled and consolidated from a molten state.

below the sea, and its re-elevation into dry land, probably took place with a slowness as gentle and insensible as the present alteration in the level of the land going on in Scandinavia and Greenland, there would be every modification in depth of water, in change of direction, and strength of current, and action of breakers over the whole surface, each change acting for a long time on every margin of land that necessarily formed the coast. The larger angular blocks were, of course, transported by the shore ice and icebergs that traversed the seas of those days; while the strength of the various currents, especially those that acted during the re-elevation of the land, would be sufficient to account for the transport of the lighter materials, the gravel, sand, and clay, and the piling of them in their present situations, as also for the removal of similar materials formerly deposited on many spots that are now bare of them.

It is requisite to take all these agencies, and the history of their action, into consideration, in order to account for the present form of the surface of the ground, and to show the relations between that surface and the matters below it.

J. BEETE JUKES.

### 3. Geological Formations or Groups of Rock.

#### AQUEOUS ROCKS.

	Name.	Colour on Map.
	Alluvium, Bog, &c., Drift.	<i>Pale Sepia.</i> <i>Engraved Dots.</i>
<i>Carboniferous.</i>	{ d <sup>5</sup> Coal Measures.	<i>Indian ink.</i>
	{ d <sup>4</sup> Upper Limestone.	<i>Prussian blue (dark.)</i>
	{ d <sup>3</sup> Calp, or Middle Limestone.	<i>Indigo.</i>
	{ d <sup>2</sup> Lower Limestone.	<i>Prussian blue (light.)</i>

#### IGNEOUS ROCK.

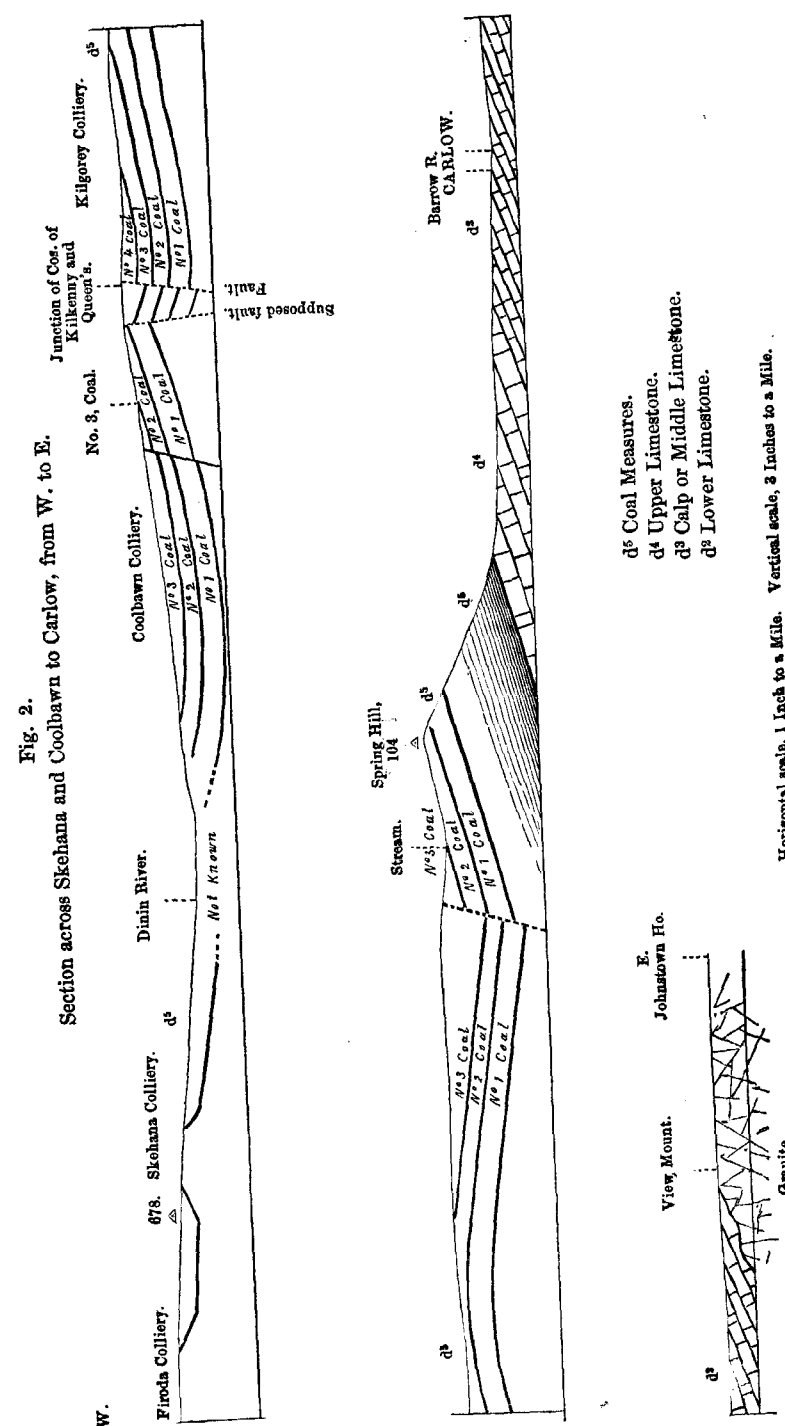
Granite.	<i>Crimson Lake.</i>
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The Carboniferous group is the only group of regularly stratified rocks found in the district included in this map. It reposes directly on the granite, without the intervention of any Old Red sandstone. The lowest sub-group of all into which this formation is divisible in the south of Ireland, that called d<sup>1</sup> *The Lower Limestone shale*, appears also to be wanting.

d<sup>2</sup>. *The Lower Limestone* is generally of a dark bluish gray, but sometimes of a pale gray. It is sometimes crystalline, sometimes compact and siliceous looking. Its lower beds are often cellular, the cells being lined with crystals of bitter spar and quartz, or sometimes with crystals of quartz alone. The magnesian or dolomitic character of this limestone is very remarkable, and appears to be nearly, if not quite universal, as is found to be the case in the country included in the next sheet to the southward, No. 147.

The fossils are principally spirifers and corals.

The country is so greatly covered by Drift, that it is not easy to give any exact estimate of the thickness of this sub-group. It may be taken as probably about 700 feet.



d<sup>3</sup>. *Calp (or Middle Limestone)*.—This is mostly an impure earthy or argillaceous limestone, generally black or very dark gray, with some beds of black limestone which afford the marble commonly called Kilkenny marble. The limestones are often separated by partings of black shale, which sometimes form beds several feet thick. Black chert also occurs in the limestones. Fossils are rare, but they occur occasionally. The thickness of this sub-group may be taken as about 600 feet.

d<sup>4</sup>. *The Upper Limestone*.—This is generally a light gray, sometimes almost a white stone, though some of the beds are much darker; and as we approach the Coal Measures they become dark blue and argillaceous, and even black, so as also to be worked for marble.\* It is often full of chert, and the uppermost beds are in some places nearly a mass of that substance. The fossils are locally abundant, large *Productæ* being the most conspicuous forms. Its thickness is believed to be about 550 feet.

d<sup>5</sup>. *Coal Measures*.—This series of beds consists almost entirely of alternations of sandstones and shales of several varieties. The lowest beds are generally black earthy shales, splitting into very thin laminae, and forming thin flaggy-looking beds of great regularity. Higher up these shales begin to alternate with fine-grained sandstones or gritstones, of a gray or sometimes an olive gray or greenish hue; and still ascending in the series the arenaceous begin to preponderate over the argillaceous materials, so that we have groups of sandstone or gritstone beds, of various thickness, interstratified with a few beds of shale. A series of excellent flagstones, largely exported for pavements, occurs at a height of about 500 feet above the limestone. At a height of about 1,200 feet above the top of the limestone the first little coal is found, forming an insignificant seam of only three to eight inches in thickness, not worth the trouble of getting. Above this is a regular series of alternations of beds of sandstone, shale, clay, and clunch, containing five other beds of coal, which have all been found to be worth working, some in one place and some in another. Besides these, there are a number of small coals called crow coals or coal rods, too thin and impure for working, as will be seen in the sections given in the detailed descriptions.

The following is the general section of the Coal Measure series of this district:—

	ft.	in.
Uppermost beds, about	12	0
VI.—Peacock coal,	1	10
7. Intermediate beds, about	45	0
V.—Stony coal,	3	0
6. Intermediate beds, about	21	0
IV.—Double seam,	5	0
5. Intermediate beds, about	120	0
III.—Three foot or Old Colliery coal,	3	0
4. Intermediate measures, about	180	0

\* The black marble pillars in the hall of Clogrenan House were taken from a quarry close by, just beneath the Coal Measures.—G. H. K.

	ft.	in.
II.—Foot coal,	1	6
3. Intermediate measures, about	300	0
I.—Gale Hill coal,	0	6
2. Flagstone series, about	650	0
1. Black shale series, about	500	0
	1,842	10

The black shales No. 1\* generally contain marine fossils only, consisting of crushed shells belonging to the genera *Aviculopecten*, *Euomphalus*, *Bellerophon*, *Goniatites*, &c. Some of these shells are also found in the sandstones which are either interstratified with these shales or form part of the set No. 2; and marine shells occur at intervals throughout the whole series of the Coal Measures of Castlecomer, as well as some that seem more likely to have been estuary or freshwater forms.

In the beds interstratified with the coals, plants are found, occasionally in great abundance, consisting of the ordinary genera *Lepidodendron*, *Calamites*, *Sigillaria*, and *Stigmara*; but upon these palæontological points more definite information will be given by Mr. W. H. Bailey.

*The Granite* is here, as elsewhere, generally white or gray, coarse-grained, highly feldspathic, with scales of black and white mica. It occasionally is traversed by veins of white very fine-grained rock, in which the mica is scarcely perceptible, and the granular structure altogether so minute as to look at first almost like compact feldspar. Probably the French "Eurite" is the best word to apply to this stone. These veins are in one place seen near together and parallel to each other, so as to give an appearance of stratification to the granite.†

The Granite of this district forms a useful rough building stone, but by no means a very ornamental or durable one, as not only does its feldspar rather rapidly decompose all over the surface, but yellow or brown spots soon form, owing apparently to the oxidation of some more highly ferruginous spots than others.

J. B. J. and G. H. K.

\* If we were to seek to force this Coal Measure series into a strict analogy with those of other districts, we might perhaps look upon these lower black shales, with marine fossils, as the representative of the Upper Limestone shale of Derbyshire; and the set of sandstones and flagstones, No. 2, as the representative of the Millstone Grit of that country. It would, however, be impossible in the south of Ireland to draw any recognisable boundaries subdividing the Coal Measure series, and the attempt would only therefore tend to confusion. Doubtless the whole of the Coal Measure series of central Ireland is contemporaneous with the lower part only of that of central England, including the Millstone Grit in that lower part.—J. BEETE JUKES.

† My notion of these veins, which occur all over the granite district of the S.E. of Ireland, is, that they are masses which were formed during the process of the cooling of the granite, either by segregation of more fusible portions from the surrounding mass, or more probably by injection from below of matter yet molten into the crevices of the consolidating, and therefore contracting part, which was nearer the surface—that part, although consolidating, still retaining a high temperature, sufficient for the newly-injected matter to partially coalesce with it, although that new matter formed itself a more compact and quasi-glassy stone, in consequence of its cooling down from absolute fusion into a solid form more rapidly than the surrounding rock had.—J. BEETE JUKES.

4.—*Palaeontological Notes.*

Although a few days only have yet been devoted to the examination of the Coal Measure fossils of this district (on which occasion I was accompanied by Mr. G. H. Kinahan), the results were of a satisfactory nature. Several important specimens of plants, mollusca, and peculiar crustacea having been collected, indicating a fossil fauna and flora allied to that of the midland counties and north of England, but at the same time presenting new forms of great interest. The fossil plants found in the localities thus hastily glanced at, show the characteristic vegetation of the Carboniferous epoch. Calamites and Sigillaria, with jointed and ribbed stems of great size, although much flattened by pressure from their once cylindrical form, being abundant at most of the collieries visited. These were accompanied by Stigmara fcoides (now known to be the roots of Sigillaria), and here also, as first noticed by Sir W. Logan in South Wales, characterizing the underclay on which each seam of coal directly rests.\*

Amongst other fossils liberally presented by Mr. Edge from this district, was included an interesting specimen from the Geneva Pit, Queen's County, showing the dichotomous branch of a Lepidodendron impressed upon the true coal. Plants of this genus are also very characteristic of the Coal Measure flora, often attaining the size of large trees. They are considered by Brongniart and Dr. Hooker to belong to the class of the Lycopodiaceae or Club Mosses. From the workings at Jarrow Colliery, county Kilkenny, we obtained some fine examples of Ferns and other Cryptogamic plants. Amongst them are some new species from the shale immediately underlying the coal; one, named by me Adiantites Kinahani, (fig. 7), being the central portion of a large frond, with bipinnate pinnules, or branches subdivided into regular branchlets, bearing rounded leaflets upon a short stalk, and gradually diminishing in number towards its termination. In the form and forked venation of the leaflets it is somewhat allied to Adiantites (Sphenopteris) adiantoides (Lindley and Hutton, *Fossil Flora of Great Britain*, tab. 115), but differs in several particulars, the branches being regularly subdivided, the distance between the branchlets much less, its leaflets more rounded, and the rachis or stem wider and straighter. I have dedicated this species to Mr. George Henry Kinahan, who was the first to discover some of the most interesting fossils found in the district. The figure represents a single pinnule of the natural size. In the same bed of shale associated with this fern was found a new species of Pecopteris (fig. 5), which I have dedicated to Mr. Benjamin B. Edge. It is allied to nervosa (Brongniart), but differs in the more obtuse form of the leaflets; also a small but pretty branchlet of what appears to be a Sphenopteris, allied to tridactylites (Brongniart), I have named it provisionally Sphenopteris? pulchra (fig. 6), and several specimens of the Alethopteris (Pecopteris) lonchitidis, which appears to be the most characteristic fern of the Irish Coal Measures. It is also found in the coal districts of the centre and north of England with associated plants and other organic remains very similar in character.

At Bilboa Colliery, Carlow and Queen's County, the common forms of Calamites, Lepidodendron, Sigillaria, and Stigmara, although not so numerous, were noticed, together with a specimen of Lepidostrobus (believed by Brongniart to be the fructification of Lepidodendron). In the four foot bed of shale immediately over the coal (No. III., Three foot or Old Colliery coal), which contained but few plants, freshwater or estuary shells (Myacites) allied to Unio, having both valves united, were found in great abundance. From their uncompressed form and superficial resemblance they are called "beans" by the colliers. With these were other species of bivalves, having the

\* Benjamin B. Edge, Esq., J.P., of Clonbrook House, Crettyard, to whom we are indebted for much information respecting this district, in confirmation of the above fact, informed us that the fireclay between the two coals in the Hartpole Royalities, Queen's County, abounds in Stigmara.

shells compressed, belonging to the same genus, and to Myalina; also some very remarkable crustacea, of which several specimens were collected on that and a previous occasion.

The first example of these peculiar Coal Measure crustacea, which are allied to forms hitherto, I believe, only found in the lower Coal Measures of Coalbrook Dale, Shropshire, was previously discovered by Mr. G. H. Kinahan, and exhibited the upper surfaces of three detached heads, or cephalic shields. This specimen I had formerly named Steropis arcuatus, but having on our visit obtained an entire specimen of it, and some also of another species, it has appeared to me, from the examination of all the specimens, advisable to include them with the allied species from Coalbrook Dale, in a sub-genus of Limulus, under the name of Bellinurus (König).

Of these interesting forms of crustacea from Bilboa Colliery, I have been enabled satisfactorily to make out two species, of which I hope hereafter to publish detailed descriptions, together with those of other fossils.

Fig. 3.



Fig. 4a.

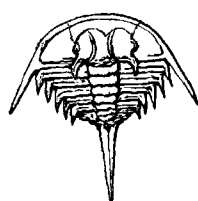


Fig. 4b.



Diagrammatic outlines—all natural size.

Fig. 3.—Bellinurus Regina. Coal Measures. Bilboa, Queen's Co.  
4a 4b " arcuatus. " Do. " "

The species named by me Bellinurus Regina (fig. 3), I procured from the debris of the same old colliery which yielded the other species. The extravagant development of its various segments into spines, which spread out on each side of the body, gradually decreasing as they approach the tail, to which is appended or articulated a spine of extraordinary length, gives it a very remarkable aspect, and perfectly distinguishes it from any other species.

The second species, Bellinurus arcuatus (fig. 4a and 4b), of which specimens were obtained from several of the pits, most of them being detached heads or cephalic shields, is allied to Bellinurus trilobitoides, figured by König in his "Icones Sectiles," plate xviii., No. 230, as Bellinurus bellulus; and by Buckland in his "Bridgewater Treatise," plate 46, fig. 3; and Prestwich on the geology of Coalbrook Dale, "Geological Transactions of London," 2nd series, vol. v., plate 41, fig. 8, as Limulus trilobitoides. It, however, differs from that species in several important particulars.

An uncompressed specimen, obtained from a concretion in the shale, exhibited the form of the body, the tail spine of which is much shorter than in the last species. This specimen showed distinctly the division of the body into segments apparently as perfect as in those trilobites which had the power of rolling or doubling themselves up; indeed one specimen was found thus doubled upon itself, an accidental fracture of the shale having brought it out in a perfect state.

The discovery in Ireland of these new forms of Coal Measure crustacea, of the same type as those characterising contemporaneous deposits in the central part of England, is of much Palaeontological interest, as the great extent of their distribution proves similar conditions to have prevailed over a wide area. The great difference in time between the deposits of the Coal Measures in which crustacea of the character noticed first appear, and the Upper Jurassic formation, where the remains of true Limuli occur, would sufficiently



account for their closer alliance to the trilobites.\* The occurrence of these intermediate forms of crustacea in the Coal Measures is interesting, from their replacing the trilobites, that great and important group of the crustacea, which is characteristic of and obtains its maximum in the older Palaeozoic Rocks; thus leading on by successive modifications of character, and by a series of gradations, from the most ancient, through the Jurassic or Oolitic strata, up to the recent genus *Limulus*, which is now represented by the King Crab, abundant in the seas of warm latitudes at the present day.

The following is a list of the fossils hitherto collected from this district:—

#### PLANTÆ.

*Queen's County*—Glen Colliery, Hartpole Royalties.

*Lepidodendron elegans*?  
*Calamites approximatus*. } in sandstone cover rock  
 „ *cannæformis*. } of No. III. coal.

*Carlow and Queen's County*—Bilboa Colliery.

*Calamites cannæformis*.  
*Lepidodendron elegans*.  
*Lepidostrobus*.  
*Lepidophyllum lanceolatum*.  
*Sigillaria* sp.  
*Stigmara ficioides*.

*County Kilkenny*—Lordship Colliery, Coolbaun.

*Calamites Suckowii*.  
 „ *approximatus*.  
 „ *cannæformis*.†

Colliery, Townland of Coorlaghan.

The shale from this colliery abounds with the remains of plants, principally *Sigillaria* and *Calamites*.

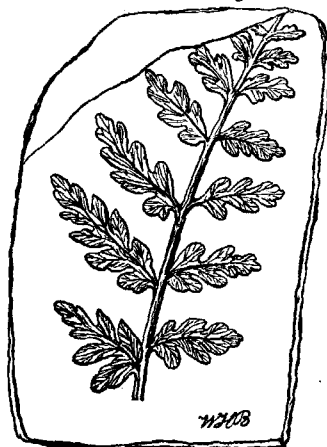
*Queen's County*—Geneva Colliery.

*Lepidodendron* sp. dichotomous branch in true coal (from No. III. coal).

*County Kilkenny*—Jarrow Colliery.

*Alethopteris lonchitidis*.

Fig. 5.



Natural size.

*Pecopteris Edgeii*, *Baily*, n. s. (fig. 5.)

*Sphenopteris pulchra*, *Baily*, n. s. (fig. 6.)

Tufts of jointed plants at present undetermined.

Fig. 6.

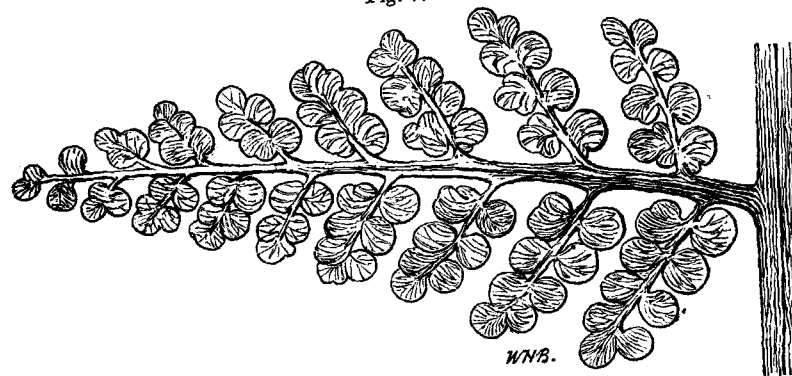


Enlarged three diameters.

\* Mr. Salter, in the *Annals of Nat. Hist.*, second series, vol. xx. p. 321, has alluded to the occurrence of crustaceans of somewhat similar character, named by him *Limuloides*, from the Lower Ludlow Rock Leintwardine, in which the segments are also articulated, forming another link probably still more closely united to the Trilobites.

† Mr. B. Edge states the fire clay between the two coals to be full of *Stigmara*.

Fig. 7.



Natural size.

Diagrammatic outline of one of the Branchlets of *Adiantites Kinahani*, *Baily*, n. s.

*Adiantites Kinahani*, *Baily*, (fig. 7.)

#### MOLLUSCA.\*

*Queen's County*—Bilboa Colliery.

Many species of the genera *Myalina* and *Myacites*, some of them being found associated with the crustacea hereafter mentioned.  
*Goniatites*, large species, too imperfect for determination.

#### CRUSTACEA.

*PÆCILOPODA*—Genus *Limulus* *Müller*.

Sub-genus *Bellinurus* *König*.

*Bellinurus Regina*, *Baily*, sp. (fig. 3, p. 13.)

„ *arcuatus*, do. (fig. 4a and 4b.)

From the three foot bed of black shale resting on the coal, associated with small bivalves and plants before alluded to.

W. H. BAILY.

\* Mr. B. Edge informed us that about five or six years since, a branching coral and shells of mollusca like the common cockle, were found in drift twenty-four yards in depth, close upon the coal, at Newtown coal field, *Queen's County*.



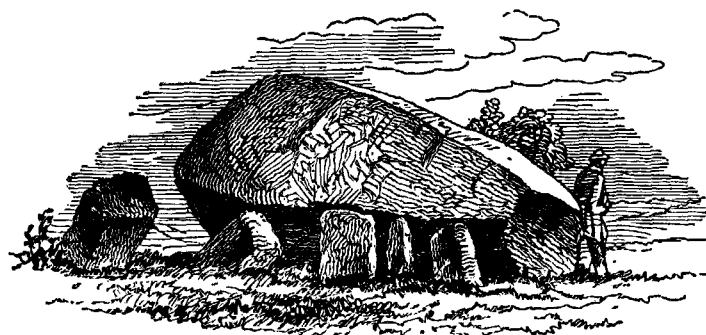
## DETAILED DESCRIPTIONS.

[A part of the district included in this quarter sheet was surveyed many years ago by the late Sir H. T. Delabeche and Mr. Warrington W. Smyth, who marked in on the six-inch maps some of the coal crops both in Kilkenny and the Queen's County. Other parts were afterwards surveyed by Messrs. A. Wyley (now Geological Surveyor of the Cape of Good Hope) and G. V. Du Noyer, under the direction of T. Oldham, LL.D. (now Superintendent of the Geological Survey of India). In 1854 Mr. W. L. Willson commenced the examination of the district near Castlecomer, but soon after left Ireland to join the Geological Survey of India. Mr. G. H. Kinahan has lately completed the examination of the district, and gone over the whole of it. The following details (except the part surveyed by Mr. Du Noyer, which he has himself described) are written by Mr. Kinahan either from his own notes, or abstracted from the notes of other observers, the latter parts being distinguished by having the observer's initials attached to them.]

## 5.—Position and Lie of the Rocks.

**Granite.**—The Granite which occupies a narrow strip extending from N. to S. along the entire eastern margin of this sheet, presents a low escarpment facing the west, having the lowest beds of the Carboniferous Limestone of the valley of the Barrow resting directly on it, the Old Red sandstone being wanting. Over the entire Granitic district now under review, this rock is rarely seen *in situ* at the surface, the country being covered by a thick accumulation of Drift, in which fragments of the adjoining Limestones are very abundant. The following are the principal localities where the Granite appears at the surface, commencing at the north of the map. On a knoll and at a quarry west of Palatine, on the boundaries of the counties of Carlow and Queen's: the Granite here is coarse-grained and quartzose, and is regularly jointed in planes striking 30° W. of N. South of this, near Ballylennon crossroads, the Granite again appears, and it comes to the surface also at the gate lodge of Burton Hall. It may be observed again in a few localities on the low ridge which extends northwards from Thornville House. To the south of these localities the Granite is not observed at the surface till we reach Pollerton House,\* close to and east of which, on the rising ground, it

Fig. 8.



Block of Granite.  
Cromlech, at Kernanstown.

again appears. A road-cutting here exposes a good section through it, and at this locality it is observed to have a tendency to decompose freely—the

\* In the townland of Remanstown, half a mile N.E. of Pollerton House, is a cromlech of Granite blocks, the upper stone of which is 16 feet × 13 feet × 5 feet (see figure, No. 8). Great loose blocks are strewed over the whole Granite district, some of them being doubtless weathered and loosened and fallen down *in situ*, or but little removed, at all events, from their original site.

feldspar being apparently in excess, and easily weathered. At the distance of two and a-half miles south of Pollerton House, and to the west and south of Bagenall's Arms crossroads, the Granite is unusually well exposed; it forms the knoll south of the crossroads, having the height marked 275 on the map, and appears constantly on the road leading southwards to Nurney. The Granite of this district is universally coarse in texture, disintegrating freely. At Ballyloo Castle, and south of the last-named localities, the Granite again appears; and at a quarry on the roadside, east of and close to the farm-house adjoining the castle, the joints in the rock present a singular regularity—one set striking N. and S., crossed by others bearing E. 15° N. The N. and S. joints, however, varying occasionally in their strike from N. 10° W. to N. 5° E. As the joints just described are traversed by others having a more or less horizontal direction, the Granite in this quarry has a tendency to break up into cuboidal blocks. At the distance of about one mile and a-half east of Ballyloo Castle, the Granite may be observed along the road skirt-ing the demesne of Kilballyhue House; here it is light coloured, coarse-grained and feldspathic.

At a quarry near the branch roads, in the townland of Graiguenaspiddoge, the Granite, which is coarse-grained and feldspathic, looks as if it was stratified, the planes of pseudo-stratification being inclined to N. 40° E. at 12°; it is also traversed by joints, the principal of which have a strike of N. 45° W. The Granite again appears along the south-west margin of Ballyloo townland, and to the south of the stream course, forming the boundary of the townland of Ballyryan. If we now proceed to the village of Nurney, the Granite is there again observed. In a quarry south of the main-street, it is jointed in planes striking N. 10° E., crossed by others having the direction of N. 40° W. Along the road from Nurney to Ballytarsna Castle the Granite appears very frequently, forming comparatively high ground; and at the distance of about one mile and a-half south-east of Nurney, in the townland of Newtown, it reaches an elevation of 676 feet, forming a well defined hill. The average strike of the main joints in this mass is N. 60° W. South-west of Nurney, and at the distance of one mile and a-half nearly due east of Leighlinbridge, the Granite forms a projecting spur to the west, against which the Carboniferous Limestone has been deposited. In general aspect and texture the rock is quite similar to that previously described. Elvan veins or dykes are apparently rare in the Granite included in the limits of this quarter sheet.

**Carboniferous Series.**—By reference to the map it will be seen that the Carboniferous Limestones which occupy that portion of the valley of the Barrow comprised in this map, rest against the western limits of the Granite; and this boundary is defined by a gently waving line extending in a nearly N. and S. direction across the map. In no instance along this boundary was the Lower Carboniferous Limestone observed to rest directly on the Granite, though in a few localities it may be observed very close to that rock, and invariably dipping away from it at low angles. These places shall be noticed in their order of occurrence, and it may be as well to take up the description of the Carboniferous Limestones at the northern limit of the map, and follow them in their line of strike southwards. Before doing so, however, I would observe that the boundary of the limestone with the Granite, as defined on the map, has, of necessity, been drawn from inference, the slight rise of ground presented by the latter rock being taken as a guide.

The first quarry which has been opened in the Lower Limestone on the northern part of the map, is one at the crossroads in Ballaghmoon, in the county Kildare, showing beds of blackish gray magnesian limestone, full of small cavities, the beds dipping N.W. at 7°. South of this, in the county Carlow, and more closely adjoining the Granite, near the pond at the gate lodge to the deer park of Oak Park demesne, is a quarry in which the rock is a regularly bedded dark gray limestone, dipping N. 20° W. at

from 10° to 15°. The principal fossils are Spirifers, Terebratulæ, and Corals. It is probable that these beds may be distant from the Granite about a quarter of a mile. Half a mile further to the south of this locality, and at either side of the road north of Pollerton demesne, extensive quarries have been opened in the Lower Limestone, which is here a dark gray dolomite; the dip of the beds being W. 20° to 25° N., at an inclination of 10° to 15°. Other large quarries occur in the fields due south of Pollerton House, and again to the west of Pollerton demesne, on the road to Carlow. This particular variety of Dolomite is very dark gray—sometimes black—highly crystalline in texture, and presents a pearly lustre when freshly fractured. It decomposes freely from atmospheric action into a gray sand. In the quarries which lie directly E. of Dean's cottage, between Carlow and Brownhill, the dolomitic limestone is highly cavernous, the cavities being filled with crystallized carbonate of lime; to which, in the hollows thus formed, are frequently attached most perfectly developed crystals of the purest quartz. These beds dip on an average to the W. at from 5° to 10°, and are distant from the probable boundary of the Granite a little more than half a mile. The quarries in limestone, similar to that just described, which lie due S. of Pollerton House, are probably not more than 500 feet distant from the Granite; and as all the beds dip to the W. at angles never higher than 15°, this inclination may be that of deposition, and consequently the absolute total thickness of the Lower Limestone may be less than the apparent thickness. Southwards from the quarries at Dean's cottage, for the distance of two miles and a quarter, the Lower Limestone is not seen till we reach two large quarries in the townland of Ballybar Lower. Here the rock is precisely similar in every respect to that last described; and its cavernous character is remarkably well developed. The beds dip W. at from 5° to 10°; the Granite being distant probably a quarter of a mile. A very extensive quarry is opened in the Lower Limestone, in the ground attached to Ballybar House, south of the last locality, and distant from it about half a mile. It exposes thin-bedded dark gray dolomitic cavernous limestone, overlying highly crystalline thin-bedded dark gray shaly beds; the average dip of all being W. at from 5° to 10°; the Granite being distant probably 400 yards to the east. South of Ballybar House, and on the road at the distance of about 500 feet west of the crossroads of Ballyloo, it is probable that the Lower Limestone is close to the surface; and if so, it approaches much nearer to the Granite than at any other locality along the supposed line of the junction.

From Ballybar House southwards to the limits of the map, the Lower Limestone is concealed by the usual thick accumulation of drift which overlies all this district, and is exposed but in one quarry at the N.W. angle of the townland of Oldtown, distant from the Ballybar Limestones about two miles and a quarter in a straight line. Here the rock still retains all its previously described characteristics. It is dark gray, dolomitic, cavernous, and decomposes readily to a gray sand; the beds dip W. 10° S. at the usual low angle of 10°; the Granite being distant about one mile and a quarter. This completes the list of quarries opened in the magnesian Lower Limestone included in this quarter sheet; and as in every instance the rock still retains its fossils, which are frequently very abundant, it is clear that it must be classed with the deposited, and not the metamorphic Dolomites.

The band of limestone just described is, throughout its entire extent on the map, overlaid by a series of dark gray and black compact limestones, classed as the "Calp" or middle group of the Carboniferous Limestone, and these again by the Upper Limestone which immediately underlies the Coal Measures. The Calp, which is now to be described, is like the subjacent Dolomite, but rarely exposed. From its northern limits on the map, to the Town of Carlow, but one quarry has been opened in it, and that is in Carlow, at the rear of Montgomery-street, where black marble was raised some years since. The

quarry is now abandoned, and full of water. On the west bank of the river Barrow, in the townland of Crossneen, adjoining the suburb of Carlow, called Graigue, several quarries yielding black marble have been opened in the Calp. The dip of the rock is to the W. at from 3° to 8°. In all these quarries the top beds have been shattered into breccia to the depth sometimes of twelve feet, suggesting the idea of the layers of rock having been shaken in "situ," so as to be broken up along the numerous cross-joint planes, the cuboidal blocks thus formed, being quite surrounded by the drift, brown calcareous clay. Fossils are common in these limestones. From the Graigue quarries just described, to the extreme southern limit of the band of Calp Limestone which is represented as passing out of the map to the south of the village of Leighlinbridge, a distance of about seven miles, not a single other quarry has been opened in this subdivision of the Limestone; its boundaries are, therefore, inferential only.

We now come to the examination of the Upper Limestone of the district, and as in the former instances, we shall commence its description at its northern limits.

The first quarries to be noted occur at the distance of about a quarter of a mile to the N.E. of the village of Arless. They expose light gray crinoidal and cherty limestone, regularly bedded, and dipping nearly W. at 6°; the Coal Measure shales being probably not more than 500 feet distant from them to the west. Half a mile eastward from these beds, and in the N.W. angle of Rossena townland, are many quarries affording an excellent exposure of the Limestone; but all these beds suddenly change their normal strike of N. and S. to that of East and West, with dips to the southward at angles varying from 5° to 10°. The rock is light gray, full of chert layers, and contains abundance of Encrinite remains along with large Productæ. Indeed, these latter are the characteristic fossils of the Upper Limestone of this district. In the strike of these beds to the west, in the townland of Rathillig, and close to the probable boundary of the Coal Measures, is a small quarry which exposes light gray limestone as the lowest beds, having above gray slaty shale and chert layers; the dip of all being S. 10° E. at 15°, or the same as the Rossena quarries. East of the Rossena quarries, at the distance of about one mile on the road south of Coolanagh Cross, a few beds of limestone appear dipping S. 15° E. at 8°. Limestones exhibiting a similar singularity in strike, occur at the southern extremity of the townland of Clonagh adjoining Hollymount. The rock here is compact and gray, with layers of chert, in which are frequently found fossils, such as corals and fragments of encrinites.

From the quarries in Rossena townland, southwards as far as Springhill House, a distance of four miles and a half along the escarpment of the Coal Measures, there is not a single quarry opened in the Upper Limestone, nor does that rock appear at the surface over the district included between that line and the River Barrow on the east; the entire surface of the country being thickly covered by the Limestone Drift. At the southern extremity of the lands of Springhill House, the Upper Limestone, as is stated, again makes its appearance in various quarries. The Limestone is gray, thin-bedded, with gray shale partings, and numerous layers and nodules of black chert. The beds are much disturbed, dipping suddenly from W. at 30° to N.E. at 20°, and, again, S.E. at 25°, where they approach nearest to the Coal Measures.

These dislocations are merely local, as at a short distance removed from the Limestones, the Coal Measure shales dip steadily to the west at their usual low angles, from 5° to 10°. The Coal Measures which were observed nearest to the limestone, consist of black shale, passing down into gray shale, with clay ironstone nodules. Nearly a mile due south of this locality, in the townland of Clogrenan, there is a quarry in the Upper Limestone, exposing thick regularly bedded highly crystalline dark gray marble, full of chert layers and nodules. The joints are corroded by atmospheric action, and the chert stands out from the beds in high relief. Some beds, 2 feet 6 inches thick, are a

mass of encrinite fragments. The dip is W. 20° N. at 8°, apparently the normal inclination of the beds; and the Coal Measure shales were observed at the distance of about 400 yards further to the west.

In the townland of Bannagagole, close to and S. of the village of Old Leighlin, a quarry is opened in the Upper Limestone which exposes the junction of this rock with the Coal Measures. The following is the section there seen:—

Section No. 1.

	Ft.	In.
14. Hard black, slaty, earthy, and splintery bands, . . . . .	3	0
13. Earthy rotten black shale, . . . . .	2	0
12. Hard black band, . . . . .	0	2
11. Brown earth, . . . . .	0	5
10. Crystalline gray crinoidal Limestone, . . . . .	3	4
9. Soft brown earthy shale, containing abundance of Fossils, with very numerous chert layers, . . . . .	8	6
8. Chert not so abundant in soft brown earthy shale, . . . . .	3	0
7. Hard gray shale, with items of Encrinites and shells, . . . . .	0	9
6. Gray compact Limestone, . . . . .	3	6
5. Chert layer, . . . . .	0	4
4. Gray compact Limestone, . . . . .	1	0
3. Thin irregularly-bedded shaly Limestone, . . . . .	2	9
2. Light gray compact Limestone, . . . . .	5	5
1. Chert layers in hard black shale, . . . . .	1	0
Compact Limestone forming base of quarry, . . . . .	—	—
	35	2

In this and all other accounts of sections, the different beds are placed in their natural order of position, the higher at top; but they are numbered in order of deposition or age of formation, calling the lowest or oldest number one.

The most extensive quarries which are opened in the light gray Upper Limestone of the district, occur at the hill of Raheenendoran, south of Clogrenan demesne; the lowest exposed beds are full of large Productæ, and are extensively used for tombstones. Over these, in the centre of the quarry, are some very massive limestones, some beds measuring fifteen feet in thickness. Above these the beds become thinner, and pass up into pale gray crinoidal marble, having pale gray coloured limestones, full of large Productæ, above them. All the Raheenendoran limestones dip westerly at from 8° to 10°, and are more or less crystalline. To the west of these quarries, at the distance of five hundred yards, the Coal Measure shales appear at the surface.

At the eastern extremity of the townland of Ballynabranagh, and to the north of Millford, a large quarry is open in the Upper Limestone; the dip of the beds is as usual to the W. at 8°, and the rock is light gray in colour, highly crystalline, and abounds in large Productæ and Crinoid fragments. Traversing this quarry in nearly a N. and S. direction, at its eastern side, and traceable for the distance of nearly 400 feet, is a fissure three feet wide, completely filled with double refracting spar or crystallized carbonate of lime.

In the same townland, and about one quarter of a mile south of the last locality, there is an old quarry from which it is said black marble was procured; it is now almost filled up, but the apparent dip of the rock is to the West at 8°.

This completes the list of quarries in the Upper Limestone, in the district comprised in this sheet, the country southwards from Millford to the extreme limits of the map, being entirely covered by Drift, which quite conceals the Limestones.

*Coal Measures.*—Owing to the great accumulation of Drift which covers the surface of the country comprised in the eastern half of this sheet, the boundary between the Coal Measures and the Upper Limestone is, for the greater portion of its extent, totally concealed. From beyond the village of Arless, on the north of the map, southwards to the limestones of Spring Hill House, a distance of fully five miles, neither rock can be observed

within a less distance than half a mile of the other; and, consequently, the boundary between them, over that extent of country, is determined within those limits, only by the outline and appearance of the ground. The Coal Measures form a well marked escarpment, facing the east, at the base of which the Upper Limestones are supposed to rise out as they may be observed to do further S. South of Old Leighlin, however, the junction of the two groups of rock can be more closely observed. The basal beds of the Coal Measures consist of black shales, which here reach a thickness of at least 250 feet. In their lower portion, those shales are frequently fossiliferous, containing impressions of plants, along with Goniatites, Pectens, and other fossils. These may be procured in the banks of the stream in the townland of Ballyhide, which lies to the south of Rossmore townland. Immediately at its base, this black shale passes downwards by alternations of thin gray gritty flags and sandy shales, into bands of thin crystalline gray limestone and gray sandy shales, both often highly fossiliferous. The black shales, which are thus seen to form the basal beds of the Coal Measure, are succeeded above by a few beds of gray grit and gray flaggy sandstone; and these again by thick deposits of hard bluish-gray and gray shales, through which are occasional layers of gray flaggy sandstone. The dip of all these beds, where they occur in the townland of Rossmore, to the west of Spring Hill House, as well as near Old Leighlin, is nearly due W., at an average angle of 9°.

Proceeding south from Rossmore, we pass out of the Queen's County at Clogrenan demesne, in the woods to the west of which is a short section through part of the basal beds of the Coal Measures, consisting of alternations of black shale and gray grit, along with gray shales, sometimes slaty and micaceous, and compact quartzose sandstones. The gray shales frequently contain plant impressions.

All these beds dip westerly at 5° to 10°, and the length of the exposed section is about 700 feet, measured along the ground. These would occur at about the centre of the mass of the basal black shales, mentioned before as appearing on the boundary of the Queen's County and county Carlow. West of Clogrenan demesne, and close to the supposed out crop of the Rossmore coal, is a quarry in the gray flaggy sandstone, the beds dipping W. at 8°. To the west of Millford, along the various streamcourses, which run down the eastern slopes of the Coal Measure escarpment, sections are obtained for the distance, in many instances, of three-quarters of a mile, measured along the ground. They, however, add little to our previous information, and no coal seams have been observed in them.

G. V. D.

*Coal Measures.*—At the N.W. corner of the map, in a tributary of the River Knocklead that flows to the east of the townland of Knockardagur, the shales that overlie the limestone are exposed by the denudation that formed the valleys in which the River Knocklead and its tributaries flow. The first beds seen, at the north of the stream, are a few thin-bedded olive grits, dipping S. at an angle of 50°. These grits are full of the debris of grass-like plants. On the top of these are olive-coloured and black shales, thin flags, thin olive-coloured and black shales, and then a black grit that looks very like a "Seat Rock" for a bed of coal, though this is too low down in the series for any coal to be found, at least no coal was ever found so near the limestone any where else in these Coal Measures. Over this are black shales, and on the top of the black shales are yellow sandstones and grits forming Knockardagur cascade. Olive-coloured flaggy grits are then met with. The dip of all these beds is S. and S. by W. at 5°. On the top of these last-mentioned beds at the old road, there are black shales lying horizontal, which seem to be those overlying No. I. coal.\*

\* The arrangement and numbering of the coals is given at page 10.

No more evidence of rock *in situ* is to be seen up this stream, as it has not elsewhere cut through the bog and drift. To the east of this, in the stream that flows N. and S. down the centre of Graiguenahown, there is a section of the same rocks. In this townland there were extensive works for clay ironstone, which was found in the shale to the S.E. of where the old road crosses the stream. Proceeding now towards the west, in a stream that flows down the S.S.W. face of Knockardagur, olive-coloured grits, on the top of flags, were seen dipping E. at 5°, from under which flags came some black shales that soon became horizontal. These black shales and flags are again met with lower down; at first they are dipping to the S. at 5°, and a little lower down the hill, they lie horizontal. The rest of the hill to the S. and W., is covered with deep drift, and no rock *in situ* is to be seen. To the E.S.E. of Glenavuder bridge, at the west of the county boundary, there are olive grits lying upon olive flaggy shales, which dip south at from 10° to 15°. These localities are in the Queen's County.

G. H. K.

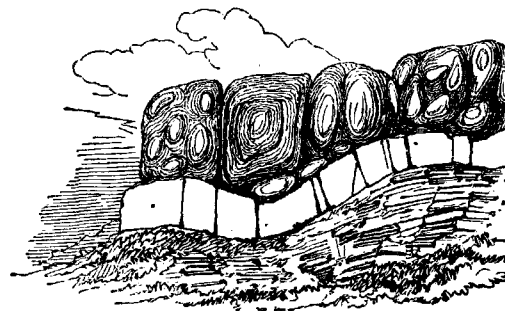
In the boundary between the counties of Kilkenny and Queen's, the smut of No. I. coal is to be seen. Going east along the road, yellowish brown quartzose sandstones are met with. These first dip to the east at 10°, and then they form an anticlinal curve, the axis of which runs N. and S. To the west of the undulation, the beds dip to the W. at 5°, and to the east of it at 10°.

No more rock *in situ* being visible here, we may now proceed to the east, to the stream that flows through the centre of the townland of Crutt. Beginning at the north, dull gray and olive grits and flagstones, apparently fossiliferous, make their appearance. These dip E. at 10°. Over these come bluish and gray sandy shale, dipping S.E. at 30°; and below these last-mentioned beds are gray flagstones, shales and grits, which are traversed by an anticlinal curve, the axis of which runs S.E., and inclines in that direction so that the beds on one side of it dip south at 20°, those on the other east at 20°. On the top of these there are olive-gray flagstones and grits dipping E. at 25°. Where this stream meets another, there are gray flaggy shale and grits, above which are shales, containing concretions, dipping S.S.E. and S.E. Where the stream runs at the north of Monala Colliery, gray flagstones and shales, with occasional grit bands, are to be seen dipping W. at 15°. Under these there are blue and black shales and flagstones dipping W. at from 15° to 5°; and below the latter, are dark-bluish and black shales, and thin gray flagstone bands—these dip W. and S.W. at from 5° to 0°. The strata here met with undulates, the undulation consisting of two anticlinal curves and one synclinal. Of the two anticlinal curves, that to the east is more rounded and flattened than that to the west. When these undulations are past, there are dark gray shales with gray flagstones, above which are bluish gray shale and thin bands of kelve and ironstone nodules. Over these lies a thin black grit, which is the seat rock for an eighteen inch coal, that has been worked here under the name of the Crutt coal. This coal will be hereafter spoken of. On the top of this coal there are black, dark gray, and bluish shale, with thin beds of gray grit and ironstone bands, which lie under thin gray rippled flags and grits, overlying which are black shale and gray grits. These all dip W. and S.W. at 10°. To the S.W. of this last locality, in the boundary between Moyhora and Ballylennen, beginning at the road, there are light gray flaggy shales and thin grits, dipping W. at from 15° to 20°. These underlie dark blue and gray shale, which dip W. at 25°.

Over these are light-gray flaggy shales and grits, dipping W. at 10°; which pass beneath soft bluish shales, with thin ironstone bands, and dark black carbonaceous shale, dipping W. at 5°. To the N. of Moyhora House

there are blue and gray shales, weathering into curious spheroidal forms (see figure 9), with ironstone; these beds dip N. at so low an angle as to

Fig 9.



be nearly horizontal. A little south they dip S. at 5°; they then undulate down to Moyhora House, where they become horizontal. They were formerly worked for the clay ironstone contained in them. To the south of this, in the stream, there are dark bluish black carbonaceous shales, light gray sandstones, and gray gritty shales, with spheroidal concretions; all dipping to the N. at about 5°. To the south of these are bluish gray shales, with grit bands and gray gritty shales with spheroidal concretions; these dip to the E. To the N.W. of Skehana colliery there are very coarse gray and brown quartzose sandstone, thick, even-bedded gray grit, and thick-bedded quartzose sandstone, "with a thin bed of brown conglomerate, full of fossils, shells, and plants." Along the road leading from Skehana to Castlecomer there are thick irregular beds of coarse sandstones, with beds of coarse conglomerate, made of pebbles of quartz and of the local rocks. These dip to the west at an angle of from 20° to 40°; while in the stream that flows a little to the west of this road, there are olive and gray grits, flagstones and shales, dipping to the east at an angle of from 5° to 10°. To the south of Castlecomer, and due west of Smithstown House, in a stream running east and west, the following section is seen:—Beginning at the east, at the road from Castlecomer to Kilkenny, there will be found, first, olive gray grit, dipping E. at 5°, then W. at 5°. Over these are hard thick olive grits, with black shale and a thin seam of coal; these beds undulate with a general dip of 20° to the W. Then black shale, under olive gray grits, which dip E. at so low an angle as to be nearly horizontal. No more rock *in situ* is seen in this stream for the space of half a mile, at the end of which there are pale gray flaggy grit, dipping to the W., which rest upon dark blue and black earthy shales, with gray arenaceous bands. These beds are horizontal, and under them are blue and black shales, which dip E. at 5°. As these beds go S. they become horizontal. They are the cover rock of a bed of coal two inches thick. The next rocks *in situ* are dark gray and blue gritty shales, dipping W. at 5°, which overlie hard olive grits and sandstones, flaggy and irregularly bedded, dipping E. at 30°; and below these are hard olive-coloured grits and sandstones, with gray sandy shale and thin gray shale: these all dip E. at 35°. A quarter of a mile further to the west, on the parish boundary, will be found gray and brown grit, with blue and gray shales and flagstones, dipping W. at an angle of from 20° to 30°; then there are shales that are concretionary, which lie apparently horizontal, and hard dull gray flaggy grits, which dip to the W. at 10°. In the stream at the south of Smithstown House, beginning at the Dinin River and going to the east, there are, first, hard gray and olive sandstones and flaggy grit, with a bed four feet thick, of an ochreous conglomerate,

which dips W. at from 20° to 35°. Under these are dark gray grits and shales, dipping W. at 40°, from beneath which appear dark gray flags and black shales, shortly becoming horizontal. The next beds met with are blue and gray shales, dipping E. at 10°, and on the top of these are beds, the continuation of those met at the west side of the anticlinal curve. At the east side of the curve they dip to the E. at from 5° to 10°.

To the south-west of the map, and going up the Muckal River, there is no rock *in situ* found until the old road from Castlecomer to Kilkenny is passed, when there is to be seen dark blue and gray shale, arenaceous in parts, apparently undulating, but in such a way as to be nearly horizontal, or to dip E. at 5°. Then dark gray gritty shales; under these are gray gritty shales, some of which are concretionary; they dip W. at 15°. No rock *in situ* is now found in this river for the space of about two miles from those last mentioned, where there are gray gritty shales, first dipping to the south, and then contorted and dipping in every direction. Under these are dark gray shales and flaggy beds, some of which are like kelve; these dip S. at 10°, and N. at 10°. Over them are the same beds as those before mentioned, dipping N. at from 10° to 20°. On top of these are dark gray flags and flaggy beds of shale, like kelve, dipping N. at 10°; then dark gray and bluish gray shale and flagstones, which dip N. at from 5° to 10°. Over these, at Rockbrook House, are thin gray rippled flagstones, and dark gray shales. No more rock *in situ* is to be found up this river. To the N.E. of this last section at Uskuty wood, at the bridge over the Dinin River, there are coarse gray sandstones and grits, obliquely laminated; these lie on an anticlinal curve, the axis of which runs N.E. and S.W., declining to the N.E., so that the beds curve round successively over it in that direction. In the branch of the Dinin River that flows to the north, at a little to the south of Castlequin, there are blue shales and flags, first dipping E. at 5°, then N.E. at 5°, and then S. at 5°. Under these are fine blue shale and thin bluish gray flagstones, often rippled marked; these dip S. at 5°, then N. at 5°. At Castlequin the same beds are met with. In the river about half a mile to the North of Castlequin, there are dark bluish gray carbonaceous shales and gray flagstones, dipping N. at from 10° to 30°; above which are thick gray sandstones and olive brown grits, gray grits and flagstones, and blue slaty shales—all these are undulating at so low an angle as to be nearly horizontal. At Kelly's bridge there are gray flaggy shales and grit lying nearly horizontal. Over these are soft blue and gray shales, with bands of gray grits, dipping N.N.W. at 5°. Then fine bluish gray grit and flaggy shale, dipping W. at 5°; over which are bluish gray grits and shale, strong bluish grits and shale, and quartzose sandstones, all dipping N.W. at 5°. These lie under bluish gray and black shales, with gray grits, dipping N.W.; and on the top of these are dark gray flags, with bluish black shales under gray grits; these dip to the N.

G. H. K., from W. L. W.'s Notes.

To the south-east of this last section, and a little to the south of Ardough House, in the stream that divides the Queen's County from the county of Kilkenny we have the following section:—Beginning at the Dinin River, at the junction of the counties of Kilkenny, Queen's, and Carlow, there are good flags, which first dip W. at 5°, then N.W. at 5°. Over these are olive and gray grits, flags, and shales, which dip W. at so low an angle as to be nearly horizontal; then black and gray shales, with one or two thin grits and layers of nodular ironstone. These beds lie under black and gray grit and shale, and dip W. at 5°. On the top of these are black nodular shales, with a few grits, which are overlaid by olive and gray grits and flags, with a few shales; these underlie black and gray shale, with a few grits and a

thin seam of coal. Above all these are olive grits and olive sandy shales. All these rocks dip to the W. at a very low angle, being nearly horizontal.

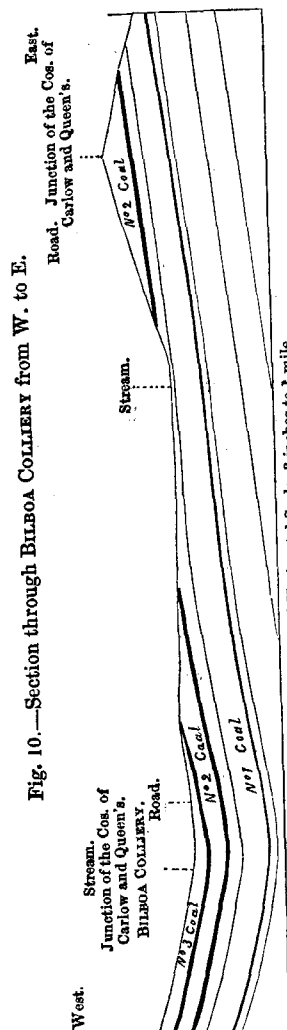


Fig. 10.—Section through BILBOA COLLIERY from W. to E.

Vertical and Horizontal Scale, 3 inches to 1 mile.

**Rossmore Colliery.**—Beginning at the eastern side of the Coal Measure district, the nearest workable coal to the limestone is the Rossmore foot coal, No. II. of the general section. It was worked formerly due west of Carlow, at Rossmore, and is traceable to the south for about two miles. It crops out towards the west from under the hill on the east side of Bilboa, in consequence of the angle of the slope of the ground being greater than the dip of the beds (see fig. 10).

**Bilboa Colliery.**—It takes the ground again on the east side of Bilboa, where, at the junction of the plantation and the River Dinin, it may be well seen.

The following vertical section is from Mr. Du Noyer's notes:—

Section No. 2.\*

	Ft.	In.
5. Gray shale, thickness not known.	3	0
4. Black carbonaceous shale, with plants.	0	3
3. Coal, No. II.	3	0
2. Gray seat rock, with stigmaria.	—	—
1. Hard gray shale, thickness not known.	6	3

This coal is about 1,200 feet above the limestone. At 200 feet above this we find the 18-inch bed of coal that is being worked in the Bilboa colliery. This is No. III. coal. It is used by Mr. Rochfort for burning lime.†

The following sections were given to me by the colliers. No. 3 is taken where outcrop of the coal crosses the boundary between Queen's and Carlow counties:—

Section No. 3.

	Ft.	In.
8. Grayish black shale.	12	0
7. Black shale.	3	0
6. Culm, No. III. coal.	1	6
5. Gray indurated clay, full of stigmaria.	2	3
4. Indurated black shaly clay.	0	9
3. Blue gray sandy shale.	1	0
2. Blue gray grit.	0	9
1. Blue gray indurated shale.	—	—
	21	3

Section No. 4.‡

Taken at a new pit on the high ground to the north of the farmhouse

\* In this and all other sections the beds are numbered in the order of their age, i.e., beginning with the lowest bed.

† It is worked by contract, the contractor being supposed to take out all the culm and support the roof after him with stones. They are paid at the rate of 1s. 5½d. per barrel of 50 stones to the barrel.

‡ In this and the following section the local names are used, for an explanation of which see glossary of local names, &c., at the end.



which lies to the north of where the stream that runs through this colliery divides into two.

	Ft. In.		Ft. In.
9. Drift,	42 0	3. Culm, with brass balls, No.	
8. Gray stone (gray grit),	12 0	III. coal,	1 0 to 1 3
7. Hard gray black shale,	39 0	2. Kelve,	0 5 to 0 9
6. Bluish black slate (compact shale),	2 0 to 3 0	1. Seat rock, white indurated clay,	4 0
5. Kelve,	0 5 to 0 9		
4. Clearing,	0 2		102 11

Section No. 5, 200 yards to east of last.

	Ft. In.		Ft. In.
8. Drift,	6 0	2. Kelve,	0 9
7. Hard bluish gray shale,	39 6	1. Seat rock, white indurated fine clay,	3 6
6. Black shale,	2 6		
5. Kelve,	0 8		
4. Clearing,	0 3		
3. Culm, with brass balls, No. III. coal,	1 3		54 5

The kelve got in this colliery is mixed with the culm by the colliers, as there is but a very small quantity of argillaceous matter in it, on which account it is good for lime burning. In the report on the Leinster Coal District, by Sir R. Griffith, Bart., there is a vertical section which proves Nos. II. and III. coal (see *Report of Leinster Coal Field*, p. 94, sec. 8). This section was taken in the south of the colliery, between Dinin river and the county boundary. In it, besides the beds of coal, there are two "coal rods" mentioned. The following is a summary of the section taken from his report:—

Section No. 6.

	Ft. In.		Ft. In.
15. Sandstone and shale,	54 0	7. Sandstone and shale, with clay ironstone,	137 8
14. Slaty coal, called kennal, 0 2		6. Coal rod,	0 4
13. Coal, 1 0	No. III. coal, 1 6	5. Fire clay,	0 6
12. Soft slaty coal or kelve, 0 4		4. Sandstone and shale, with clay ironstone,	50 0
11. Fire clay,	2 0	3. Coal, No. II. coal,	1 0
10. Sandstone and shale,	6 2	2. Seat clay and seat rock,	3 0
9. Coal rod,	0 1	1. Sandstone and slate clay,	17 6
8. Fire clay,	0 3		274 0

This coal has not been worked in the Queen's County, except in Clogrenan. It is most likely that the eastern out crop runs north towards the Coorlaghan colliery, but of that there is no direct evidence. The western out crop has not been proved, but it is supposed to run as it is marked on the map. The "brass balls" are pieces of the stems of sigillaria, which are now either pure iron pyrites or iron pyrites mixed with quartz. The latter kind, when broken open, has a very pleasing effect, and very fine specimens are to be got at the new pits. In the bed No. 6, Sections No. 4 and 5, masses of the bivalves mentioned in the general description have been found, together with plants, and with these is associated the crustacean before mentioned, for which this, as yet, is the only known Irish locality (see *Proceedings of the Geological Society, Dublin, 1858*). In the bed No. 8, Section 3, ferns and stems of plants were found.

*Coolcullen, Agharue, and Ridge Collieries.*—The collieries of Coolcullen, Agharue, and Ridge lie to the S.S.W. of Bilboa, and are in the counties of Kilkenny and Carlow. The coal there worked is the same as that worked at Bilboa (No. III. coal). The coal crops where it does in consequence of the denudation which formed the valleys in which the Dinin and Coolcullen

river flow. If these valleys had not been formed, its out crop would have run along the south-east face of the ridge which now separates these valleys from the valley of Old Leighlin. The debris of the grits that overlie the coal can be traced running N.E. along the southern and eastern slopes of Gallows Hill. This coal has not been worked here for some time, and no proper section of the work could be got. One of the colliers gave me the following as the order of the rocks:—

Section No. 7.

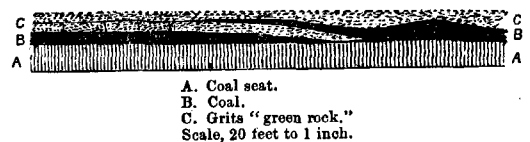
	Ft. In.		Ft. In.
6. Strong olive grit, with beds full of debris of plants,	—	2. Foundation (fire clay)	3 0
5. Black shale,	—	1. Indurated dark gray clay,	—
4. Black shale, full of bivalves, 2 0 to 3 0			7 6
3. Culm, No. III. coal,	1 0 to 1 6		

No. 1 and 2 are very well seen in Coolcullen river, to the east of Millfall House, where they are brought to the surface by a slight upthrow to the east. No. 6 is a most typical bed over this coal, as will be hereafter seen. The bed marked above as No. 4 has the same bivalves as those mentioned in the general description.

*Coorlaghan Colliery.*—The Coorlaghan colliery lies due west of Carlow, and N. by E. of Bilboa. The coal that was worked in it seems to have been the same as that worked at Bilboa, namely, No. III., but here the nature of the measures has changed. Over the coal, in place of shale we have grit, which comes in in a very peculiar manner. We are indebted to Harman Fitzmaurice, Esq., for the following description and sketch of these remarkable beds. The colliery was first worked at the out crop of the coal to the east, and after they had gone west some distance the coal died out in a point (see fig. 11), the overlying grit coming nearer and nearer to the seat rock till at

Fig. 11.

Overlap of beds in Coorlaghan Colliery.



last it rested on it. This grit became the seat rock of another coal, which made its appearance where the first coal began to thin; but this grit remained the seat of the second coal for only a short distance, when it disappeared, and the second coal rested on the continuation of the same seat (a shaly black impure fire clay) as that which was under the first coal. This remarkable formation was repeated two or three times in the workings that are now abandoned. This coal was on an average nine inches thick, but it sometimes thickened to eighteen inches. When it did thicken it always was in the upper portion or "into the roof." The old colliery was bounded on the east by the out crop of the coal; on the south the coal got thin and bad, and was not worth working; and on the west and north it was cut off by a fault running N.E. and S.W. This fault is a downthrow to the N.W.

The coal was worked by a level from the face of the hill, until they came to the upthrow to the N.W. They are now sinking to the west of that fault, where they expect to find the same coal; but the measures in which they are sinking seem to be those over No. II. coal, of which the out crop is to be seen in the old lane, to the north of this townland. Due south of Coorlaghan colliery, at the south of the glen, on the townland boundary, a little to the south of an old road, there is a coal which seems the same coal, No. III., as was worked at Coorlaghan, as it has the same

typical under clay. There seems to be an east and west fault between this latter place and the old colliery. To the north-west of this colliery, No. I. coal is seen in the stream of the glen, in the townland of Keeloge.\*

*Towlerton and Ardteggie Collieries.*—To the N.N.W. of Coorlaghan colliery, lie the Towlerton and Ardteggie collieries where No. III. coal was worked. These collieries are very much cut up by faults. To the south-west of Towlerton, there is an upthrow which throws the coal completely out of the ground. A little to the north of the boundary, between Towlerton and Ardteggie, there is a downthrow to the north of nine yards, running E.N.E. and W.N.W. Seven hundred feet to the southward of this, there is a parallel fault between which and the Coorlaghan colliery, no trial for coal has as yet been made. From these collieries the pillars are now being taken out, to do which they support the roof with timber, a process which here, as elsewhere, is called "robbing the pillars." No extension of regular work is going on at present. For a section of these collieries, see Sir R. Griffith's Report on Leinster Coal Field, page 100. To the east of these collieries, in the townland of Coornariska, the No. II. coal was proved. To the north of Towlerton House, in the townland of Woodlands, there was an old boring proving two coals; but what coals they are we are not prepared to say. The following is a summary of the borings from Sir R. Griffith's report:—

Section No. 8.			
	Ft. In.		Ft. In.
8. Clay and gravel, . . . . .	35 2	3. Blue shale, . . . . .	1 5
7. Shale and grit, . . . . .	22 10	2. Coal, . . . . .	1 0
6. Coal and culm, mixed with shale, . . . . .	1 7	1. Fire clay, . . . . .	2 0
5. Fire clay, . . . . .	9 1		
4. Grit, . . . . .	37 8		111 9

*Corgee, Rushes, Pauliteen, and Glen Collieries.*—To the N.N.W. of Towlerton House lie the Corgee, Rushes, Pauliteen, and Glen collieries, in which are No. I., II., III., and IV. coals, all well shown. No. I. is found on the top of Gale Hill. Pits were sunk on it; but, as it was only six inches thick, they did not pay and were abandoned. About 230 feet above No. I. coal, is a group of flagstone beds; these are well seen to the north of Corgee Cross, and to the east of Kingscote old colliery. Eighty feet above these flags is No. II. coal, called here the Kingscote coal; it is about twelve inches thick. One hundred and sixty feet above that is No. III. coal; it has been worked here in the Rushes, Corgee, Pauliteen, and Glen collieries. In the Rushes, near the road from Castlecomer to Athy, the roof of the coal was a shale, but as they went to the south, it changed into a grit. In this colliery, No. IV. coal was about 130 feet over No. III. coal, and was called "Ward's Seam." The following section at the Rushes is from Sir R. Griffith's report:—

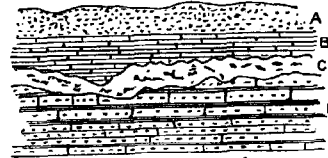
Section No. 9.			
	Ft. In.		Ft. In.
9. Gray grit, hard and coarse grained, . . . . .	15 0	4. Solid coal, . . . . .	1 6
8. Dark blue shale, . . . . .	20 0	3. Culm, . . . . .	0 3
7. Grayish blue micaceous shale, . . . . .	2 0	2. Coal, mixed with shale, . . . . .	1 3
6. Clay ironstone, . . . . .	0 3	1. Dark gray fire clay, . . . . .	3 0
5. Gray grit, . . . . .	10 6		53 9

In the gray sandstone, No. 9 of that section, there is a remarkable irregular bed, full of the debris of plants, and generally resting on an eroded

\* The coal at Coorlaghan Colliery was sold at the pit's mouth for 1s. per cwt.

surface of the underlying beds. This bed is very well seen in a quarry to the north-east of the Rushes' old engine house, (see figure 12). As before

Fig. 12.  
No. 9, in Section No. 9.



A. Drift.  
B. Grits.  
C. Irregular bed full of fragments of Plants.  
D. Grits with partings.

remarked, in the description of the Ridge colliery, this bed is most typical, being found nearly everywhere over No. III. coal. This colliery is cut off from the Corgee and Pauliteen collieries by a trouble (see Sir R. Griffith's Report, page 33). Corgee and Pauliteen collieries are divided by an anticlinal curve, along the axis of which there is a fault. The fault begins at the out crop of the coal, at which spot there is no displacement, but it increases as we go south, till, on reaching the new road, there is an upthrow to E. of 32 yards. These collieries are very much cut up with troubles, and what the colliers call faults.\* A very remarkable one runs between the Pauliteen and Glen collieries. The coal is all cut away as if by a stream of water, and the place where the coal ought to be is filled by stones and rubbish; this runs nearly down the new road. There is another trouble runs nearly east and west to the north of the Glen winding shaft, in which the coal is mixed with sand, and not worth taking out. In the Corgee colliery, at the north of the anticlinal axis, there was a large space in which the coal grew so thin that it was not worth "getting." None of these collieries are now at work except the Glen.

The following section of the winding shaft was given by the proprietor, B. B. Edge, Esq.:—†

Section No. 10.			
			Ft. In.
16. Drift, . . . . .			15 0
15. Loose brown shale, with clay ironstone, . . . . .			18 2
14. Grayish brown shale, with clay ironstone, . . . . .			54 4
13. Blue shale, with clay ironstone, . . . . .			4 0
12. Coal, . . . . .			0 5
11. Fire clay, mixed with coal rod, . . . . .	} the double seam, No. IV. coal {		4 4
10. Gray stone, . . . . .			12 0
9. Gray stone bind (gritty shale), . . . . .			6 0
8. Gray rock (in thick beds), . . . . .			36 0
7. Dark gray rock (curled and calcareous), . . . . .			6 0
6. Black rock (indurated shale ferruginous), . . . . .			48 0
5. Blue shale (arenaceous, with pyritic ironstone), . . . . .			21 0
4. Blue stone (hard, gritty, pyritic shale), . . . . .			2 6
3. Black slate, . . . . .			1 6
2. Coal, No. III. coal, . . . . .			1 1
1. Fire clay, full of coal rod, thickness unknown, . . . . .			—
			230 4

\* Fault is a very universal term with the colliers. When coal crops out, when it is replaced by any other substance, or when it thins out and becomes not workable, it is said to be either cut out by a fault, or that it is faulty ground. Troubles are when the coal is mixed with earth, sand, or other impurities, which deteriorate its value or make it not worth getting.

† We must here return our thanks to B. B. Edge, Esq., for his courtesy and kindness in placing his maps, sections, time, and practical experience at our disposal; and also for drawing our attention to every thing remarkable and of interest in the neighbourhood.

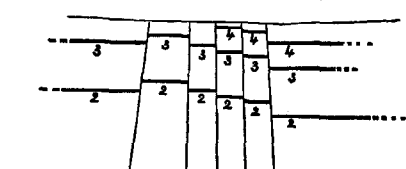


In this section, as we have a greater depth than 120 feet over No. III. coal, we have the representative of No. IV. (the double seam). Here its thickness is 4 feet 9 inches. As it will be interesting as we go on to see the thickness between Nos. III. and IV. coals, we shall record it in each place. Here they are 133 feet apart. This colliery is cut off to the west by a fault, which is an upthrow to the west.\*

**Ballylethane Colliery.**—The Ballylethane colliery lies to the north of the Glen colliery, from which it is divided by a step fault, which runs nearly east and west; this fault has five steps in it (see figure 13). This colliery is not worked at present; it extends to the north into Sheet 35 S.E., or 128.†

Fig. 13.

Step fault to the South of Ballylethane.



**Meeragh Colliery.**—To the west of the Glen colliery lies the Meeragh colliery, in which No. III. coal seems to lie nearly in a basin. Its out crop has only been proved on the north side, where it is at present being worked, and to the south, where a pit was sunk which proved its out crop, and also proved No. II. coal. The details of this section are not forthcoming, but the following thicknesses are said to be correct:—

## Section No. 11.

	Ft.	In.		Ft.	In.
5. Drift,	126	0	2. Grits and shale,	120	3
4. Coal smut, No. III.			1. Coal,	1	3
coal,	2	6			
3. Fire clay,	3	6		253	3

At the north of the basin the following section of the pit, now being worked, was procured through the kindness of Mr. Delany:—

## Section No. 12.

	Ft.	In.		Ft.	In.
12. Drift,	12	0	6. Black pyritic grit,	0	8
11. Decomposed yellow sandstone,	15	0	5. Black slate,	0	3
10. Yellow sandstone, with bed full of debris of plants,	24	0	4. Coal,	1	2
9. Black rock (hard, sandy, black shale),	30	0	3. Clayey culm, } No. III. coal, {	1	0
8. Blue bind, with pyritic balls,	18	0	2. Shaly black clay,	0	8
7. Black slate,	12	0	1. Seat rock, indurated fire clay,		
				114	9

Nos. 5 and 6 of the above section vary in thickness, and are often want-

\* The coal is an inferior coal, mixed with culm. The two substances are sold together at the pit's mouth for 3½d. per cwt.

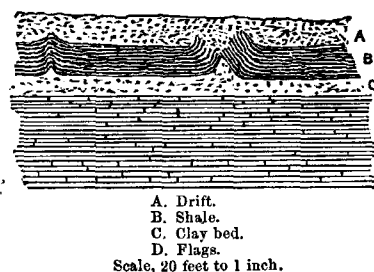
† Trial pits are now (November, 1858) being made in this colliery. See explanation of Sheet 128 (Quarter Sheet 35 S.E.)

ing. No. 10 is a typical bed before remarked in describing the Rushes colliery. Here it is a good sandstone, like the Gornal sandstone got in the South Staffordshire coal field, and is used to make sharpening stones for scythes, knives, &c.

**Newtown and Hollypark Collieries.**—The Newtown and Hollypark collieries lie to the south of the last mentioned, and are separated from it by a step fault, which was proved by Mr. Delany, who tried for coal just where the fault is marked on the map. In Hollypark they are working No. II. coal. In Newtown they worked out Nos. III. and IV. coal, but have not as yet taken out any of No. II. The Hollypark colliery is nearly a "maiden colliery,"\* and the edge of the coal has not yet been proved; but it must necessarily be not far from the place where it is marked on the map. Under this coal we have the same flags as those which we find at Corgee. These flags can be raised of an average size of 12 feet square. The largest flag ever raised here was 22 feet long by 12 feet wide. On the top of these flags lies a bed of clay; and above the clay we find olive shale; this olive shale is crushed in a very curious manner (see figure 14).

Fig. 14.

Crushed Shale in Flag Quarry, Farnans.



The following is a section of one of the pits at present at work at Hollypark, given me by one of the colliers:—

## Section No. 13.

	Ft.	In.
7. Drift,	5	0
6. Black bind,	60	0
5. Black slate (compact shale),	1	0
4. Clearing (black smut),	0	2
3. Good coal,	1	0
2. Steel or bottom coal,	0	4
1. Seat gray rock,		
	67	6

No. 1 in the above section is a hard grit, and has never been cut into. In working the coal they take out No. 5 to give headway; they then take all the coal, and support the roof behind them with stones.†

In the Newtown colliery a very deep bore hole was put down by the Grand Canal Company's agent in the bottom of a pit that was situated a little to the west of the crossroads that lies to the east of where L in Slieve-margy is engraved on the one-inch map.

\* "Maiden colliery" is a local term for a colliery that has not been previously worked.

† The culm is sold at the pit's mouth for 3½d. per cwt.; the coal for 8d. and 9d. according to the season.

The following copy of the account of the beds passed through, was given me by B. B. Edge, Esq. :—

## Section No. 14.

	Ft. In.		Ft. In.
Old pit, . . . . .	141 0	19. Blue stone, in thin beds, with parting, . . . . .	8 3
44. Coal, No. III., . . . . .	3 4	18. Gray stone, . . . . .	1 1
43. Fire clay, . . . . .	4 0	17. Parting, . . . . .	0 6½
42. Gray stone, . . . . .	4 6	16. Gray stone, . . . . .	0 6
41. Blue shale, . . . . .	7 4	15. Blue stone bind, . . . . .	0 7
40. Gray stone, . . . . .	97 7	14. Gray stone, . . . . .	1 9
39. Clay ironstone, . . . . .	0 6	13. Blue shale, with clay ironstone, . . . . .	62 7½
38. Gray stone, . . . . .	20 11	12. Black shale, with clay ironstone, . . . . .	9 6
37. Gray stone bind, . . . . .	8 11	11. Blue shale, . . . . .	0 9
36. Blue shale, . . . . .	2 4	10. Gray stone, . . . . .	0 5
35. Clay ironstone, . . . . .	0 5	9. Blue shale, . . . . .	0 11
34. Blue shale, . . . . .	5 9	8. Gray mine, . . . . .	0 2
33. Clay ironstone, . . . . .	0 4½	7. Blue shale, . . . . .	4 4
32. Blue shale, . . . . .	3 3	6. Black shale, . . . . .	2 0
31. Clay ironstone, . . . . .	0 7	5. Gray mine, . . . . .	0 3
30. Blue shale, . . . . .	11 5	4. Black shale, . . . . .	0 11
29. Coal (No. II. coal), . . . . .	1 4	3. Black sandstone, . . . . .	0 2½
28. Fire clay, . . . . .	3 2	2. Black shale, . . . . .	5 6
27. Gray stone, . . . . .	29 4½	1. Blue stone, . . . . .	3 1
26. Arenaceous shale, . . . . .	20 8	Short of real depth, . . . . .	6 10½
25. Blue stone (siliceous shale) . . . . .	1 0		
24. Gray stone, . . . . .	23 3		
23. Arenaceous shale, . . . . .	17 4½		
22. Gray stone, . . . . .	34 4½		
21. Gray stone bind, . . . . .	14 0		
20. Blueshale, with clay ironstone, . . . . .	30 0		
			597 0½

This section shows the position of Nos. II. and III. coal, but it is not deep enough to reach No. I. coal, as that lies about 350 feet below No. II. coal, while this boring only reached to the depth of 250 feet below it.

The following section given me by B. B. Edge, Esq., shows the position of Nos. II. and III. coals. It was before published by Sir R. Griffith.—(See his Report, p. 126.)

## Section No. 15.

	Ft. In.		Ft. In.
22. Drift, . . . . .	75 0	10. Gray slaty grit, . . . . .	9 2
21. Blue shale, . . . . .	6 0	9. Gray calcareous grit, . . . . .	12 0
20. Coal, . . . . .	1 0	8. Blue shale, . . . . .	3 0
19. Fire clay, . . . . .	0 8	7. Gray calcareous grit, . . . . .	5 2
18. Coal, . . . . .	0 10	6. Micaceous shale, . . . . .	0 9
17. Fire clay, . . . . .	1 0	5. Gray calcareous grit, . . . . .	8 11
16. Grit, seat rock, . . . . .	4 4	4. Micaceous slaty grit, . . . . .	22 0
15. Blue shale, . . . . .	4 2	3. Black shale, . . . . .	35 8
14. Gray slaty grit, . . . . .	6 0	2. Coal, . . . . .	3 8
13. Gray calcareous grit, . . . . .	1 0	1. Coal seat, . . . . .	3 7
12. Black shale, with ironstone, . . . . .	1 6		
11. Gray calcareous grit, . . . . .	0 10		
			206 3

Here No. IV. coal is only 3 feet 6 inches thick, and it is only 114 feet above No. III. coal.

The following section was copied from Mr. Ahern's bore book, through the kindness of Mr. Edge :—

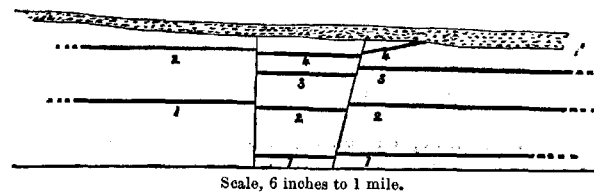
## Section No. 16.

	Ft. In.		Ft. In.
18. Drift, . . . . .	55 11	9. Blue shale, with iron mine, . . . . .	3 3½
17. Stony clay and coal smut, . . . . .	3 0	8. Gray rock, . . . . .	1 1
16. Strong clay, . . . . .	7 1	7. Blue shale, with iron mine, . . . . .	6 2
15. Soft brown stone, . . . . .	3 10	6. Gray rock, . . . . .	14 0
14. Soft blue slate, . . . . .	3 8	5. Stone bind, with iron mine, . . . . .	21 10
13. Strong slate, with "cat heads" and ironstone, . . . . .	3 0	4. Stone bind, with layers of hard stone, . . . . .	13 1
12. Slate, with ironstone (sank to this), . . . . .	16 1	3. Blue shale, with iron mine, . . . . .	14 4½
11. Blue shale (bored from this) . . . . .	1 6	2. Black shale, . . . . .	3 7
10. Gray rock, . . . . .	2 2½	1. No. III. coal, . . . . .	3 4
			177 0½

This pit was sank on the out crop of No. IV. coal, as seen by No. 16 and 17. No. 13 is a most remarkable bed, and will be referred to when we are speaking about the Geneva colliery, as there it is found at the same distance over No. III. coal.\*

The beds of this colliery are cut off to the south by an east and west fault, which at its greatest displacement is a downthrow to the north of fifty yards, so that at the south of it there is only a very small patch of coal. To the north of this E. and W. fault there are a pair of N. and S. faults (see fig. 15). These

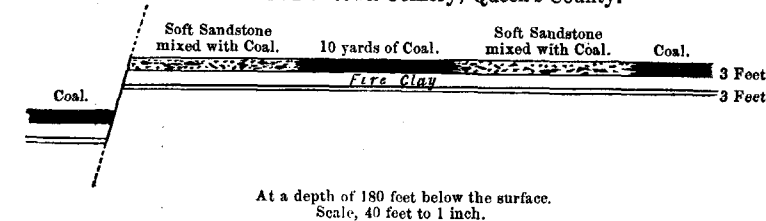
Fig. 15.  
Wedge fault at Newtown.



begin together at a little to the north of Newtown crossroads, and get farther and farther apart as they go south. The western of these faults, when it reaches the E. and W. fault, has a displacement of fifty yards, being a downthrow to the east, throwing out the coal altogether to the west. The eastern fault, at its maximum displacement, is only eleven yards downthrow to the west. At the east of this fault there is a "trouble" (or deterioration of the coal), which begins at a point in the same place with the faults, and increases in size until it comes to a maximum width of forty yards. In the centre of this trouble there was a ridge of good coal ten yards wide (see fig. 16). This colliery

Fig. 16.

Trouble in Newtown Colliery, Queen's County.



being now abandoned, it is impossible to examine this trouble; but from what could be learned, it seems that sand and other impurities were mixed with the carbonaceous matter at the time of its deposition all over the "troubled" part, except in the ten yards wide ridge, while the coal unmixed with sand was being deposited all around.† The cause of the phenomenon

\* "Cat heads" are nodules of very hard curled green ferruginous spheroidal grits, found in shale beds, with nodules of ironstone. These "cat heads" are sometimes called "stone mine," and the beds they are in are sometimes called "boulder beds." † Similar occurrences happen in several places in the South Staffordshire coal field and others. In South Staffordshire the place of the coal is sometimes taken by pure sandstone; it is then called by the colliers a "rock fault." Sometimes the two substances are intermixed either in irregular layers, patches, or in small more or less irregular beds. There it is then called "rock and rig." Good workable portions of unmixed coal occur also in the midst of this "troubled" part, as mentioned above by Mr. Kinahan, so that in some cases the pieces of good coal met with pay for the expense of exploring the part which is worthless. These irregularities are very interesting, as bearing on the question of the exact method of the formation of coal. They seem to me to prove its subaqueous deposition, at all events in the parts where they occur.

J. B. J.

C

is not very easy of explanation. This trouble was continued to the south of the E. and W. fault, but the N. and S. fault, which bounded the trouble on the west, was not continued to the south of the E. and W. fault.

At about 700 feet to the west of the N. and S. fault, No. II. coal was "got," at a depth of 120 feet. At the south-east of this colliery, to the east of the stream, the same coal was "got," at a depth of sixty feet; it was worked here for some time. The out crop was never proved, but must run nearly where it is marked on the map. There is a section near this in Griffith's Report, p. 123. Due south of the Newtown colliery, a little to the east of the juncture of the two streams, at the depth of seventy-five feet, No. II. coal was found (see *Sir R. Griffith's Report*, p. 122, sec. No. 25). A little to the west of this trial, to the south of the river, and north of a farmhouse, a coal was got at 216 feet. The bore book of this is not forthcoming; but at that depth there were found fourteen inches of coal and five feet of kelve. This is supposed by B. B. Edge, Esq., to be No. III. coal. If it is, there must be a very large downthrow to the west, between the last-mentioned trial pit and this; and on the hill to the north-west, No. IV. and V. coal, or their representatives, ought to be found. I should be inclined to think this is No. II. coal, and that there is a slight downthrow to the west between this and the last trial pit, and that No. III. coal will be found in the before-mentioned hill, as shown in Section No. 1 in the sheet of engraved sections illustrative of this map.

*Mayo Colliery*.—To the S.S.E. of these trial pits lies the Mayo colliery. In this colliery there is no workable coal within 300 feet of the surface, as B. B. Edge, Esq., has made a trial to that depth, of which the following is the account:—

#### Section No. 17.

	Ft. In.		Ft. In.
44. Drift,	36 0	21. Blue bind with beds of clay ironstone,	9 6
43. Soft black shale, A trace of	3 0	20. Blue slate with beds of clay ironstone,	7 0
42. Fire clay and coal was } found here,	3 0	19. Black slate (sunk to this),	4 0
41. Blue bind and black slate,	13 8	18. Black slaty sandstone (bored from this),	2 0½
40. Coal,	0 4	17. Stone bind,	5 8½
39. Fire clay,	1 4	16. Dark gray stone,	3 9½
38. Seat rock,	2 0	15. Gray stone bind, with hard thin bands,	4 8½
37. Blue bind,	6 6	14. Soft blue shale,	0 8
36. Black stone extremely hard,	1 6	13. Soft black shale,	0 4
35. Strong blue bind,	8 0	12. Culm, kelve and shale mixed,	1 8
34. Kind gray stone,	9 0	11. Black fire clay,	0 9½
33. Blue stone bind, with clay ironstone and hard bars,	25 0	10. Kind blue grits,	1 0½
32. Gray stone with bind partings	15 6	9. Blue slaty stone with partings,	3 8
31. Blue stone bind,	5 6	8. Hard gray stone with partings,	8 9½
30. Bluish gray stone curled and calcareous,	3 2	7. Slaty stone, with very hard bands,	12 0
29. Blue stone bind,	7 8	6. Blue bind,	3 4
28. Gray stone extremely hard,	1 0	5. Blue soft parting,	0 3
27. Blue stone bind,	18 9	4. Blackish shale, with strong bands,	5 2
26. Very strong gray stone bind,	9 0	3. Blue arenaceous shale,	13 3
25. Blue stone bind, with clay ironstone,	11 10	2. Very strong blue stone bind,	8 8½
24. Bluish gray stone curled and calcareous,	3 0	1. Very hard gray stone,	8 3½
23. Arenaceous blue bind and beds of clay ironstone,	12 4		303 2½
22. Clay ironstone in very large nodules,	0 5		

The following section is a little south of *r* in Church, as engraved here on the one-inch map:—

#### Section No. 18.

	Ft. In.		Ft. In.
16. Drift,	45 0	6. Blue shale,	12 4
15. Stone bind,	12 6	5. Stone bind,	7 7
14. Hard stone,	18 0	4. Kind black slate,	2 6
13. Blue and gray bind,	50 4	3. Coal and culm mixed with kelve and shale,	1 8
12. Strong stone bind,	7 5	2. Black seat earth,	1 10
11. Hard gray stone,	3 6	1. Blue bind,	0 9
10. Blue bind,	17 3		
9. Stone bind,	16 6		218 5
8. Stone and stone bind,	16 6		
7. Stone bind,	5 0		

By these sections we see that the coal is very badly represented in the measures hereabouts. What coal is represented by bed 3 in Section 18, and bed 12 in Section 17, it is hard to say; but as in Section 17 we have a coal (bed 40) 178 feet over it, and as this is very nearly the distance that ought to be between No. II. and III. coals, this coal (bed 12, Section 17) is most likely the representative of No. II. coal, and bed 40 the representative of No. III.\*

*Doonane Colliery*.—The Doonane colliery lies to the south-west of Newtown, at the boundary of the Queen's County. Nos. II. and III. coals are contained in it. No. III. coal is continued into the county Kilkenny, and was got in the Curragh colliery. No. III. coal is all worked out; No. II. coal has not been worked as yet. To the north of this colliery No. II. coal was worked for a short time, and the out crop of part of it proved. The out crop seems to have run as marked on the map. Towards the east it appears to have come down near the Newtown colliery, and then suddenly to have turned up to the north, the coal dipping, or, as the colliers would say, "going down head foremost" under No. III. coal in Meeragh colliery. The out crop of this coal was also proved to the south-east in a bore hole put down by the Grand Canal Company. This is a most instructive section, as it also proves No. I. coal. I am indebted to B. B. Edge, Esq., for this copy of the section:—

#### Section No. 19.

	Ft. In.		Ft. In.
40. Drift,	5 3	19. White grit,	4 9
39. Brown shale,	7 6	18. Gray slaty grit,	23 3
38. No. II. coal,	0 3	17. Blue arenaceous shale,	7 1
37. Fire clay,	1 6	16. Black shale,	18 1
36. Black shale,	3 7	15. Gray slaty grit,	42 7
35. Gray slaty grit,	6 9	14. Gray grit,	43 0
34. Gray grit,	7 7	13. Black shale,	28 4
33. Black arenaceous shale,	0 10	12. Clay ironstone,	0 4
32. Clay ironstone,	0 2	11. Blue shale,	55 0
31. Black arenaceous shale,	6 4	10. Gray slaty grit,	14 2
30. Clay ironstone,	0 1	9. Black shale,	9 0
29. Blue shale,	1 1	8. Coal, No. I. coal,	0 2
28. Clay ironstone,	0 5	7. Fire clay,	1 2
27. Black arenaceous shale,	8 6	6. Clay ironstone,	0 6½
26. Clay ironstone,	0 1½	5. Gray slaty grit,	1 8
25. Blue shale,	5 2	4. Black slate clay ironstone,	31 10
24. Clay ironstone,	0 1	3. Gray slaty grit,	0 7
23. Black shale,	1 3	2. Black shale with ironstone,	8 3
22. Gray slaty grit,	0 10	1. Very hard black stone,	13 7
21. Fire clay,	5 11		
20. Hard gray grit,	1 8		368 3

This is the only section in which No. I. coal was pierced. At the west of the Roman Catholic chapel in this colliery there is a U shaped synclinal

\* Mr. Edge's opinion of this colliery is, that all the measures worked through are those over No. III. coal, and that that coal has never been reached yet.

curve, along part of the axis of which there was a slight downthrow to the west, as marked in Section No. 1 of the sheet of engraved sections. Near Doonane bridge there is a downthrow of four yards to the west. This fault runs nearly N. and S. into the county of Kilkenny. The beds of this colliery are cut off at the south by a fault, which at the boundary of the two counties is a downthrow to the N. of fourteen yards. This fault must change its nature when it goes east, as it then seems to be a downthrow to the south between this and the Geneva colliery.

*Geneva Colliery.*—The Geneva colliery lies due east of Mill-bridge. In it they are working No. III. coal, and at present the colliery is in full work. The following is the section of the engine pit, received from B. B. Edge, Esq. :—

## Section No. 20.

	Ft. In.		Ft. In.
14. Drift,	42 0	6. Black slate,	3 0
13. Bind,	12 0	5. Kelve coal (called kennal),	1 0
12. Coal,	0 4	4. Black slate with pyritic iron-stone,	4 0
11. Indurated fire clay, 4 0 } No. IV. coal,	4 4	3. Good coal, 2 0 { No. III. coal	3 0
10. Strong blue bind with clay ironstone,	26 0	2. Bottom coal, 1 0 { with pyritic ironstone,	3 0
9. Strong gray stone,	15 0	1. Fire clay decomposed,	0 9
8. Strong blue bind with "cat heads" and clay ironstone,	75 0		192 1
7. Strong black bind,	6 0		

Here No. IV. coal is four feet four inches thick, and is 130 feet above No. III. coal. No. 8 in section 20 has not the "cat heads" all through the bed, but only in about four feet near the top. This remarkable bed is very well seen in the Dinin river, to the south of Mill-bridge. This bed was also found in the Newtown colliery at about the same heights over No. III. coal as seen at No. 13, Section 16. At the north of this colliery the coal is supposed to go up by steps (a step fault) to the Doonane colliery; to the east it thins out as it comes to the edge, and fire clay takes its place; to the west it has not been proved, but is most likely bounded by a downthrow to the east; to the south it was found near its outgoing, close to the Castle-comer and Carlow road, where there was the following section, given by B. B. Edge, Esq. :—

## Section No. 21.

	Ft. In.
4. Drift,	5 0
3. Shale,	46 0
2. Coal,	0 10
1. Fire clay,	3 4
	55 2

To the east of this, and north-east of Garrendenny Castle, there was a trial pit began by B. B. Edge, Esq., which is not yet finished. It seems to be in the measures over No. II. coal. Due south of Section No. 21, where the stream joins the old road, a bore hole was sunk 261 feet, and no coal was reported to have been found; but the borers are supposed to have falsified their returns, as they afterwards offered to prove near the same place a 34-inch coal. Due south of this, at the boundary of the County of Kilkenny, an 8-inch coal, with fifty-six inches of fire clay under it, was proved, at a depth of fourteen yards. This was supposed to be No. IV. coal.\*

\* Since the above was written I have again examined this place, and am now inclined to think that this is No. III. coal; that Section No. 22 was on its out crop; and that No. IV. coal is not represented in this colliery.—G. H. K.

*Kilgorey Colliery.*—Having now come to the Kilgorey colliery, there is a coal which was worked formerly under the Grand Canal Company, that seems to be No. IV. coal; it was thirteen inches thick, and was principally worked by "basset." The following is the account of the measures passed through in a bore hole on this coal :—

## Section No. 22.

	Ft. In.
4. Drift,	6 0
3. Bind, with clay ironstone,	38 4
2. Coal,	1 1½
1. Culm and kelve mixed (a clearing course),	0 5½
	45 10½

B. B. Edge is now making trials prior to working No. III. coal here. The following is the section of a bore hole now in progress :—

## Section No. 23.

(Communicated by B. B. Edge, Esq.)

	Ft. In.		Ft. In.
34. Drift,	12 0	16. Bluish gray stone,	4 8½
33. Brown earth and trecher,	6 2	15. Kind blue shale,	3 0
32. Blue shale,	7 4½	14. Grayish stone bind,	12 0½
31. Black shale,	0 4½	13. Blue arenaceous shale,	16 9½
30. Coal (probably No. III. coal),	0 6½	12. Blue slate clay,	12 6
29. Fire clay,	6 0	11. Black slate clay,	3 4
28. Black slaty sandstone,	24 0	10. Very soft gray argillaceous metal,	4 8
27. Soft black parting,	0 7½	9. Blue arenaceous shale, with clay iron stone,	8 7½
26. Hard gray stone bind, with partings,	22 2½	8. Blackish slate clay,	1 7
25. Blue stone bind,	12 0½	7. Extremely hard clay iron-stone,	0 2½
24. Blue shale, with clay iron stone,	4 7	6. Hard gray stone,	7 6½
23. Black slaty sandstone,	8 4½	5. Blue stone,	1 5½
22. Gray slaty sandstone,	3 3	4. Dark blue slaty sandstone,	2 1½
21. Soft blue parting,	0 7	3. Clay ironstone,	0 1
20. Hard bluish gray stone,	9 7½	2. Extremely hard dark gray stone,	0 1
19. Gray stone bind, with thin layers of sandstone,	14 9	1. Ditto, at present being bored,	0 0
18. Blue stone bind,	35 9½		272 3½
17. Blue arenaceous shale, with clay ironstone,	23 6½		

In No. 1 they are progressing very slowly, only at the rate of one inch per day. Mr. Edge thinks that bed No. 30 is No. III. coal, and that No. II. is wanting. I am inclined to think the same thing, and that the place where No. II. coal ought to be is between beds Nos. 10 and 11.

The following is a section of a bore hole on No. III. coal, near the bounds of the county Kilkenny, due north of the Monteen Colliery :—

## Section No. 24.

	Ft. In.		Ft. In.
12. Drift,	15 0	4. Hard coal, with brass balls (iron pyrites),	2 9
11. Stone,	3 10	3. Clearing course (coal sand and culm),	0 3
10. Stone bind,	21 7½	2. Black seat earth,	2 6
9. Kind gray stone,	22 0	1. Very hard stone,	0 4½
8. Blue shale, with clay ironstone,	7 4		105 7½
7. Black shale,	5 7½		
6. Blue shale, with clay ironstone,	18 4		
5. Black shale,	6 0		

*Monteen Colliery.*—South of Kilgorey, in the county of Kilkenny, is the Monteen colliery, the coal in which is a continuation of that last described. The following is the section of Mr. Brennan's engine pit, as given by one of the colliers:—

## Section No. 25.

	Ft.	In.
6. Drift, . . . . .	18	0
5. Blue bind, . . . . .	21	0
4. Gray stone, . . . . .	2	8
3. Black bind, . . . . .	17	5
2. Black slate, . . . . .	0	11
1. Coal, with brass balls, No. III. coal, . . . . .	2	10
	62	10

Between the N. and S. fault, marked in the map on the county boundary, there was a bore hole made by Mr. James Brennan, proving No. IV. coal.\* He was kind enough to give me the following section of it:—

## Section No. 26.

	Ft.	In.		Ft.	In.
8. Drift, . . . . .	7	2	3. Bind, very kind, . . . . .	0	7
7. Rock, . . . . .	2	6	2. Coal, No. IV. coal, . . . . .	0	5
6. Gray bind, . . . . .	2	6	1. Seat, . . . . .	2	8
5. Stony gray bind, . . . . .	13	8			
4. Blue bind, with mine, . . . . .	13	10		43	4

This colliery† seems to be bounded on the east by the out crop of the coal, as marked on the map; on the west it is bounded by a N. and S. fault, which is an upthrow to the east. This is well seen where it crosses the county boundary. To the west of this fault there must be a downthrow to the east, which brings up No. III. coal in the Rushnowle colliery, where that coal was formerly worked, but is now worked out.

*Coolbaun Colliery.*—The Coolbaun colliery is in a sub-denomination of the Lordship of Castlecomer. It lies to the west of Monteen colliery; in it we have Nos. III., IV., V., and VI. coals. In Sir R. Griffith's report there is a section showing the relative distances between III., IV., and V. coals. A copy of it is given below as it is the only section obtainable of these upper measures.

## Section No. 27.

	Ft.	In.		Ft.	In.
21. Drift, . . . . .	10	0	10. Coal, . . . . .		
20. Blue shale, . . . . .	22	0	9. Fire clay, . . . . .		
19. Ironstone, . . . . .	0	2	8. Coal, . . . . .		
18. Black shale, . . . . .	2	10	7. Fire clay, . . . . .		
17. Ironstone, . . . . .	0	2	6. Blue arenaceous shale, . . . . .	37	0
16. Blue compact shale, . . . . .	11	11	5. Gray sandstone, part of it		
15. Ironstone, . . . . .	0	1	slaty, . . . . .	29	3½
14. Black shale, . . . . .	6	4	4. Blue arenaceous shale, with		
13. Coal, No. V. coal, . . . . .	3	0	ironstone, . . . . .	19	8½
12. Coal seat, . . . . .	3	0	3. Blue shale, with ironstone, . . . . .	13	10½
11. Blue shale, with plants and			2. Black shale, . . . . .	4	10
small nodules of iron py-			1. Coal, No. III. coal, . . . . .	2	10
rites, . . . . .	17	10			
				189	10½

In this section the compound seam forming No. IV. coal, is five feet thick, and is only 104 feet over No. III. coal. No. V. coal is twenty-seven feet over No. IV. The only section in all the district that we have gone over that has the measures in which No. V. coal ought to be, is Section 10. There the measures are shales, like those in beds No. 6 and 11, of Section No. 27; but no coal, or trace of coal, was found. In Section No. 27, bed No. 13,

\* Subsequent examination has made me more inclined to think this is No. III. coal.—G. H. K.

† The coal is sold here for the following prices:—best coal, 8d.; second, 7d.; Culm, 3d. per cwt.

is returned as entirely coal, but its proper section is as follows: as it was on account of the intervening bed, between the coals, that it got the name of the Stoney coal.

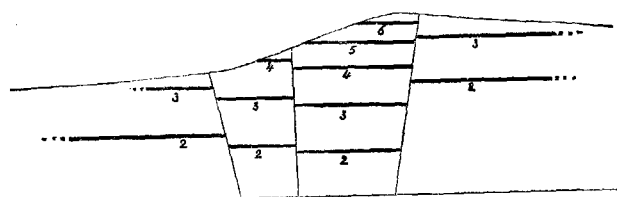
## Section No. 28.

	Ft.	In.	Ft.	In.
3. Coal, . . . . .	0	9 to 1	3	
2. Pyritic earthy kelve, . . . . .	1	3 to 0	4	
1. Coal, . . . . .	1	0 to 1	5	
			3	0

No accounts of any of the pits sunk through No. VI. coal are now forthcoming; but it is said to be about forty-five feet above No. V. coal. Nos. IV., V., and VI. coals, are brought in here by means of a double wedge-fault (see map and sections). To the south this complex fault begins somewhere towards Castlecomer, splitting into two branches as it approaches the Rock colliery. The most southern of these branches, called by the colliers "the main fault," runs across Coolbaun hill, with the bearing of N. 35° E., and dies out at the old road, where its termination is marked on the map. At its maximum displacement, it is an upthrow to the south of eighty yards. The northern fault goes round the hill; when it has proceeded about 700 yards it also divides into two branches, the northern branch being at its greatest displacement a downthrow of thirty yards to the south, while the middle fault is a downthrow to the south of five yards (see fig. 17.) These

Fig. 17.

Double wedge fault on Coolbaun Hill.



Scale, 6 inches to 1 mile.

branches again meet at about 300 yards from the east end of the main fault, which, here at the juncture of the three, is an upthrow to the south of five yards. These faults have been proved everywhere, except at the south-west. To the south of the old castle, on Coolbaun hill, where marked on the map, there is a downthrow to the south of five feet, which brings in a small patch of No. III. coal on the south side of the hill. No. VI. coal is nearly all worked out, and as it lay on the surface it was worked by "basset work;" it was twenty-two inches; it broke up into cubes, and was the colour of purple copper ore. No. V. coal is being worked at present; they are working it on the old system, of sinking a number of pits, and are thereby losing a quantity of money and labour, which, if they worked it properly, they would save; very little of No. IV. coal has been taken from it as yet. It is at present being worked by Mr. Samuel Bradley. At the out crop of this coal, between the two southern faults in the new adit level, the following section was noted:—

## Section No. 29.

	Ft.	In.
4. Coal, . . . . .	1	0
3. Fire clay, . . . . .	3	4
2. Coal, . . . . .	1	2
1. Fire clay, . . . . .	2	0
	7	6

The fire clay diminishes towards the middle fault, and at the northern side of it the beds have the thickness noted below:—

Section No. 30.		Ft. In.
4. Coal,	.	1 0
3. Fire clay,	.	2 4
2. Coal,	.	1 2
1. Fire clay,	.	1 6
		6 0

Making a difference of one foot six inches in the thickness of the seam, in seventy feet distance.\*

No. III. coal has all been worked to the north of the main fault; to the south some of it still remains, the colliers being driven out by the water. There is now a deep adit, being opened by Mr. S. Bradley, for the purpose of letting off the water, and taking out the remainder of the coal.†

Sir R. Griffith gives a section on this hill of Coolbaun, which proves the existence of No. II. coal. Of this the following is a summary (see *Report on Leinster Coal Field*, p. 116):—

Section No. 31.		Ft. In.
10. Shale, with clay ironstone,	39 1	4. Grits and a few shale, 85 10½
9. No. III. Coal,	3 0	3. No. II. Coal, 0 6½
8. Coal seat,	6 2	2. Fire clay, 7 8
7. Sandstone and shale, with clay ironstone,	38 6	1. Grits, 61 3½
6. Coal,	0 3	
5. Coal seat,	3 7½	246 0

In this section we have a coal rod, and its accompanying fire clay, Nos. 5 and 6, which must be remarked, because I have never met any thing like it in any section hereabouts. In Section 8 there are two coals, which are the same distance apart. They may or may not be the same coals.‡

*Rock Colliery.*—To the S.E. of the colliery now described is another called the Rock colliery, which is bounded on the N.W. by the wedge-fault before mentioned, and on the S.W. by a fault running N.W. and S.E. See *Map*. The following is a section from this colliery, given in *Sir R. Griffith's Report*, p. 106:—

Section No. 32.		Ft. In.
13. Drift,	3 0	6. Blue shale, 0 8
12. Gray grit, with micaceous shale parting,	80 11½	5. Hard slaty grit, 1 6
11. Blue shale,	2 6	4. Blue shale, 2 4
10. Clay ironstone,	0 1½	3. Slaty grit, 1 10
9. Black compact shale,	2 1	2. Blue arenaceous shale, 5 1
8. No. II. coal,	2 8	1. Hard gray grit, 1 0
7. Black shale,	2 6	106 5

This is a most remarkable section, as there is no fire clay under the coal, and grits take the place of most of the shales over it; but we met the same grits in Section 31, bed 4, though there we have a very thin coal six and a-half inches, bed 3, and a remarkable thick bed of fire clay, seven feet eight

\* This coal could, I think, be worked to great advantage, and with very little expense, by running in two levels along the "end" to the main fault, then joining them by a cross course along the board; and then beginning at the main fault, and working to the out crop, bringing all the coal with them. If worked, as they have began, on the old system, much money will be lost in sinking pits, and winding.—G. H. K.

† Here I must thank Mr. S. Bradley for his courtesy while I was engaged in his neighbourhood. In fact, every one about this district, whether working in it or otherwise, appeared to be both willing and anxious to put themselves to trouble in order to give me information. G. H. K.

‡ The coals in the Coolbaun colliery are of different qualities, according to the bed of coal they are taken from, and are sold at 1s., 9d., and 8d., per cwt. The culm at 3½d. per cwt.

inches, bed 2; in place of the latter we have the shales, beds 6 and 7, Section 32. A smut of a coal has been found in a stream a little to the east of this, which is most likely the smut of No. II. coal, and the same coal as was proved in the west of Croghtenclogh (see *Griffith's Report*, p. 121, section 24). To the S.W. of the N.W. fault before mentioned there was a fifteen-inch coal found, which is most likely the same coal, No. II., but enough has not been proved about it to say for certain what coal it is. An outlier of No. III. coal seems to lie where 899 is marked on the one-inch map due south of Rushnowle colliery.

*Massford and Curragh Collieries.*—The Massford and Curragh collieries are in a part of the Lordship of Castlecomer, and form a continuation of those of Doonane and Coolbaun. In them we have Nos. II. and III. coals. No. III. is nearly all worked out; it has all been worked over, and they are now robbing the pillars, and, as one of the colliers said, "are not leaving a cinder in them."

The following section, taken a little to the north of the crossroads to west of Gazabo church, was procured through the kindness of Mr. Hall:—\*

Section No. 33.		Ft. In.
35. Old pit,	32 0	16. Gray and blue bind, with mine, 13 9½
34. Coal, No. III. coal,	3 0	15. Gray bind, with two thin rocks, 14 11½
33. Fire clay,	2 3	14. Stone bind, 4 7
32. Gray rock,	0 11	13. Hard gray stone, 1 1
31. Strong gray bind,	15 5	12. Stone bind, 1 7
30. Gray stone,	0 7	11. Hard white stone, 4 8½
29. Gray bind,	8 3	10. Gray bind and bury, 20 4
28. Hard blue stone,	2 4½	9. Blue bind, with mine, 22 5½
27. Gray bind,	4 8	8. Soft black slate, 0 8½
26. Blue bind, with mine,	9 7	7. Coal, No. II. coal, 0 3
25. Blue stone (hard siliceous shale),	0 8	6. Fire clay, 0 3
24. Gray bind,	1 4	5. Blue bind, 0 9
23. Gray stone, with partings,	5 6	4. Blue stone, with partings, 3 1
22. Gray bind,	6 3½	3. Gray bind, 3 2
21. Gray rock,	3 0	2. Dark blue bind, 11 1
20. Strong gray bind,	3 5½	1. Hard white stone, 0 8
19. Gray rock,	0 10½	
18. Stone bind,	1 1	239 9
17. Gray and white stone,	5 0½	

This section was taken a little to the south of O in Massford, as engraved on the one-inch map:—

Section No. 34.		Ft. In.
33. Drift,	23 0	15. Gray rock, 0 9½
32. Gray bind,	25 0	14. Gray bind and bury, 24 7½
31. Gray slate,	9 0	13. White and gray stone, 3 5½
30. Coal, No. III. coal,	3 0	12. Gray bind, 18 5½
29. Coal seat,	3 0	11. Blue stone, 9 1
28. Gray bind,	23 8	10. Gray bind, 23 8
27. Blue bind,	2 6	9. Blue bind, with mine, 15 3½
26. Gray stone,	1 0	8. Black slate, 10 10
25. Gray bind,	2 6	7. Mine, 0 2
24. Blue bind, with mine,	6 0½	6. Black slate, 1 10
23. Black bind,	4 9	5. Kelve, 0 5
22. Coal rod,	0 3	4. Soft parting, 0 4
21. Black bind and bury,	3 6	3. Good coal, 2 4
20. Gray bind,	0 5	2. Bottom coal, 0 8
19. Gray stone,	0 10½	1. Seat, 2 0
18. Blue and gray bind,	5 9	
17. White stone, with partings,	18 1	259 1½
16. Gray bind,	12 10	

\* To Mr. Hall, Mining Engineer and manager for the Lordship of Castlecomer, I am indebted for most of the information about these collieries, as well as for this and the following sections.



The following section is from a spot 250 yards to the west of the last :—

## Section No. 35.

	Ft. In.		Ft. In.
25. Depth of pit, including No. III. coal, . . . . .	89 2	9. Gray bind, . . . . .	1 7
24. Gray bind, with mine, . . . . .	11 11½	8. Gray stone, . . . . .	0 7
23. Black bind, . . . . .	3 9	7. Strong gray bind, with a little mine, . . . . .	10 8½
22. Thin shell of black rock, . . . . .	0 3	6. Gray and white stone, . . . . .	3 8
21. Gray bind, with mine, . . . . .	7 9½	5. Gray bind, with rock mine (cat heads), . . . . .	7 8½
20. Gray rock, . . . . .	2 1	4. Blue and gray bind, with mine, and a fine rock parting, . . . . .	45 9
19. Gray and blue bind, with mine, . . . . .	7 9	3. Blue slate, with slate mine, slate mine generally every 10 inches, and from 3½ to 12 inches thick, . . . . .	13 5
18. Black rock, with parting, . . . . .	2 0½	2. Black slate, . . . . .	1 9
17. Black bind, . . . . .	3 7	1. Coal kelve and mixture, No. II. coal, . . . . .	16 0
16. Hard black rock, . . . . .	0 2½		
15. Gray bung, . . . . .	3 1		
14. Hard gray stone, . . . . .	1 6½		
13. Gray bind, with mine, . . . . .	7 4		
12. White and blue stone, with parting, . . . . .	15 9		
11. Gray bind, with hard rock mine (cat heads), . . . . .	14 10½		
10. Gray rock, . . . . .	1 2½		
			273 6½

These three sections are most instructive, being all so near together, and yet so different. In Section 35 there are 153 feet between the second and third coals; in Section 34, 190 feet 4½ inches; and in Section 33, 168 feet. In Section 34 there is a coal rod (bed 22), 40 feet 5½ inches below No. III. coal; and although Section 35 is only 250 yards to the west of it, it has not a trace of it; in other particulars, these two sections are very much alike. In Section 33 there are more grits in the measures between the two coals, and No. II. coal is almost entirely wanting. We shall now compare these sections with the sections over what is called the Massford four-foot coal.

This section was taken a little to the south of the E. and W. fault :—

## Section No. 36.

	Ft. In.		Ft. In.
42. Drift, . . . . .	20 6	21. Gray bind, . . . . .	8 8
41. Seat rock, . . . . .	0 4	20. Gray bind, with mine layers, . . . . .	2 5
40. Parting, . . . . .	0 4	19. Blue bind, with layers of mine, . . . . .	14 4½
39. Gray bind, . . . . .	7 11	18. Rock mine, . . . . .	0 7½
38. Gray rock, . . . . .	3 10	17. Blue bind and slate, . . . . .	14 1
37. Gray bind, . . . . .	7 10	16. Black slate, with a little mine, . . . . .	7 11½
36. Black rock, . . . . .	1 1	15. Kelve, slaty, 2 5	
35. Black bind, . . . . .	9 3	14. Mine, . . . . .	0 1
34. Black rock, . . . . .	0 3	13. Kelve, slaty, 2 0½	
33. Gray bind, . . . . .	13 10	12. Shell of mine, 0 0½	
32. Gray and white rock, with parting, . . . . .	4 0½	11. Kelve, . . . . .	0 9
31. Gray bind, . . . . .	10 10	10. Coal, . . . . .	1 10½
30. Blue bind, with mine, . . . . .	9 1½	9. Parting, . . . . .	0 1
29. Gray bind, with rock mine (cat heads), . . . . .	13 4	8. Hard coal, . . . . .	0 9½
28. Gray and white stone, with one parting near bottom 3½ inches thick, . . . . .	3 0½	7. Parting, . . . . .	0 1
27. Gray bind, . . . . .	9 10	6. Kelve coal, . . . . .	0 5½
26. White and gray stone, part in layers, with partings, . . . . .	3 3	5. Seat, mixed with slate, 0 1½	
25. Gray bind, with rock mine (cat heads), . . . . .	13 8	4. Coal, mixed with slate, 0 4½	
24. Blue bind, . . . . .	7 0½	3. Black slate, . . . . .	0 5
23. Black stone, part in layers, with parting, . . . . .	4 11	2. Kelve coal, . . . . .	0 6½
22. Blue and white stone, part in layers, with parting, . . . . .	1 11	1. Kelve, mixed with slate and seat, . . . . .	0 7½
			205 0

South of the last, and a little to the north of the out crop of No. III. coal, we get :—

## Section No. 37.

	Ft. In.		Ft. In.
31. Drift, . . . . .	22 5	15. Gray bind, with 2 inches of rock mine (cat heads), . . . . .	4 8
30. Gray bind, . . . . .	3 8	14. Hard gray rock, . . . . .	12 5½
29. Gray sandstone, with partings, . . . . .	6 0	13. Stone bind, . . . . .	1 0
28. Gray bind, with mine, . . . . .	6 8	12. Gray rock, . . . . .	6 3½
27. Blue bind, . . . . .	2 1	11. Stone bind, . . . . .	0 8
26. Black bind, . . . . .	3 8½	10. Gray rock, . . . . .	16 10
25. Gray bind, . . . . .	1 11	9. Gray bind, with balls mine, . . . . .	11 2½
24. Gray sandstone, . . . . .	2 6	8. Blue bind, . . . . .	2 10
23. Gray bind, . . . . .	1 4½	7. Mine, . . . . .	0 1½
22. Gray rock, . . . . .	0 5½	6. Gray bind, . . . . .	8 5
21. Gray bind, . . . . .	9 7½	5. Blue bind, . . . . .	20 4
20. Hard gray rock, with parting, . . . . .	11 5	4. Black slate, . . . . .	1 2
19. Gray stone bind, . . . . .	18 1½	3. Coal, No. II. coal, . . . . .	2 6
18. Gray rock, . . . . .	0 8	2. Fire clay, . . . . .	2 6
17. Gray bind, with a thin rock, . . . . .	4 8	1. Seat rock, . . . . .	0 10
16. Gray rock, . . . . .	0 5		
			187 6½

There was another section where the second "s" in Massford is on the one-inch map, given me by Mr. Hall; but as Sir R. Griffith has already published it (see *Report on the Leinster Coal Field*, p. 111, section 21), I will only give a summary of it.\* It is instructive, as having the coal rod in it the same as in Section 34, bed 22, at exactly the same thickness over No. II. coal :—

## Section No. 38.

	Ft. In.		Ft. In.
11. Old pit, . . . . .	51 2	4. Kelve and pyrites, 2 10 } No. II. coal, . . . . .	6 10
10. Shale and grit, with ironstone, . . . . .	42 10	3. Coal, . . . . .	4 0
9. Coal rod, . . . . .	0 2	2. Coal seat, slaty, . . . . .	2 2
8. Grits, with only a few shale, . . . . .	28 10	1. Seat rock, not penetrated, . . . . .	0 5
7. Shales and grits, with ironstone, . . . . .	78 6½		
6. Blue shale, full of ironstone, . . . . .	31 10½		
5. Black shale, . . . . .	9 5		
			252 8

The following section, to the west of the last about 800 yards, is taken from Sir R. Griffith's Report, p. 102, section 16 :—

## Section No. 39.

	Ft. In.		Ft. In.
8. Drift, . . . . .	37 6	3. No. II. coal, . . . . .	0 8
7. Gray grit, . . . . .	12 2	2. Coal seat, . . . . .	0 11½
6. Blue shale, with clay ironstone, . . . . .	33 9	1. Seat rock, . . . . .	0 3
5. Clay ironstone, . . . . .	0 2		
4. Black slate, . . . . .	3 7		
			89 0½

By these sections it is seen that to the south of Massford No. II. coal has swelled to an amazing thickness; when it goes N.W. it begins to thin, see Section 39, and toward the south it also thins, see Section 37; while to the south-west it nearly disappears, see Section 33. Sections 33 and 37 are only 450 yards apart. Between where the O of Castlecomer is engraved on the one-inch map, and the little stream that flows into the river Dinin, there was a bore hole put down 375 feet, it proved this coal No. II. at a depth of 105 feet, where it was found to be ten inches thick.

*Jarrow Colliery.*—The Jarrow colliery lies to the north of Clogh bridge.

\* There is a slight difference between Mr. Hall's book and Sir R. Griffith's copy. I have taken Mr. Hall's figures.



It is most probably No. II. coal which is worked there, though there is no positive evidence as to what coal it is.

The following is the section of the Jarrow pit given by Mr. Hall:—

## Section No. 40.

	Ft. In.		Ft. In.
25. Drift, . . . . .	36 0	11. Gray stone bind, with mine, . . . . .	6 4
24. Gray rock, with partings, . . . . .	13 5	10. Blue bind, with slate mine, . . . . .	17 1
23. Strong stone bind, . . . . .	5 4	9. Black slate, . . . . .	6 3½
22. Hard rock, with partings, . . . . .	16 7½	8. Slate mine, . . . . .	0 1½
21. Gray bind, . . . . .	6 5	7. Black slate, . . . . .	3 10½
20. Gray rock, with partings, . . . . .	14 3½	6. Strong kelve, . . . . .	5 6
19. Gray bind, with ironstone, . . . . .	19 3	5. Coal, 2 11	
18. Blue bind, . . . . .	2 0	4. Parting, 0 1	Probably } 5 5 No. II. } coal. }
17. Gray stone bind, . . . . .	6 2	3. Coal, 1 1	
16. Coal rod, or leader, . . . . .	0 2	2. Parting, 0 2	
15. Black stone bind, . . . . .	2 5	1. Coal, 1 2	
14. Hard gray rock, with partings, . . . . .	16 6½		
13. Strong gray bind, . . . . .	0 10½		
12. Hard gray rock, . . . . .	1 3½		
			185 5

To the east of Clogh bridge, and north of the river Dinin, there was obtained the following section, given by Mr. Hall:—

## Section No. 41.

	Ft. In.		Ft. In.
15. Drift, . . . . .	39 6	6. Gray stone, . . . . .	6 6
14. Gray bind, . . . . .	4 6	5. Blue bind, . . . . .	29 9
13. Gray stones, . . . . .	20 6	4. Black slate, . . . . .	13 5
12. Gray bind, . . . . .	11 0	3. Upper coal, 0 3 { Jarrow coal,	} 2 9 probably } No. II. coal, }
11. Blue bind, with a little mine, . . . . .	21 3	2. Good coal, 2 6	
10. Gray bind, with mine, . . . . .	28 3	1. Seat fire clay, . . . . .	1 10
9. Blue slate, . . . . .	5 1		
8. Fine black slate (coal rod wanted here), . . . . .	1 0		
7. Black stone, . . . . .	0 8		186 0

To the west of Clogh bridge, and south of where the Dinin river flows between two little islands, we have a very deep section given by Mr. Hall:—

## Section No. 42.

	Ft. In.		Ft. In.
49. Drift, . . . . .	8 6	22. Gray and blue stone with partings, . . . . .	2 9½
48. Blue bind, . . . . .	8 6	21. Dark sandy bind, . . . . .	1 7
47. Blue bind, with balls of mine, . . . . .	5 1	20. Blue stone, . . . . .	4 9½
46. Shell of gray rock, . . . . .	0 3½	19. Blue sandy bind, . . . . .	22 4½
45. Kind blue bind, . . . . .	5 0	18. Blue stone, . . . . .	13 2½
44. Black bind, . . . . .	7 7½	17. Blue sandy bind, . . . . .	11 3
43. Coal, . . . . .	0 4	16. White and blue stone, with partings, . . . . .	11 2½
42. Coal seat, . . . . .	0 4	15. Dark blue bind, . . . . .	7 8
41. Blue stone, with partings, . . . . .	5 3	14. Blue, white, and gray stone, with partings, . . . . .	19 10½
40. Gray bind, . . . . .	4 5	13. Gray bind, . . . . .	8 9
39. Gray and white stone, with partings, . . . . .	25 9	12. Gray and blue stone, . . . . .	26 9
38. Gray bind, with "rock mine," 7 9½		11. Gray bind, . . . . .	7 6
37. Blue bind, with mine, . . . . .	3 6	10. Gray stone, . . . . .	3 10
36. Blue stone, . . . . .	1 1	9. Gray bind, . . . . .	2 0
35. Blue bind, with mine, . . . . .	15 9	8. Blue bind, with a little mine, . . . . .	31 3
34. Gray bind, with mine, . . . . .	17 7½	7. Blue slate, . . . . .	19 2
33. Kind blue bind, . . . . .	2 8½	6. Black slate, . . . . .	6 6
32. Hard blue stone, . . . . .	0 11	5. Soft black slate, . . . . .	0 9
31. Strong gray bind, with mine, . . . . .	27 5	4. Coal smut, . . . . .	0 0½
30. Blue bind, . . . . .	1 1	3. Fire clay, . . . . .	3 5
29. Mine, . . . . .	0 1	2. Black and blue bind, . . . . .	7 3½
28. Soft black slate, . . . . .	1 9½	1. Hard rock, . . . . .	
27. Coal, . . . . .	0 4		
26. Fire clay, { Jarrow coal, { 0 3			
25. Blue sandy bind, . . . . .	20 5½		
24. Hard blue stone, . . . . .	1 8½		385 8½
23. Dark sandy bind, . . . . .	1 1½		

There is another section due east of the Jarrow engine pit, just inside the boundary of the Queen's county, given by Mr. Edge:—

## Section No. 43.

	Ft. In.		Ft. In.
46. Drift, . . . . .	18 6	21. Black slate, . . . . .	2 6½
45. Soft shale, . . . . .	1 2	20. Coal, { Jarrow coal } 0 2½	
44. Gray stone, . . . . .	2 11	19. Fire clay, { probably, } 0 6	
43. Gray stone bind, . . . . .	3 3½	18. Gray stone bind, . . . . .	2 10
42. Blue arenaceous shale, . . . . .	15 7	17. Gray stone, with parting, . . . . .	5 5½
41. Black shale, . . . . .	1 5	16. Blue stone bind, . . . . .	9 0
40. Coal, . . . . .	0 1	15. Hard gray stone, . . . . .	1 11
39. Black stone bind, 2 1	6 8½	14. Blue stone bind, . . . . .	6 5½
38. Kelve bind, 1 8½		13. Gray stone, . . . . .	4 11
37. Black shale, 2 4		12. Blue stone bind, . . . . .	9 6½
36. Slaty coal, 0 6		11. Gray stone, . . . . .	21 11
35. Fire clay, . . . . .	0 6	10. Gray stone bind, . . . . .	11 11½
34. Gray stone bind, . . . . .	7 3	9. Clay ironstone, . . . . .	0 2½
33. Gray stone, . . . . .	1 8	8. Blue stone bind, . . . . .	2 5½
32. Blue arenaceous shale, . . . . .	1 0	7. Gray stone, . . . . .	0 8
31. Gray stone, . . . . .	0 10	6. Blue stone bind, . . . . .	4 0
30. Blue arenaceous shale, . . . . .	0 7	5. Blue arenaceous shale, . . . . .	15 10
29. Gray stone, with parting, . . . . .	34 3	4. Kelve bind, . . . . .	12 5
28. Blue stone bind, . . . . .	2 9	3. Gray stone, . . . . .	3 6½
27. Parting, . . . . .	0 1½	2. Gray and blue stone bind, . . . . .	15 6½
26. Light gray bind, . . . . .	3 5½	1. Hard gray stone, not penetrated, . . . . .	0 1½
25. Blue and gray stone, . . . . .	2 3		
24. Black stone bind, . . . . .	7 6½		291 5
23. Blue arenaceous shale, . . . . .	47 5½		
22. Clay ironstone, . . . . .	0 1½		

To the N.N.W. and N.W. of the Jarrow pit, trials have been made for the Jarrow coal. At 380 yards to the N.W. the Jarrow coal was got at 171 feet; but there it was only 7 inches thick. At 520 yards to the N.N.W., at 186 feet deep, it was 7 inches thick; and at 670 yards to the N.N.W. they bored 240 feet without finding any coal. From these sections and evidence it is seen that here there is a great cake of coal, which thins out as we proceed in every direction but the west from the Jarrow pit. At the west no trials as yet have been made. It remains to discover which coal it is, and the sections from which most evidence on this point is to be derived are 42 and 43. In section 43 the representative of the Jarrow coal (beds 19 and 20) is found, only 8½ inches thick; and at 111 feet 6 inches over it another coal, (beds 36, 37, 38, 39, and 40). This is the exact place in which No. IV. coal ought to occur over No. III. In Section 42 the representative of the Jarrow coal (beds 26 and 27) is found, only 7 inches thick; and at 115 feet over it, a coal (beds 42 and 43) in the place where No. IV. coal ought to be found over No. III. Besides, in this section, which was very deep, there is a coal (beds 3 and 4) below the representative of the Jarrow coal, in the exact place where No. II. coal ought to be. In Section 40 there is a "coal rod" (bed 16) which is entirely wanted in all the other sections. The coal of the Clogh colliery, which lies to the north of this, was, at the south, cut off by a downthrow to the south; it was proved, at the west of Clogh river, by Mr. Patrick Finlan, to be a step-fault, and that the coal was going down, as the colliers say, by "jumps." To the west of the Jarrow, at the east boundary of the tongue of No. III coal, which runs to the north of the Dinin river, where the fault is marked, No. III coal was thrown down to the east. The coal at the east of the downthrow was so thin (9 inches), that it was not worth following; this coal was worked under the superintendence of Mr. Finlan, of Clogh, and he says that the coal seemed to dip at a high angle to the east. The evidences in favour of its being No. II. are as follows:—In Section 42 and bed 38 there is gray bind with "rock mine." These "rock mines" are called, in the Queen's County, "cat heads," and were before described in the descrip-

tion of the Newtown colliery. These beds are very constant and very typical, and on examining the ten last sections it will be found that there are many beds with "rock mine" in them, all below and none of them above No. III. coal. This bed is 72 feet over the representative of the Jarrow coal. Now in Section 36 we have a bed with "rock mine" 76 feet over No. II. coal; in Section 35 it is 80 feet; and in Section 37 it is 84 feet. But on the other hand, in the sections referred to there is not a sufficient depth over No. III. coal for this bed to occur, and in Sections 16 and 20, we have a bed of "cat heads" at about 80 feet above No. III. coal. These cat heads are not mentioned, if they were in the Jarrow pit; but the greatest argument against its being No. III. coal is, that if it be No. III. coal, there must be a very large downthrow all round it, north, south, east, and west; while if it is No. II. coal it is nearly in its proper position at present. If it is No. II. coal it most likely runs in a trough of thick coal across till it meets the No. II. coal at Massford. However, as before stated, there can be no positive proof of what coal it is until there is a trial made at the west, in the before-mentioned tongue of No. III. coal that lies to the north of the river Dinin, and is called the "Clogh new colliery."\*

*Clogh Colliery.*—At the Clogh colliery No. III. coal was formerly worked, but is now worked out. In the western portion they are robbing a few of the pillars that still remain. It is bounded on the south by a fault, and is partly bounded on the north by a downthrow to the north. At the west the roof changed from a slate to a clay, and they were not able to follow the coal, as the supporting the roof properly was found to be too expensive. At the south of the colliery where the fault is marked, the roof to the north of the fault was a slate and to the south a clay. It was a step-fault, the first displacement of which was a downthrow of eight feet to the south. In this colliery the roof very often changed from a slate to a clay, so that a good deal of the coals had to be left behind. A detached portion of this colliery lies to the east of the Clogh river, at its junction with the Dinin river. This was called by the colliers the new Clogh colliery. In this part of the colliery No. III. coal was worked out. This coal was a continuation of No. III. coal in Massford colliery. If the Jarrow coal is No. II. coal, as is supposed by a great many people, No. II. coal ought to be thick in this colliery, as it lies right between the Jarrow and the thick No. II. coal at Massford. As yet no trials have been made hereabout; but if a trial was made in this colliery, and thick No. II. coal got, it would prove at once that the Jarrow is No. II. coal.

*Broompark Colliery.*—The Broompark colliery is a subdivision of the Clogh colliery. The following is the section of Mr. Finlan's pit, which he was kind enough to give me:—†

#### Section No. 44.

	Ft.	In.
13. Drift,	28	2
12. Soft nodular gray bind, with large disks of soft gray ironstone,	7	0
11. Strong gray bind, thin bedded, with mica,	2	0
10. Very strong stone, like gray bind, crumbling by exposure,	1	6

\* Mr. B. Edge considers that beds 36, 37, and 38 in Section 43 are the representative of the Jarrow coal, and that it is there thrown up by an upthrow to the east, which fault will be proved when they have worked the Jarrow colliery a little farther to the east.

† The coal sold for 8d. per cwt., and the culm for 3d. per cwt. at the Jarrow pit.

‡ To the proprietor of this colliery, Mr. Finlan, I am also greatly indebted. Besides being one of the oldest inhabitants of the place, and being practically acquainted with the working, his power of observation has enabled him to lay in a stock of information not generally to be met with, which knowledge he freely imparts to any one looking for it.

G. H. K.

	Ft.	In.
9. Gray and blue bind, alternating frequently, and having layers of soft slate clay,	4	6
8. Bed of "cat heads," cemented by a concrete of slate clay, sand and mica,	11	6
7. Curled streaky gray bind, in thick rough beds, having some beds of slate, with ironstone in thick disks, mostly concave on the upper surface,	12	8
6. Blue and gray bind, containing several ironstone layers and nodules,	11	10
5. Gray slate, with ironstone,	0	6
4. Black slate,	0	6
3. Coal, probably No. II. coal, average thickness,	1	7
2. Fire clay,	2	0
1. Hard curled gray seat rock, not penetrated,		

83 9

This coal is considered by Mr. Finlan to be the same as the Middle Riesk coal; if it is, it is No. III. coal; but we are inclined to think it is No. II. coal, as shown in Section No. 3 of the engraved sheets of sections, as there was a trial made 250 yards to N. of its out crop, 150 feet deep, and they got no coal. The beds between this and Clogh colliery must either be thrown into undulations, or else cut up with faults. I am inclined to think with Mr. Finlan, that the latter is the case, as nowhere have the rocks hereabouts been found to dip at a high angle. Very little of this coal has been worked as yet, and the out crop has been proved for a short distance only.\*

*Riesk Colliery.*—This coal is divided on the north from the Middle Riesk coal by a fault which is a downthrow to the north. The Middle Riesk coal has been partially worked, and the out crop proved where it is marked on the map. At the east end it seems to turn suddenly to the south and be lost against the fault. It is the No. III. coal. To the north of the crossroads a trial pit was made which proved No. II. coal, the outcrop of which is seen in the field to the north, near the Queen's County boundary, where there are the remains of old Bassett work.† To the west of this, in the Queen's County, to the south of Swan crossroads, the flags that underlie No. II. coal are to be seen in a stream. To the north of this colliery there must be an upthrow to the south, which brings up No. III. coal again, the smut of which was found, where marked on the map, by Samuel Edge, Esq., M.D., when draining his land.‡ In the county of Kilkenny, to the west of Moyadd bridge, and at the houses to the south of where 821 is engraved on the one-inch map, a coal was got at 42 feet, in sinking a pump-hole.

*Crutt Colliery.*—The Crutt colliery lies two miles to the west of Clogh. The coal formerly worked in it is No. III. coal. The western out crop only has been proved. It is not being worked at present.

*Monala and Moyhora Collieries.*—The Monala and Moyhora collieries contain the No. III. coal, the western out crop of which has been proved. They are divided from the Crutt colliery by an anticlinal curve. To the west of these coals, where the road crosses the county boundary, there is a small coal, which is most likely No. I. coal. This coal was also got to the north, in the townland of Knockardagur, Queen's County, at the depth of seventy-nine feet, in a trial sunk by William Cope Cooper, Esq. If this last-mentioned coal is No. I. coal, No. II. coal should be found between its outcrop on the county boundary and Moyhora colliery.

*Skehana Colliery.*—The Skehana colliery lies to the S.S.W. by W. of Moyhora and Monala. There is not enough evidence to enable us to say whether it was No. II. or III. coal that was worked in it. An anticlinal curve,

\* This coal is sold for 8d., and the culm for 3½d. per cwt.

† I find that Sir R. Griffith has marked this out crop on his map and mentions it in his report, and yet, strange to say, none of the inhabitants thereabouts know of coal having been worked here.

‡ In sinking a pump-hole lately a crow coal and coal rods have been proved on these lands. The crow coal may be No. IV. coal. They were seen on the farm of a man named Walsh. Mr. Meadows communicated this information to me.

G. H. K.

The axis of which runs north and south, divides the colliery into two. In the west division, the coal is well seen at the surface, in a stream to the north of the colliery, where the road divides into two. We noted there the following section :—

## Section No. 45.

	Ft. In.		Ft. In.
8. Blue shale, with thin beds of fire clay,	—	2. Black carbonaceous shale, and thin bands of fire clay,	2 6
7. Fire black shale,	10 6	1. Indurated fire clay and flaggy shale,	—
6. Coal,	2 0		22 0
5. Fire clay,	1 6		
4. Olive grit,	2 6		
3. Olive shale,	3 0		

In the east division we have the following section of a pit where S in Castlecomer is engraved on the one-inch map. The details of this section were given by one of the colliers working there at the time :—

## Section No. 46.

	Ft. In.		Ft. In.
12. Drift,	10 6	5. Greenstone,	6 0
11. Quarry rock,	2 0	4. Black slate,	10 6
10. Slate,	51 0	3. Coal,	2 0
9. Black rock bind,	2 0	2. Seat (fire clay),	1 6
8. Gray bind,	6 0	1. Seat rock not penetrated,	—
7. Greenstone rock,	12 0		112 6
6. Gray bind,	9 0		

In the western division the coal is very irregular, as in places it was found to be three feet thick, while in a few yards it was only as many inches. In some of the pits in this division a "crow coal" was got at about twenty-five feet over the coal.\*

*Firoda Colliery.*—The Firoda colliery is situated to the south of the last, and is a continuation of its western division. The coal is not at present worked. The following is the section of the engine-pit, given me by a collier who formerly worked in it :—

## Section No. 47.

	Ft. In.		Ft. In.
8. Rock,	24 0	3. Cover rock,	24 0
7. Bind rock,	12 0	2. Coal,	2 3
6. Rock,	21 0	1. Fire clay,	0 6
5. Slate,	48 0		132 0
4. "Crow" or "craw" coal,	0 3		

Bed No. 4 was only found in some of the pits. We see by the last two sections what a difference there may be in the measures that overlie the same coal. The colliers say that Skehana is the same coal as Moyhora. If it is, these coals are No. III. coal, which seems to be very likely; and that between these two places there is an east and west fault.

G. H. K.

To the south-west of Castlecomer, a few small coals have been found; but what coals they are it is hard to say.

In the stream at Rockbrook Woollen Manufactory, there are two beds of kelve.

G. H. K., from Notes by W. L. W.

\* There is very little good coal in this colliery, it being nearly all culm. The culm is sold for 3½d. per cwt.

In the stream to the east of Uskerty wood, the smut of a coal is found dipping E.S.E. At the south-west of Uskerty wood, a little to the south of the Dinin river, in the townland of Coolraheen, there is a coal fourteen inches thick, dipping south at a low angle. A little to the south-west of this, in the townland of Clogharinka, there is the out crop of a coal which dips to the east.

In the townland of Coan East, at the west of Black bridge, which spans the Dinin river, there is a coal from twelve to sixteen inches thick. This coal dips to the W.N.W. at 4°. The roof of this coal is a gray argillaceous grit.

G. H. K., from Notes by W. W. SMYTH.

This last-mentioned coal is No. III. coal, and is the out-crop of the coal at the opposite side of the valley, from the Agharue colliery. The coals in Uskerty, Coolraheen, and Clogharinka, are so detached, and so little evidence is to be seen near them, that it is hard to say what coal they are; but they may be the coal No. III. in Coolcullen colliery, coming to grass at this side of the basin.

A tabular view of what is known of all the coals in the district will be found in the Appendix.

Before leaving the collieries, there are a few remarks to be made on the way of working them. Sir R. Griffith, when he published his report, took the trouble of giving the plans and descriptions of the proper ways of working coal; and though that was published thirty-three years ago, nearly all the coal that has been taken since has been extracted according to the old expensive and slovenly method; and that method is still followed, except in the Jarrow and Glen collieries. At the Jarrow, there is one great defect, and that is, that there is only one pit. This pit was sunk in very wet ground, and the top of it had to be "tubbed" to keep back the water. This tubbing may stand; but if any thing happens to it, and the water breaks in, there is no way for any persons that are in the pit at the time to get out, and they must be lost.

## 6. Drift, Bog, Alluvium.

(The boundaries of the Drift on the west of the Castlecomer table-land were marked by Mr. Willson; on the east side of the sheet by Messrs. Du Noyer and Wyley; the other portion by Mr. G. H. Kinahan.

The limestone Drift, which completely covers the portion of the valley of the Barrow which is included in this map, extends also over the Granite to the east of it, though not to an equal amount, as certain knolls and eminences over the Granitic district are now bared of it, while the low limestone district is entirely concealed by it. The high Coal Measure table-land, west of the valley of the Barrow, which is for the most part steeply escarped along its eastern margin, has this Drift deposited along the base of that escarpment, at elevations varying from 325 to 500 feet above the sea—above which level the surface of the escarpment is covered only by the local debris of the Coal Measure rocks.

The Granite district, which lies northwards of an east and west line drawn through Kilballyhue House, is totally covered by the limestone drift; but as the country south of this becomes more elevated and hilly, the higher portions of the Granite stand out from the Drift. This feature in the aspect of the country can be well observed along the road from the village of Nurney to the Fighting Cocks crossroads. This road runs along the southern flanks of a low range of hills, which reach the maximum height of 558 feet, at either side of this ridge. In the open valleys and boggy flats the Limestone Drift is thickly deposited, while the Granite ridge is quite free from it. To the north of this ridge, in the high ground of the townlands of Ballyloo and Knockbower, the Granite reaches the elevations of 557 and 642 feet, respectively. These knolls rise far above the Drift, which appears to terminate

at an elevation of about 450 feet over all that side of the country. South-east of Nurney, at the distance of two miles, the granite reaches the elevation of 676 feet, when it forms a low irregular shaped hill, round which, on every side, the drift limestone gravel rests thickly in the low grounds. Enough, probably, has been said to explain the mode of occurrence of the limestone gravel over the eastern half of the quarter sheet. With regard, however, to the limits of this Drift, as defined on the map, or described in this report, it will be borne in mind that they are only an approximation to the absolute truth; the erratic nature of the deposit which they profess to define, rendering it impossible to sketch its limits with positive accuracy.

G. V. D.

The Coal Measure hills that form the outer margin of the table-land, are generally covered with local drift; but the drift on nearly every other Coal Measure hill is largely composed of limestone, even on the top of hills 700 feet high. What is most remarkable, however, is, that in some places there are valleys and plains not more than 400 feet above the sea, without a particle of limestone on them, while hills in their vicinity are covered with it. It seems probable that much of the drift has been carried away by subsequent currents from many of the valleys and lower grounds, while that in other situations was left undisturbed. In the Newtown colliery, the phenomena connected with the drift were very remarkable, since it was in some place accumulated to a depth of 108 feet. In a pit of that depth, due east of Newtown crossroads, there was this section:—

Section No. 48.

	Ft.
3. Drift, . . . . .	96
2. Peat, . . . . .	3
1. Drift, . . . . .	9
	108

The bed of peat thus included in the drift was highly bituminous; when lighted it blazed like a candle. It was only found in this pit. At the eastern edge of this coal, under seventy-two feet of drift, in running sand, shells were said to be found, being those alluded to by Mr. Baily, at p. 15. The same shells were got at the edge of the coal in the Geneva colliery, under six feet of drift. At the edge of the Newtown coal, due west of Sally's bridge, under ninety-six feet of drift, there were large pieces of timber found. The following is the section of the drift in a pit to the west of this colliery:—

Section No. 49.

	Ft.	In.
5. Clay, with boulders of limestone, . . . . .	36	6
4. Sand and gravel, . . . . .	6	3
3. Book or leaf clay, calcareous, . . . . .	3	2
2. Strong clay, with detached pieces of coal, . . . . .	6	0
1. Fine sand, . . . . .	4	0
	55	11

"Book clay" is clay that was deposited in thin lamina. In the townland to the north-east of Cooper Hill, horns of the Magaceros Hibernicus were found by William Cope Cooper, Esq., while reclaiming those lands. There is good brick clay got in different places in this sheet; small patches of it are found in the valley of the Barrow. These patches are in the middle of the limestone drift, and yet there is very seldom a particle of lime in the clay.

*Bog.*—The bog in the district included in this sheet is generally deep; the bottom portion being good, bituminous, hard and black, the top soft and brown. There is generally a great waste in the cutting of it, as the bog holes are not properly drained, and the "banks" not laid out systematically. In the neighbourhood of the bogs it is the principal fuel of the inhabitants, and in the

towns and large houses it is used for kindling the anthracite brought from the collieries. At the very south of this sheet of the map, a little to the west of Leighlinbridge, in the townland of Moanduff, in a small patch of bog, which lies in a hollow of the drift, there has lately been found the skeletons of two specimens of *Magaceros Hibernicus*, by some workmen who were sinking a pond for cattle; but the skeletons were so broken in extraction, that they were of very little value afterwards. They seemed to lie on the top of the marl that is under the bog; but they were partially, at least, embedded in the bog.

*Alluvium.*—Along the River Barrow and its tributaries, there are some small alluvial flats, and also, in some places, along the Dinin river. The latter, however, are so small that they could not be marked on the map.

G. H. K.

7. Minerals.

The minerals procured in the district included in this sheet of the map, are three varieties of coal, two of clay, and two of iron, with a little galena that is found in the drift. The varieties of coal consist of *Anthracite*, *Culm*, and *Kelve*.

*Anthracite.*—The anthracite is very hard, of a brownish black colour, with a strong metallic lustre, impregnated more or less with iron pyrites, which makes it give off, when ignited, very offensive gases. It is rather difficult to ignite; but when once it is lighted, it gives out intense heat. It is very much used for malting and culinary purposes.

*Culm.*—The regular culm is a scaly soft coal, which is taken out of the pits in flakes, and crumbles when it is exposed to the atmosphere; with this is mixed the breakage of the coal to form the culm of commerce. The culm is extensively used for brick-making and lime burning, and by the country people it is mixed with clay, and rolled in balls for fuel. In this state it is called "bellows coal."

*Kelve.*—This is a carbonaceous ferruginous shale, in some places with so much carbon in it that it can be used for fuel. It is extremely heavy, having a quantity of sulphuret of iron in it, and it is a question whether it might not be used as an ore of sulphur. We do not know whether it has ever been analyzed. It is generally found in all the collieries; and in the collieries of Newtown, Jarro, and Massford, it is in a large mass over the coal.

*The clays are fire clay and brick clay.*—The *fire clay* is very abundant, a thick bed lying under nearly every coal as before-mentioned in the different sections. Sir R. Griffith in the report written in A.D. 1820, speaks very highly of it (see his Report). The *brick clay* was mentioned before in describing the drift. At Castlecomer it is made into tiles and bricks.

*Clay Ironstone.*—This is found in greater or less quantities in the shales at all the different collieries. In the deep workings at Massford the iron-bearing shales are very thick and rich in ore; also the shales on the north of Garrendenny hill. The remains of ancient workings for the stone are to be found on Coolbaun hill, Moyhora, Moyadd, Graiguenahown, Knockardagur, &c. At Moyhora, there used to be an old furnace for smelting the ore. At Moyadd the works were very extensive, and were worked at a very recent period; the stone was sent to Lacka, in the north-west of the Queen's County, to a furnace that was there worked till the end of the last century. The adit level for draining the works is still open.

*Iron Pyrites.*—This is found in many of the collieries; there is enough to deteriorate the value of the coal, but not enough to be of any commercial value in itself. The lower shales next the limestone are impregnated with it; and sometimes, in the shape of pyritous ironstone, it takes the place of the regular ore in the shales over the coal.

*Galena* pieces of this ore were found in the drift on the N.W. face of Coolbaun hill, and in the drift near Ballickmoyler.

G. H. K.

## APPENDIX.

TABLE showing the Position and Extent of the principal Coals, and their present condition.

Explanation of Abbreviations used.—C. *Carton*. K. *Kilkenny*. Q. *Queen's County*. n.w. *not worked*. n.p. *not proved*. n.k. *not known*. w.o. *worked out*. w. *working*. p. *only proved*. u. *the coal unprofitable*. t. *trial being made*. s. *smut of coal proved*.

County.	Nos. of Coals.	Names of Collieries.	I.			II.			III.			IV.			V.			VI.		
			Thick- ness.	Present condition.	Thick- ness.	Coal.	Fire Clay.	Present condition.	1st Coal.	2nd Coal.	3rd Coal.	Total Coal.	Fire Clay.	Present condition.	1st Coal.	2nd Coal.	2nd Fire Clay.	Total.	Present condition.	Thick- ness.
C. & K.		Agharue, Ridge & Coolcullen,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
C.		Bilboa,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Bilboa,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Coorlaghan,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Towlerton and Ardataggle,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Rushes and Kingscote,*	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Corgie and Pauliteen,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Glen,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Ballyhane,†	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Meeragh,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Newtown and Hollypark,‡	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Mayo,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Doonane,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Geneva,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Kilgorey,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Monteen,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Rushmore,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Coolbaun,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Rock,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Massford and Curragh,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Jarrow,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Clogh,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Riesk and Broompark,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q. & K.		Cur Moyhora, &c.,§	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Skehana,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Firoda,	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Q.		Moyadd,¶	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	n.p.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.

\* This includes Gale Hill.

† This includes Knockardagar.

‡ The details of this colliery are given in Explanation of sheet 189.

§ These coals seem to be No. III. coal.

¶ No. II. coal is only worked at Hollypark.

|| This seems to be the smut of No. III. coal.

By this Table it is seen that though No. I. coal is very thin, it extends over a large surface, being found at the E. and W. of the coal field. No. II. coal is on an average about one foot thick, except in part of the Castlecomer lordship, where it swells to an immense thickness at the Rock, Jarrow and Massford collieries; in these places it consists of two or three beds.

No. III. coal is composed nearly universally of two or three beds, as will be seen by examining the foregoing sections and those in Sir R. Griffith's report. The cover rock over this coal is very changeable in its nature. At Agharue, Ridge, Cookcullen, and Bilboa, it is a black "curled" shale, the part next the coal containing brachyopods and crustacea, the rest plants; while at Coorlaghan it changes into a compact green grit. This latter rock is found over it at Ardataggle, Towlerton, and the south part of the Rushes. In the north part of the Rushes, Corgie, Pauliteen, Glen, Ballyhane, and Meeragh collieries it is a compact black shale, in which are marine shells, *Aviculo-pecten*, *Euomphalus*, *Bellerophon*, and *Goniatis*. In part of the Lordship of Castlecomer, and in Clogh this coal has a clay roof.

The seam which forms No. IV. coal averages 4 feet 6 inches in thickness, except at Ballyhane, where there is only one coal and no fire clay, the coal having a hard seat and roof.

Nos. V. and VI. coals are only found in Coolbaun Hill, where they are in the mass between the sides of a wedge fault (see fig. 17). In the Glen colliery there is a sufficient thickness over No. IV. coal for No. V. to come in, but there was not a trace of a coal where it ought to be.

G. H. K.

## GLOSSARY OF LOCAL TERMS.

*Back and in crack*—Terms used by the colliers in describing the system of work: *backs* are N. and S. joints, *in cracks* E. and W. joints.

*Bind*—Shale.

*Bind Rock*—Sandy shale.

*Blue Rock*—Siliceous shale, generally pyritic.

*Basset work*—Open work, where all the cover is removed before getting the coal.

*Bury*—Shale. This term seems to be obsolete. It is found in the old section, county Kilkenny.

*Cat heads*—Nodules of very hard, "curled," green, ferruginous, spheroidal grit, found in shale beds, with nodules of ironstone. These are sometimes called *boulder beds*.

*Clearing*—A smut on the top of the coal, which the colliers first take out. If there is no clearing they say it is an *unnatural coal*.

*Coal leader*,

*Coal rod*, } A thin seam or film of coal. *Craw* and *crows* are also used to denominate coal that is in detached pieces in the drift, or sometimes coal that has only a drift covering.

*Crow coal*,

*Curled*—Rocks are said to be curled when they break with a conchoidal fracture.

*End and board*—Terms used by the master colliers in describing the system of work: *ends* are N. and S. joints, *boards* E. and W. joints.

*Foundation*—Used sometimes for the coal seat, but generally means the debris of rock between rock and drift.

*Hard bar*—Generally a pyritic grit.

*Iron mine*—Clay ironstone.

*Kelve*—Shaly earthy pyritic coal, or earthy pyritic carbonaceous shale.

*Kennel coal*—Slaty kelve, generally with so much carbon in it that it can be used for fuel.

*Kind bind*—Soft shale that is easily worked.

*Leaf or book clay*—Clay that has been deposited in thin laminae.

*Mine*—Iron ore; either clay ironstone or pyritic ironstone.

*Outgoing of coal*—The outcrop.

*Parting*—Thin beds, generally of micaceous sandy shale.

*Rock*—Grit or sandstone.

*Rock bind*—Sandy or gritty shale.

*Rock mine*—Same as *cat heads*.

*Sluggagh*—Indurated sandy olive shale.

*Slate*—Compact shale.

*Slate mine*—Very poor clay ironstone.

*Stone*—Grits or sandstone.

*Stone bind*—Sandy or gritty shale.

*Stone mine*—Same as *cat heads*.

*Trouble*—Where sand, clay, or any other impurity has either replaced or got mixed with the coal and deteriorates its value.

*Trecher or trucker*—Loose broken shale.

*Verge of coal*—Same as outgoing.

G. H. K.

## SCALE OF ANGLES.

1° equal to 1 in 37.	8° equal to 1 in 8.	45° equal to 1 in 1.
2° " 1 in 26.	9° " 1 in 7.	55° " 3 in 2.
3° " 1 in 18.	10° " 1 in 6.	63° " 2 in 1.
4° " 1 in 15.	12° " 1 in 5.	71° " 3 in 1.
5° " 1 in 13.	15° " 1 in 4.	75° " 4 in 1.
6° " 1 in 11.	19° " 1 in 3.	80° " 6 in 1.
7° " 1 in 9.	27° " 1 in 2.	84° " 11 in 1.

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