GEOLOGICAL SURVEY OF IRELAND

EXPLANATIONS

TO ACCOMPANY

SHEET 142 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTIES OF CLARE, KERRY, AND LIMERICK

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

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

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

Condensed memoirs on particular districts will also eventually appear.

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

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EXPLANATIONS

TO ACCOMPANY SHEET 142 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND.

General Description.

That part of this sheet which lies to the north of the River Shannon belongs to the County of Clare; in it are situated the villages of Kilmihil, Knock, Labasheeda, Killadysert, and Ballynacally. At the S.W. corner of the sheet there is a small portion of the County of Kerry, in which is the little town of Tarbert; while the rest of the area forms part of the County of Limerick, the places of most note being the villages of Glin, Foynes, Shanagolden, and Loghill.

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1. *Form of the Ground.*

The portion of the county Clare lying within the limits of this sheet, is an undulating tract of land, of which the average height above the sea level is probably not more than 200 feet; but it attains in some places to more than 300 feet, and even to more than 500 in the country between Lough Lomaun and Ballydoolavaun Lough. It is drained by the Doonbeg river which flows into the Atlantic at Doonbeg, in sheet 131, and by the Crompaun and Cloon rivers which flow into the Shannon at the head of Clonderalaw bay.

West of the village of Knock, the slopes towards the Shannon are rather abrupt, with occasional cliffs along the shore.

East of Knock, the slopes are more gentle, the higher ground merging into the alluvial flats at the head of Clonderalaw bay.

The promontory forming the S.E. side of the latter is a small table-land, the highest point of which is Knockroe Hill 267 feet above the sea level.

East of the Cloon river there is more regularity in the form of the ground than there is west of it, the low hills running nearly parallel to each other from W.S.W. to E.N.E., curving more towards the northward as we approach the River Fergus.

The most remarkable feature of this eastern portion is the hilly ground about two miles west of Killadysert, generally called "*The Black Hills*," the highest point of which is 425 feet. Their abrupt forms form a striking contrast to the other parts of the district, the undulations of which are rounded, and have easy slopes.

N. of these hills the country, which is more of an elevated plateau, attains to an elevation of upwards of 500 feet above the sea level.

Of the islands in the River Fergus, the highest point of Coney Island is 194 feet, and that of Deer Island, 139 above the sea level; Inishtubrid, 136; and Inishcorker, 104. The others do not attain to 100 feet.

On the south side of the Shannon, and in the S.W. corner of the map, the portion of the county Kerry west and south of Tarbert is an irregularly formed elevated tract of land, of which the greatest height is Tarmon Hill, which is 430 feet above the sea level. From this the ground slopes gently northwards, descending to the sea level, at Tarbert, in about two miles. N. of Tarbert the ground rises again to a height of 170 feet and forms the promontory, at the N.E. end of which is Tarbert Island.

From Tarbert to Shanagolden is the northern extremity of the high land that forms the western portion of the county of Limerick, sloping steeply down to the valley of the Shannon, which bounds it on the north.

The principal and most striking peaks in this portion of the district are Knockpatrick, which rises to the height of 574 feet; Knockourha, that overhangs Shanagolden, and is 531 feet high; Prospect Hill, 450 feet; and at the south-west of the village of Glin, the Tullyglass Hill, the altitude of which is 514 feet.

To the S.E. of Foynes the country consists of a corner of the great plain that stretches over nearly the whole of the eastern part of the county of Limerick, terminating at the foot of the escarpment of the high land just described, which follows a line running nearly due south from Foynes. To the east of this line the ground, although lower, is in many places rugged, broken, and intersected with rocky glens, while to the west of it, deep drift and bog generally cover the undulations, and give the hills and valleys a tame appearance. To the south-west of the village of Shanagolden lies the little, nearly conical, hill on which Shanid Castle was built. This hill seems to be partly natural and partly artificial, and is worthy of notice, as it can be seen from all the country round, rising to the height of 446 feet above the sea level, and 200 above the adjacent plain.

G. H. K. and F. J. F.

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2. *Formations or Groups of Rock entering into the Structure of the District.*

Aqueous Rocks.

	Name.	Colour on Map.
	Bog, Alluvium, &c.,	*Pale Sepia.*
	Drift, (principally Limestone Gravel),	*Engraved Dots.*
Carboniferous.	d^5. Coal Measures.	*Indian ink.*
Carboniferous.	d^4. Upper Limestone.	*Prussian blue (dark).*
Carboniferous.	d^2. Lower Limestone.	*Prussian blue (light).*

Igneous Rocks.

Carboniferous.	D. Trappean Ash,	*Crimson, with dark dots.*

d^2. In this sheet the lowest beds seen of the *Lower Limestone* consist of dull, dark blue, in places nearly black, flaggy, fœtid limestone, and black and gray shale; over these are very cherty limestones, some of which are full of ferruginous nodules, which give them the appearance of a conglomerate. Above these beds light gray and blue is the prevailing colour of the limestones. Associated with these are a few red and yellow beds, and on rare occasions argillaceous shale partings are found. Generally the bedding is obscure; but the limestone seems to be in thick massive beds, which undulate in such a way as to be nearly horizontal. It is all affected by three or four systems of joints, which will be hereafter spoken of. The *Lower Limestone* is supposed to be about 1,000 feet thick.

In these rocks fossils are abundant, particularly in the uppermost beds. In the lower beds bivalves predominate, while in those near the Upper Limestone large and beautiful univalves are found in great profusion.

d^3. *The Calp or Middle Limestone.*—Over the limestones just described there come dark, often earthy, limestones, with black shale partings, which answer very well lithologically to the description commonly assigned to the Calp in Ireland. It has, however, been found impossible to assign an upper boundary line to these beds except over a comparatively small part of the district, and even there it would be at but a slight depth below the Coal Measures. It has, therefore, been thought best to merge this subdivision into the next.

d^4. *The Upper Limestone,* inclusive of that which might be considered Calp, is a series of beds of dark blue and black argillaceous fœtid limestone, which are often granular, occasionally slightly oolitic, and are interstratified with thin shales that are usually calcareous. It abounds in layers and elongated nodules of chert, especially in the lowest beds. Immediately on the top of the Lower Limestone, indeed, there occur a set of beds about 30 or 40 feet thick, which consist principally of chert in layers and nodules quite close together, forming a very distinct and easily traceable band, which has been taken as determining the base of the Upper Limestone. The chert, both here and elsewhere, is usually black or dark gray. The beds of this Upper Limestone range from one inch to four feet in thickness. When they are thick, they make a good building stone, and when thin, they form indifferent flags. Sometimes the limestone is affected by cleavage, which changes it into a coarse calcareous slate. In the county Clare, this subdivision consists of alternations of black shale and limestone, some of the latter being magnesian, often nearly a pure dolomite of a flesh colour, and highly crystalline. Over these beds are thin-bedded limestones, interstratified with either shales or chert; these underlie a massive bed of light blue limestone, over which the limestones are generally thin-bedded, of a light blue or whitish colour, and interstratified with shales, some of which are sandy. The beds above these are dark blue, very argillaceous and fœtid, forming, generally, good building stones. Next in ascending order are the junction beds between the Limestones and Coal Measures, which are better seen at the north side of the Shannon than at the south.

This subgroup, due east of Knockpatrick, is about 1,300 feet thick (see fig. 1).

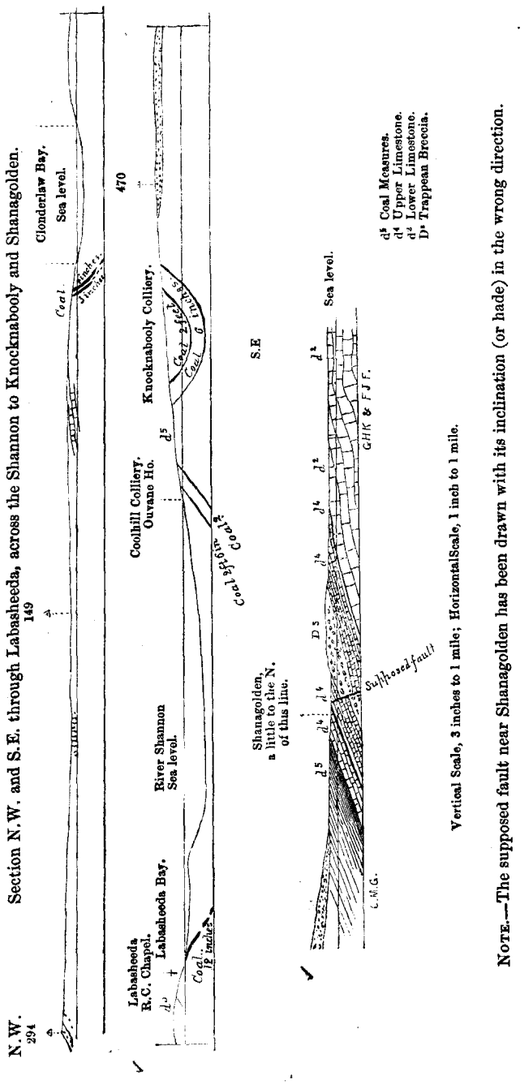

Fig. 1.

Section N.W. and S.E. through Labasheeda, across the Shannon to Knocknabooly and Shanagolden.

Vertical Scale, 3 inches to 1 mile; Horizontal Scale, 1 inch to 1 mile.

NOTE.—The supposed fault near Shanagolden has been drawn with its inclination (or hade) in the wrong direction.

Ds. *Trappean Ash** is found associated with the Upper Limestone in the district contained in this sheet (fig. 1). It varies from a fine ash to a coarse conglomerate, its matrix being usually of a red or green colour, the conglomerate containing pebble and blocks of grits, slate, limestone, felstone, and other kind of rocks.

d^5. *The Coal Measures* consist of grits, shales, clunch, fireclay, coal, and thin seams and nodules of ironstone.

The following is the general section of these Measures in this district:—

General Section.†

		Feet	in.	sec.
8.	Shales principally, of which the thickness is not determinable,			
7.	"Money Point flag" series, about	150	0	0
6.	Shales principally, about	200	0	0
III.	Coal,‡	0	1	6
5.	Intermediate beds, about	600	0	0
II.	Coal,	0	2	6
4.	Intermediate beds, about	700	0	0
I.	Coal,	0	0	6
3	Grits and shales, about	930	0	0
2.	Lower flagstone series, about	70	0	0
1.	Shale series, about	500	0	0
	Total, over	3,150	4	6

From this section it is seen that in this part of the coal field there are three regular beds of coal, besides which there are a few local *coal rods*§ of a few inches in thickness: these will be spoken of in the detailed description.

No. 1. *Shale Series.*—Immediately over the limestone at the bottom of the Coal Measures is a thick mass of shales. The lowest part of them is usually cherty and destitute of fossil; over these cherty beds the shales are flaggy, and in them Posidonomya often abounds with a few Goniatites. The rest of the series consists of black, gray, and olive shales, which are generally argillaceous, but sometimes arenaceous. They often assume a spheroidal structure, the shales being almost entirely converted into a number of large balls with concentric coats, some of them over three feet in diameter, through which the original lines of lamination are still perceptible. Some of these beds abound in fossils, which are principally Goniatites with a few Aviculo-pectens. Grit beds and bands are often found in these shales at different places, but in this district none of them are of any magnitude.

No. 2. *Lower Flagstone Series.*—To the south of the Shannon

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* These *Trappean Ashes*, in the county of Limerick and part of the county of Clare, are very characteristic of the *Upper Limestone*, and are rarely found in the other Carboniferous rocks.

† The beds are numbered according to the order of their deposition.

‡ There may be more coals than those mentioned, but as no regular mining operations have been carried on in the district, and no good continuous natural sections are exposed in it, it is impossible to determine their number with certainty. A greater number are found southwards in Sheet 152. G. H. K. and F. J. F.

§ *Coal Rod* is a term used in the Kilkenny and Queen's County collieries for small thin local seams of coal; and as they have no local name here, we have adopted it in this explanation. G. H. K. and F. J. F.

this set of beds does not produce good flags; but to the N., near Ballynacally, good flags are quarried in it. It is probable that these beds represent those known in the Queen's and Kilkenny counties as the Luggacurren and "Carlow" flags (*see Explanation of Sheets* 128 *and* 147.) Annelid tracks, however, are not so common in them in this district as in those places.

Nos. 3, 4, and 5 consist of alternations of grits and shales. The roof of the coals is generally a fine argillaceous shale, locally called *pincil* or pencil, passing up into arenaceous shale, over which are alternations of shales and grits.* This order is nearly always followed. Sometimes the coal is wanting, but there is generally some trace of it where it ought to be found.

No. 6 is principally composed of black, olive, and gray shale, with here and there a massive green grit, locally called "*green grenát.*" In the lower beds, fossils are numerous, as before-mentioned. Ironstone also occurs in nodules and bands, and was formerly rather extensively worked.

No. 7. The "*Money Point flag*" series consists of a mass of olive and gray flags, which are from half-an-inch to two inches in thickness, but usually one inch and a-half; they are only seen to the N. of the Shannon, the Measures to the south being limited to the beds below the "Money Point flag" series. These flags are well exposed in the stream which forms the boundary between the parishes of Killofin and Kilfiddane, and which flows into the Shannon at Goleen Bridge, also at Acre and Money Point; at the latter place, they were, a few years ago, extensively quarried, being good substantial flags for street and other purposes. In the neighbourhood of the quarry, they are used for every purpose that they could possibly be applied to. The surfaces of these flags are covered with numerous tracks and markings, which are noticed and figured by Mr. Baily in the Explanation to Sheet 140 and 141, page 9 and 10.

No. I. Coal is a good coal, but has a hard seat and roof, from which it has got the name of the *Hard Seam.* This coal at present is only known to the S. of the Shannon. It was worked to a small extent at the Foxcover of Mount Trenchard about seventy years ago, and was proved both N. and S. of the Knocknaboola colliery.

No. II. Coal, or the *Coal Hill vein,* has at present only been proved to the S. of the Shannon, where it was worked at the Coal Hill, Knocknaboola, and Rock collieries. A coal that seems to be the same was also worked near Glin.

No. III. Coal has been worked both N. and S. of the Shannon—to the E. of Labasheeda and W. of Loghill, as yet only near the outcrop; in the latter place, it is called the *Rock Lodge vein.* In the

* The following are the principal local terms used in this district:—

Binder,	Thin grit or thin hard band of siliceous shale.
Clay,	Fireclay.
Green Grenát,	Hard green siliceous grit.
Sandy Limestone,	Magnesian limestone.
Seat,	Clunch.
Seat Rock,	Grit under clunch or coal.
Spar,	Hard gritty band, full of white quartz.
Stone,	Grit.

bed of shale immediately over this coal, are shells the same as those found over the coal in the Bilboa colliery, in county Carlow (*see Explanation of Sheet* 137). With these, in the last-named place, are associated crustacea of the genus Bellinurus, which may therefore possibly be found in this place also.*

G. H. K. and F. J. F.

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3. *Palæontological Notes.*

The organic remains obtained from the calcareous nodules of the Coal Measures at Foynes Island, county Limerick, [1] (see page 30), are of great interest from their perfect state of preservation and uncompressed character, and, like those found in the ironstone nodules of the N. of England, present a condition very favourable to their study. Although the collection does not include many species, some of them are new forms, and others exhibit many important points not before observed.

When broken up, these hard nodules are found to be crowded with fossil shells, principally Goniatites crenistria, which occurs of all sizes, from that of a mere speck to examples upwards of two inches in diameter. The smaller specimens, when broken through, often exhibit a section of the chambers, which are generally found to be filled with white crystalline carbonate of lime, and sulphate of alumina.

At *fig. 2 a—m,* is represented a series of this Cephalopod, which is such a very characteristic fossil of the coal shales, showing its gradation in size and other peculiarities of structure. In its young state the shell of this species is more globular, becoming flatter with age.† The umbilicus also varies in size, being of larger proportions in the young specimens: the transverse striæ are coarser, and occur at wider intervals round its edge, and the small inner whirls, are sometimes strongly ridged at regular intervals, like some species of Ammonites. Fig. 2 *a* shows a series of the very young forms, which are almost globular in shape; (*b*) and (*j*) are examples of the coarsely-striated small inner whirls; of the latter, an enlarged figure is given, which is proved to belong to this species by the section (*l*), retaining the inner whirls in a perfect state; and the section across the whirls (*k*), which shows on either side the large umbilicus or cast of the inner whirls. Most of the young examples of this species have peculiar constrictions or transverse channels at distant, but nearly regular intervals crossing the exterior of the whirls, and generally three in number. This character, which is not uncommon in Goniatites, has also been observed in some species of Ammonites. It is well shown in fig. 2 *d, e, f, g, h,* and *j*. In addition to the transverse constrictions, *e* and *f* show that the inner whirls were channelled dorsally; this sulcated character of the back has not, I believe, been before noticed. Professor Phillips, in his "Geology of Yorkshire," does not figure any varieties with constrictions, although he does indicate the transverse ones in the figures he gives of this species in his Palæozoic Fossils, plate 50, fig. 234 *a, f.* In the magnificent work of the Drs. Sandberger, on the Fossils of Nassau,‡ at plate v, fig. 1 *a*–

* We searched this shale near Labasheeda for the Bellinurus, and found what seemed to be pieces of it, but the shales were so much decomposed (the pits having been worked more than twenty years ago) that the evidence was not conclusive.

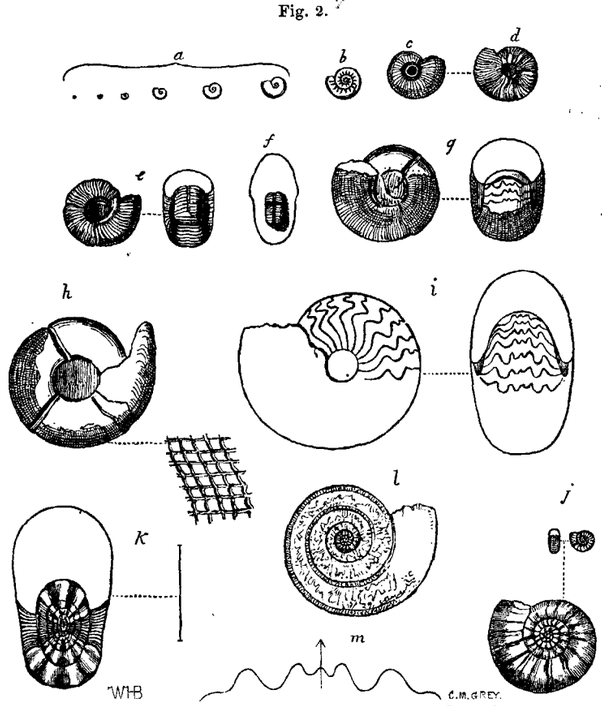
G. H. K. and F. J. F.

† Professor John Phillips, in his "Geology of Yorkshire," vol. 2, p. 234, notices this fact.

‡ "Versteinerungen des Rheinischen Schichten Systems in Nassau," by Drs. Guido and Fridolin Sandberger.

i, are figured smooth and transversely constricted, but not dorsally sulcated varieties. In the list of synonyms of this species given by them, p. 74, they include *Goniatites* (*Ammonites*) *striatus*, Sowerby, Min. Conch. 1, p. 115, pl. 53, fig. 1; Phillips' "Geol. of Yorkshire," vol. 2, p. 233, pl. 19, fig. 1–3; *Goniatites carbonarius*, J. de C. Sowerby, in Geol. Trans., vol. 5, pl. 52, fig. 8 and 9 male; and *Ammonites sphæricus*, Sow. Min. Conch. 1, p. 116, pl. 53, fig. 2. On a revision of the genus Goniatites, it will, no doubt, be found that several other species may be transferred to the list of synonyms of G. crenistria, from the great variety of form and external markings this very abundant and characteristic species assumes. Amongst them I should be disposed to consider G. *subsulcatus*, *undulatus*, *intermedius*, and probably *dorsalis*, Brown.*

Fig. 2.



Goniatites crenistria. Coal Measures, Foynes Island, Co Limerick.

On the wood-cut, fig. 2 *c*, is shown a small unconstricted variety, with closely-arranged transverse striæ, not reticulated by others: *g* and *h* are larger examples on which the transverse constrictions are well marked; portions of the thin shell exhibit a most beautifully-ornamented surface of fine reticulated striæ, the transverse striations being gracefully curved and crenulated; at (*h*) is a portion of the surface enlarged. The outline of an uncon-

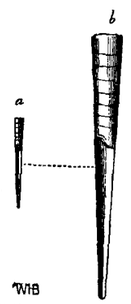
* Manchester Geol. Trans., vol. 1, pl. 7, pp. 213, 214.

stricted and still older specimen is given (*i*), from which, as in *g*, the shell has been removed, exposing the septal divisions—one of these being enlarged (*m*). The multiplicity in the varieties of form assumed by this shell causes also a corresponding variety in the angularity of the outline of the septal divisions, according to the age, and, perhaps, the sex of the animal, as in the young and more inflated forms the lobes are found to be rounded, becoming more angular in the adult and flattened examples.* A very instructive section is represented at 4 *k*: where the shell has broken across the whirls exposing their septal surfaces; the casts of the large umbilicus on either side, show these inner whirls to have been transversely striated, and enable us to determine the volutions to be six in number, decreasing in size to the central nucleus. Another section, shown at fig. 2 *l*, is broken in the direction of the whirls, leaving the smaller central ones entire, showing them to be strongly ribbed, as in fig. 2 *b* and *j*; the other portion is filled with crystals, but does not show any trace of the septal divisions.

Two or three kinds of Orthoceras accompanied the Goniatites, the most abundant being a very small and gradually-tapering species allied to O. *acutissimum*, Sandberger, but not so long and slender in its proportions. Fig. 3 *a* represents the natural size, and *b* the same enlarged. Traces of the septa may be observed on the upper portion of this specimen. I have named this species *Orthoceras minimum*. Another species, with strong transverse rings, I have been enabled to identify with *Orthoceras dactyliophorum*, De Koninck.

With these were associated fragments of large plant stems, having an internal fibrous structure. In the shales from the same locality good examples of the following characteristic Coal Measure plants were collected, viz., *Lepidostrobus*, *Calamites cannæformis*, and *Stigmaria ficoides*.

Fig. 3.



Orthoceras *minimum*, n.s. Coal Measures, Foynes Island, Co. Limerick.

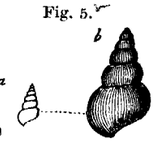
The only bivalve shells observed in the calcareous nodules were numerous specimens of *Posidonomya vetusta*, a species common in the Carboniferous limestone of Great Britain and Belgium. Some of the shales abound with *Aviculo-pecten papyraceus*, accompanied by small *Posidonomya Becheri or lateralis*, together with a new species—*Myalina Foynesiana* (fig. 4)—of which the cast of both valves are preserved in juxtaposition, showing the impressions of the adductor muscles: the cast of one valve measures $\frac{6}{10}$ by $\frac{8}{10}$ of an inch.

Fig. 4.

Myalina Foynesiana, n.s. Coal Measures, Foynes Island, Co. Limerick.

Of univalves, two small species only have been detected, both of which I believe to be undescribed: they are abundant in the calcareous nodules, and, like the other fossils from the same deposit, very well preserved. One of these—*Loxonema Galvani* (fig. 5 *a*, *b*)—is an elongated spiral shell, with about six very convex volutions, their surfaces being covered by very fine longitudinal striæ. Fig. 5 *a* is an outline of the natural size; 5 *b* the same enlarged three diameters.

Fig. 5.



Loxonema Galvani, n.s. Coal Measures, Foynes Island, Co. Limerick.

* In confirmation of the distinction of sexes in some of the Cephalopoda, as probably causing variations of form, see Woodward's Manual of Mollusca, p. 83.

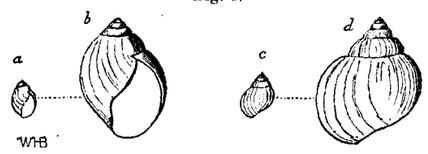
This species, which I have named after Mr. Charles Galvan, Fossil Collector to the Geological Survey, is allied to *Loxonema* (*Pyramis*) *reticulata*, Brown, but differs in the greater proportions of the last whirl and in not being reticulated.

Dimensions of figured specimen, elevation, . . . $\frac{6}{10}$ inch.
,, ,, diameter, . . . $\frac{3}{10}$,,

Other specimens are of larger dimensions, one of them measuring $\frac{4}{10}$ of an inch in diameter.

The other univalve, *Macrocheilus inflatus* (fig. 6 *a*, *d*), is a small ventricose shell, with a large ovate aperture and small spire, the volutions on which are much inflated and sometimes very irregular in their relative proportions.

Fig. 6.



Macrocheilus inflatus, n.s. Coal Measures, Foynes Island, Co. Limerick.

The surface of this shell is marked by a few faint longitudinal striæ, or lines of growth, curving at unequal distances across the whirls. It is allied to *Macrocheilus* (*Buccinum*) *Gibsoni*, Brown, and *M. Michotianus*, De Koninck, but differs in several particulars. Fig. 6 *a* and *c* are outlines of the natural size, *b* and *d* being enlarged three diameters.

The assemblage of fossils from the calcareous nodules above mentioned, in its facies or general aspect, bears a considerable resemblance to the interesting set of Coal Measure fossils, from near Todmorden, Yorkshire, described and figured by Captain Thomas Brown, F.L.S., &c., in the "Transactions of the Manchester Geological Society," vol. 1, p. 212.

The following is a list of the species from Foynes Island :—

PLANTÆ.

Calamites cannæformis.
Stigmaria ficoides.
Lepidostrobus—fruit of Lepidodendron.
Stems with longitudinal fibrous structure, and others having a diameter of 2½ inches,

MOLLUSCA, *Conchifera*.

Aviculopecten papyraceus. ×
Posidonomya vetusta. ×
,, Becheri ?
Myalina Foynesiana, n.s. (fig. 4, p. 13).

GASTEROPODA, *Pyramidellidæ*.

Loxonema Galvani, n.s. (fig. 5 *a*, *b*). ×
Macrocheilus inflatus, n.s. (fig. 6 *a*, *d*). ×

CEPHALOPODA, *Tetrabranchiata*.

Nautilus tuberculatus.
Orthoceras minimum, n.s. (fig. 3 *a*, *b*). ×
,, dactyliophorum.
,, sp ?
Goniatites crenistria. × ×

The mark × indicates the abundance of the species.

At the village of Foynes, on the Shannon shore, county Limerick, $\frac{1}{8}$°, near the Railway terminus, the following species were collected from dark Coal Measure shales, abounding in fossils :—

Plant stems.
Stigmaria ficoides.
Aviculopecten papyraceus. × ×
Posidonomya vetusta. ×
Goniatites crenistria × × ×
Orthoceras lineolatum.
,, Steinhauerii.

At one mile S. of Foynes, Mr. G. H. Kinahan collected in thinly laminated Coal Measure shales—

Posidonomya membranacea.
Crushed Goniatites.
Fish bones and scales, like those from Rosscliff mentioned on p. 19.

On the road W. from Shanagolden, county Limerick, $\frac{1}{1}$°, the following fossils were collected from the Coal Measure shales :—

Plant stems, longitudinally and transversely striated.
Posidonomya membranacea.
Aviculopecten variabilis.
Goniatites crenistria. ×
Orthoceras lineolatum.

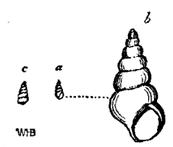
From the Coal Measure shales at Mountdavid, near Shanagolden, county Limerick, $\frac{2}{1}$°, which, as well as those from the previous locality, are extremely rich in fossils, the following species were collected :—

Plant stems, longitudinally striated. ×
Calamites cannæformis.
Posidonomya vetusta.
Aviculopecten papyraceus. × ×
Goniatites crenistria. × ×
(One very large specimen measures three inches across the outer whirl.)
Orthoceras inæquiseptum ?

At Loghill, county Limerick, $\frac{9}{2\frac{1}{4}}$, in Coal Measure grits and shales, some of the shales contained masses of Plant stems longitudinally striated, with impressions of *Calamites*, while from the grit *Diploxylon elegans*, and small tracks of marine animals, $\frac{1}{10}$ of an inch in diameter, were collected.

At Knockabooly colliery, county Limerick, $\frac{1}{2}$° (see p. 38), Mr. Kinahan found in the shales, *Posidonomya*, with a number of exceedingly small univalves ; *Loxonema minutissima, n.s.* (fig. 7 *a*, *b*, *c*). This species, which I believe to be a new form, has also been found very abundant in the Coal Measures near Abbeyfeale, county Limerick, $\frac{2}{3\frac{1}{4}}$. It is an elongated spiral shell with five or six rounded whirls, and so small that some examples are not more than the twentieth of an inch in height ; the largest (fig. 7 *c*) showing the back, measures $\frac{3}{20}$, with a diameter of about $\frac{1}{20}$-inch : *a* represents a specimen of the natural size showing the aperture, *b* the same enlarged six diameters.

Fig. 7.



Loxonema minutissima, n.s. Coal Measures, Knockabooly, Co. Limerick.

From the old collieries, near Glin, in the townland of Ballygiltenan Lower, county Limerick, $\frac{1}{1}$°, the following Fossil Plants were collected :—

Sphenopteris latifolia, *Brongniart*.
Alethopteris heterophylla, *Lindley*, sp.
Corynepteris stellata, nov. gen., *Baily* (fig. 8 *a*, *b*, *c*, p. 17).
Asterophyllites grandis ? *Lindley*. ×
Calamites cannæformis, *Schlotheim*.

Probably all belonging to the same plant.	Lepidodendron elegans, *Brongniart*,	*stem.*
	Lepidophyllum lanceolatum, ,,	*leaves.*
	Lepidostrobus ornatus, ,,	*fruit.*
	Sigillaria oculata, *Lindley.*	
	,, organum, ,,	
	,, tessellata, *Brongniart.*	
	Stigmaria ficoides, ,,	*roots.*

It may be remarked that all the above fossil plants with the exception of that considered to be new, are identified with species from Coalbrook Dale, in Shropshire, and Newcastle, in the north of England.

One of the most abundant of these plant remains is a peculiar form, which, from its verticillate leaves and their arrangement at regular intervals on a jointed stem, belongs to the family Asterophyllitæ (*Brongniart*). I have referred this, with some degree of hesitation, to *Asterophyllites* (*Bechera*) *grandis*. Lindley Fossil Flora, plate 19, fig. 1.*

This beautiful fossil plant is very conspicuous from the peculiar characters of its leaves and stem before mentioned, and from its branches bearing terminal organs of fructification resembling ears of corn. As it occurs in much better preservation in some of the collieries I have visited in the county Tipperary, especially at Knockilonga, townland of Colebrook, near Killenaule, being abundant in some of the compact shales, I shall reserve any further notice respecting its affinities for the Explanations to Sheet 146.

Forming quite a matted mass in these shales are longitudinally striated leaves, much elongated, having a middle rib; they bear considerable resemblance to the leaves figured by Brongniart, as attached to *Sigillaria lepidodrendifolia.*†

In consequence of the fragmentary condition of the shales, which have been lying for many years exposed to the disintegrating action of the atmosphere in the neighbourhood of these old and now abandoned pits, but few species of ferns have been identified from this locality. Of these *Sphenopteris latifolia*, is the prevailing form; one specimen only having been collected of *Alethopteris heterophylla;* with them were found detached acuminate leaves of the same character as *Lepidophyllum lanceolatum*, figured by Brongniart, and Lindley, and Hutton, as probably belonging to some species of *Lepidodendron.*

The most important plant here, as in other coal formations, is the *Sigillaria*, several kinds of which were collected, three of these being the common forms; with them also occurred portions of their roots, *Stigmaria ficoides*, showing the pits or scars to which the rootlets were attached.

Specimens of *Lepidostrobus ornatus;* the cone-like fruit of *Lepidodendron*‡ were also collected; together with well preserved fragments of the stems of *Calamites cannæformis*, a genus of plants abundant in the Coal Measure shales of the south of Ireland, and north of England, having hollow stems, externally ribbed and jointed, from which proceeded lateral branches.

From a black shale associated with the plants before mentioned, Mr. G. Henry Kinahan procured the remarkable plant *Corynepteris stellata*,§ nov. gen., fig. 8, *a*, *b*, *c*, a notice of which was given by me at the meeting of the British Association, in Dublin, September, 1857. Further examination has

* Since this was in type I had an opportunity of showing the above specimens to Dr. Geinitz, of Dresden, an eminent author on Fossil Botany, to whom I am indebted for much information respecting the relations of many of the fossil plants of this country. He informs me that the specimens I have doubtfully referred to *Asterophyllites grandis* is the *Sphenophyllum saxifrageifolium*, Steinberg sp., figured in his "Flora der vorwelt." Not having access to that work, however, I had not the means of identifying it.

† Histoire de Végetaux, fossiles, Tome 1, pl. 161.

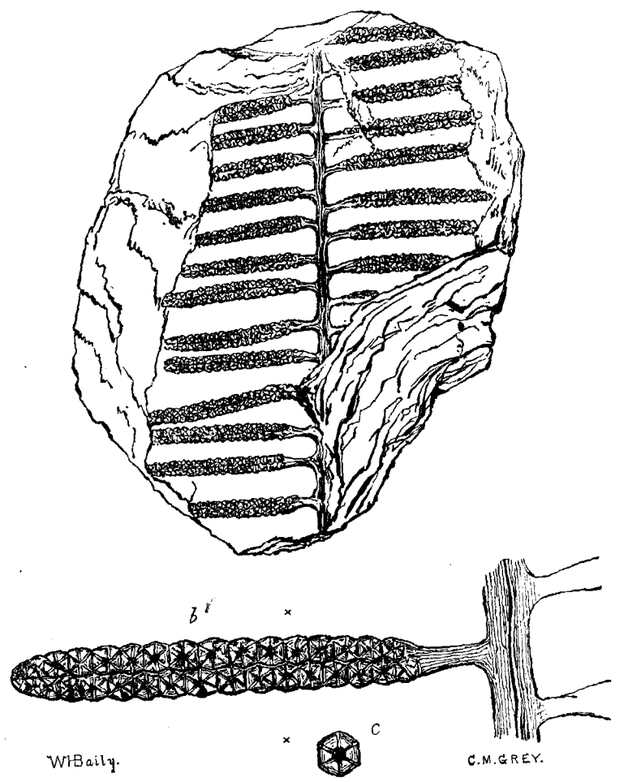
‡ Remarks on the structure and affinities of some Lepidostrobi, by Dr. J. D. Hooker, "Memoirs of the Geological Survey of Great Britain," vol, 2, part 2, p. 440, &c.

§ From κορύνη, a club—stellata, full of stars.

induced me to consider this unique fossil fern as forming the type of a new genus, the description of which was read before the Geological Society of Dublin, March 14, 1860.*

It appears to be the central portion of a fern frond, bearing about twenty pinnules. The stem is striated and longitudinally grooved, the groove having a flexure towards the pinnules on one side. The pinnæ are closely arranged at nearly right angles to the stem, alternating, and covered by sori or cases of the reproductive organs, which are arranged in two closely set alternating series, presenting an appearance resembling rows of small star-like flowers; which may, however, have been originally associated in spikes or clusters, becoming flattened by pressure. Fig. 8 *a*, *Corynepteris stellata*, natural size; *b*, one of

Fig. 8.



Corynepteris Stellata.—*Baily.*
Coal Measures, Glin, Co. Limerick $\frac{1}{1}$.
a. Natural size.
b. One of the pinnules enlarged 3 diameters.
c. A single spore case ,, 6 ,,

* Journal of the Geological Society of Dublin, vol. viii.

the pinnules enlarged, showing the rows of spore cases; *c*, a single spore case still more highly magnified, showing the separating of the indusium into six parts.

Dimensions.—Length of fragment, ... 3 inches.
Breadth of do., ... 2 ,,
Length of each pinnule, ... 1 ,,
Breadth of do., ... $\frac{1}{16}$,,
Diameter of stem, ... $\frac{1}{12}$,,

I am not aware of any Coal Measure plant which could be mistaken for the specimen under consideration, the nearest approach to it is *Filicites scolopendroides*, Brong. from the Triassic formation. There is a considerable resemblance to the arrangement of the spores and their star-like character in *Asterocarpus Sternbergii, Göpp*:* and in Hugh Miller's Testimony of Rocks, a figure is given, p. 460, fig. 125, of a somewhat similar form from the Airdrie Coalfield; they are all however very distinct from the fossil I have described.†

The rare occurrence of the preservation of organs of fructification in fossil ferns of the Carboniferous period, which in this specimen appears to be so fully developed, gives it much greater interest; and would favour the supposition, that it may possibly be the frond of a species of fern which, if found entire, would present, as in recent examples, a different aspect in its barren fronds. In the absence, however, of evidence to warrant its connexion with any described species, I have thought it advisable to retain it as a new generic form ‡

From the basal shales of the Coal Measures in the townland of Rosscliff, county Clare, $\frac{5}{8}$, at a cutting in the old road (see page 21), Mr. F. J. Foot collected the following fossils:—

PLANT STEMS.

Aviculopecten papyraceus.
Posidonomya membranacea? with both valves attached.
Lunulacardium Footii, n.s. *Baily*, fig. 9, *a—d.*, p. 19.
Goniatites crenistria. ×
Orthoceras, *sp.*
Fish scales and bones.

I have referred a very distinct and well marked bivalve shell, in the above list to *Lunulacardium*, a genus of the family Cardiadæ, established by Count Münster 1840.§ This genus is included by Bronn in his Index Palæontologicus,‖ as Lunu*li*cardium, all the species being there catalogued as Devonian, except one which commences in the Upper Silurian. Mr. S. P. Woodward does not, however, admit it as a genus, but makes it a synonym of *Conocardium*, again changing its orthography to Lunu*lo*-cardium.¶

Although some of the species described by Count Münster, may perhaps, belong to *Conocardium*, I am disposed to consider the genus a good one, and to refer to it the well marked Cardioid shells from the Coal Measures discovered by Mr. Foot at Rosscliff, with others found by me at Westown, county Dublin, and near Drogheda, county Meath, together with one or two

* H. R. Göpperti Systema Filicum Fossilium, 1836. Tab. vi., fig. 1-3.

† Dr. Melville has suggested to me its affinity with Alethopteris, as being probably the fertile frond of *A.* lonchitica.

‡ Dr. Geinitz, who has since examined this specimen, agrees with Dr. Melville in the probability of its being the fructification of Alethopteris, and would, in that case, be disposed to refer it to the genus Asterocarpus; which is, in fact, a genus founded upon the fertile fronds of Aiethopteris.

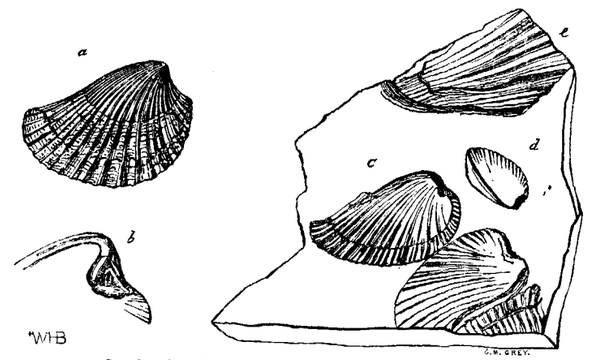
§ Beiträge zur Petrefacten-kunde, Heft III. p. 69. Von Herm. V. Meyer, und Georg Graf zu Münster. Bayreuth 1840.

‖ Index Palæontologicus, von Dr. H. G. Bronn, 1848-9, vol. 1, p. 677, and vol. 2, p. 311.

¶ Manual of Mollusca, 1854, p. 292.

species in the collection of Sir Richard Griffith, Bart., which Mr. John Kelly informs me he collected in what has been called the Millstone Grit, at Cahernanalt, Kendue, county Roscommon.

Fig. 9.



Lunulacardium Footii, n.s. Coal Measures, Rosscliff, Co. Clare.
a, c, d, e, nat. size; *b*. enlarged 2 diameters.

The species I have named *Lunulacardium Footii*, fig. 9 *a–d*, although somewhat crushed, exhibits in all the specimens collected the same curved character of outline at the posterior portion. This elongated and probably depressed shell, had an oblique angle posteriorly like *Cypricardia*, and is ornamented with about twenty-five strong angular ribs, radiating from the umbo, becoming flatter towards the margin, crossed by fine transverse lines of growth. The casts of the hinge teeth are very deep, but not easily made out; *b* is an enlarged figure from the left valve.

The specimens collected were all grouped upon one slab of hard black shale, which, on splitting, showed the casts and mould of the interior and exterior of the shell. Fig. 9 *a*, is an outline of the exterior surface of the left valve, *b* hinge of do., enlarged twice; *c, d, e*, a group of the casts of these shells of different ages. *Dimensions.*—Height, $\frac{8}{10}$ inch; breadth, $1\frac{1}{10}$ inch.

I am unacquainted with any form of bivalve, from the Carboniferous Limestone or Coal Measures, at all comparable with this well-marked shell, or which so closely resembles some of the recent sub-genera of the genus *Cardium*. It becomes, therefore, an interesting addition to the Carboniferous fauna; its nearest alliance being to *Conocardium*, a genus which attains its maximum in the limestones of that formation.

I have given at fig. 10 *a, b*, outlines of two kinds of fish scales which occurred, with scattered bones of fish, on a fragment of hard black shale, collected by me at Rosscliff.

Fig. 10.

Fish Scales. Coal Measures, Rosscliff, Co. Clare.

Figure *a* is very similar in form to one I obtained from Coal Measure shales on the south bank of the River Boyne, near Drogheda, associated with other fossils of a similar character to those from Rosscliff.

May 3, 1860. W. H. B.

4. *Relations between the Form of the Ground and its Internal Structure.*

Almost all the mainland N. of the River Shannon is composed of the Coal Measures. A small portion N. and E. of the village of Ballynacally is formed of Limestone, as are also the islands in the River Fergus, with the exception of Inishcorker, which consists of Coal Measures.

The Coal Measures lie above the Limestone (see section near Shanagolden, fig. 1), and form the higher ground, which ends in a well-defined but rounded and gently sloping escarpment, looking towards the east over the Limestone plain.

All the Limestone, however, was once undoubtedly covered by the Coal Measures, until the action of denudation removed the superincumbent rocks, leaving the Limestone bare.

To the same general action of denudation, operating upon uplifted and often contorted or dislocated beds, is to be attributed all the varieties in the present form of the surface of the ground, both above and under water. The higher Coal Measure ground, on the western side of the sheet, has been rather less subject to this action than the lower Limestone ground to the east, or at least we may say that the action has been less complete there. While, however, there can be no difficulty in pointing to the action of denudation as the general producer of the form of the ground, it would be very difficult to specify the precise modifying causes which made this action more complete in one part, or less so in another. We should have, for instance, to extend our view far beyond the limits of the district if we attempted to speculate on the origin of the valley now occupied by the bed of the Shannon, since there is nothing in the structure, or position, or lie of the rocks which would have caused the river to run where it now does, rather than in any other direction, or to cut through the escarpment of the Coal Measures immediately at Foynes, rather than at any other point.

J. B. J.

Detailed Descriptions.

5. *Position and Lie of the Rocks.*

[That part of the district contained in this sheet, which is situated in the county of Limerick, was surveyed by Mr. G. Henry Kinahan, the rest by Mr. F. J. Foot.] J. B. J.

d^2. *Lower Limestone.*—The lower beds of this subgroup are found on the south-eastern part of the sheet. On the coast to the north-east of Court Brown Point, there is dark blue argillaceous limestone, that dips S. and S.S.W. at 5°. To the south of the last-named place, and due east of Court Brown Point, are calcareous gritty shales, abounding with nodules, which, when weathered, are full of red clay; they dip at 40° to the W. A little to the south of this these same beds form two small quaquaversal curves, and more south still they dip S. at a low angle under the gray limestone. To the east of this, and north of Court Brown, dark blue limestone, with black shale and chert, is found dipping N.W. at 55°. In these beds is a vein of calc spar that was *driven* on for ore, but without success. To the south-west of Court Brown are seen similar beds.

At Illaunlea, and to the north of it, some of the beds take a most peculiar aspect, being full of nodules, giving them the appearance of a conglomerate; these rocks are associated with dark blue argillaceous limestone. Part of the same beds are found at the west and south-west of Ballynash Castle. To the east of this are good dark blue argillaceous limestones.

The rest of the Lower Limestone is usually a confused mass, the stratification of the beds being generally so obscure that it is difficult to determine either their dip or strike; but they seem to undulate over the district at a low angle. Above the lower beds, at Court Brown, Ballynash Castle, and Shannon View, are seen dark gray, gray, and blue limestones, in which are numerous fossils. On the coast to the south of White Island, the limestones, which are gray and blue, are affected by two sets of nearly vertical joints, which bear E. 10° N., and N. 20° W. To the west of this there is a purplish blue limestone that takes a good polish. At the north of Morgan's House the same sets of joints as those just spoken of were remarked. The rocks to the east of Barrigone are cut up by four sets of joints, the most universal of which runs N. and S.; another set bear N. 20° W., and S. 20° E.; and the third, which is very partial, is W. 10° N., and E. 10° S.; while the fourth, which was only remarked to the N.E. of Barrigone, runs E. 30° N., and W. 30° S. Half-a-mile to the north of Barrigone there is a bed of magnesian limestone nearly a true dolomite. At the south of Aughinish the rocks are cleaved; the strike of the cleavage running E. 30° N., while to the north of the island they are affected by two sets of joint, the bearings of which are N. 20° E., and E. 20°. S.

About half-a-mile to the south of Barrigone the limestone is magnesian. To the east of Nutgrove House there are two E. and W. dykes of dolomite. A mile to the W. of Creeves there is magnesian limestone. All the rest of the rocks that are exposed to view are gray and blue limestone, with here and there a red or purple bed, and in places it is magnesian to a greater or less degree. These limestones usually abound in fossils, especially those near the Upper Limestone.

d^4. *Upper Limestone.*—The junction beds between the Upper and Lower Limestone are only seen in a few places. There is a small outlying basin of Upper Limestone situated to the south of Ballycullen House, in which there is dark blue argillaceous limestone, full of layers of gray and black chert. At the S.E. of the sheet, and in a basin about a mile to the south of Barrigone, similar rocks are found. In these three places the junction beds are the only rocks of the Upper Limestones that are seen. Along the west coast of Aughinish, the junction beds of the Upper and Lower Limestone are well seen; they nearly follow the contour of the coast line. There are three faults, as marked on the map, which slightly shift the beds.

Due west of Barrigone, on the old road from Limerick to Foynes, there is gray magnesian limestone, full of layers of chert, dipping W. at 30°. On it are black limestones, with thin shale partings, which dip first W. at 30°; then, E.N.E. at 30°; and lastly, W. at 15°. These underlie beds of the same sort of beds, over which, at the N. of the old church, are black limestone and shale; in some places the limestone is so thin-bedded as to be a coarse flagstone; in others, it is cleaved into a coarse slate. Part of this limestone burns into a good hydraulic lime. These dip W. at 15°. The rest of the section to the west exposes beds of black limestone, interstratified with thin partings of shale and layers and nodules of chert, the colour of which is usually black or gray; all these beds dip W. at 15°. Most of this limestone is a good building stone.

To the S.S.E. of Foynes, and W. of Corgrig House, there are large quarries that are extensively worked, and out of which large blocks can be raised; the dip of the beds is to the W. at 25°. To the N.E. of this, and S. of Durnish Cottage, the rocks are dark blue and black, with chert, and dip N. W. at 35°. Similar beds are found to the S. of Durnish Point; they dip S.W. at from 25° to 30°, and W. at 35°. To the south of Corgrig House there is an anticlinal curve, the sides of which dip W. at 20°, and E.S.E. at 45°. Some of the beds here are slightly oolitic. Very good limestone is quarried about three-quarters of a-mile to the N.N.W. of Shanagolden; it is used extensively

for window-stools, tombstones, piers, &c. Shanagolden R. C. Chapel is built on black limestone with shale partings. About half-a-mile due west of Shanagolden, associated with trappean ash, is a mass of gray limestone, in appearance very like the Lower Limestone. It is remarkable, as gray limestones are often found associated with these igneous rocks, though all the surrounding limestones may be black or dark blue. (*See Explanation of Sheets,* 143, 144, *and* 154.)

Good fossils were got at Durnish Point; in the railway cutting to the S. of Durnish Cottage; to the S.W. and S.E. of Corgrig House; in the quarries to the N.N.E. of Shanagolden; and to the S.W. of the R. C. Chapel belonging to the last-named place. Associated with these limestones, to the S.E. of Shanagolden, at Kilmoylan old church, there is *Trappean brecciated ash,* that has usually a green base, and is in coarse and fine layers. The pebbles contained in it are principally limestone, along with a few pieces of grits and shales. Where it is seen *in situ* to the S.W. of old church, it dips W. at 25°. To the S.E. of this, it seems to be rolling in such a way as to be nearly horizontal; but on account of the nature of the ground no conclusive evidence is seen.

To the E. of the Vicarage that lies to the S.S.E. of Foynes, there are blue limestones, both massive and thin-bedded. Similar beds are found at the foot of the east slope of Knockpatrick. At the former place, in a quarry newly opened, there is a good section of the beds near the top of this series, of which the following measurements were taken:—

Section No. 1.

		Ft.	In.
13.	Compact gray limestone,	0	10
12.	Earthy shale,	0	2
11.	Dark blue limestone,	0	3
10.	Black shale, with a few productæ,	0	8
9.	Black limestone,	0	3
8.	Earthy and black shale,	0	2
7.	Dolomite, flesh colour,	0	4
6.	Shale parting,	0	1
5.	Thin flaggy limestone, with a few thin partings,	2	4
4.	Clay parting,	0	1
3.	Dark blue compact limestone,	0	6
2.	Shale parting,	0	1
1.	Blue limestone, thickness not known, over	4	0
		9	11

To the north of Shanagolden there is massive blue limestone; over it are thin-bedded blue limestones, interstratified with black and gray argillaceous and arenaceous shales. These lie under dark blue, in places nearly black, limestone. To the south of Shanagolden the beds are nearly one mass of chert; they lie under a massive gray limestone. In the stream a little to the west of this a very siliceous red Hematite, associated with crystals of quartz—the latter imbedded in white Wavellite,—was noted. Whether they are in a lode or in beds it is hard to determine, the stream only partially exposing the section.

At Shanagolden the ground is faulty; the faults seem to run as they are marked on the map; but there is no conclusive evidence of their exact position. At Shanid Castle there is massive blue limestone.

G. H. K.

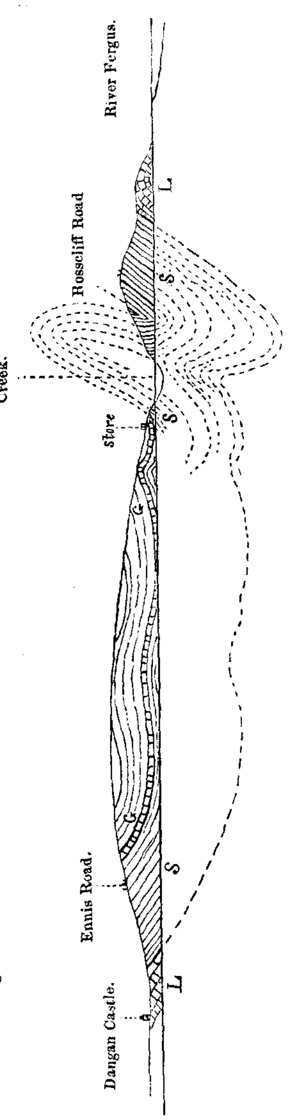
The Upper Limestone at the north of the Shannon—

At the N.E. point of Inishloe are beds of thick dark gray or bluish granular limestone undulating, but having a general dip to the N. at 35°. A little S.W. of the point, on the S. shore of the island, beds similar to these, but above

them in the series, dip S. 30° W. at 40°. This dip continues for more than a quarter of a mile along the shore; but at about 170 yards from the most westerly parts of the island, the beds turn over and dip W. 30° N. at from 30° to 50°.

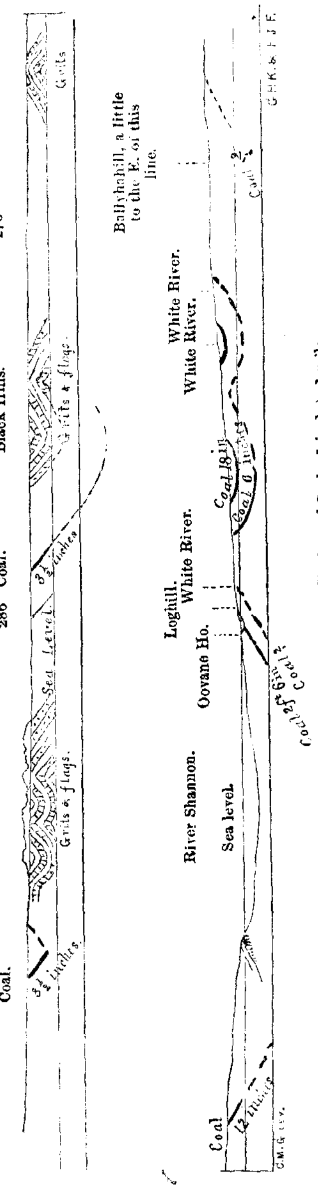
In the section of the rocks between the west point of Inishloe and the N.E. coast of Cannon Island, the thick beds of dark gray granular limestone seen at the former place pass upwards into thin-bedded dark gray fine-grained limestone, the dip continuing N. 30°, W. at about 40°.

Fig. 11.
Diagrammatic Section from River Fergus, opposite S.W. point of Deer Island, to Dangan Castle.



G. 1st Grit bed.
S. Shales (base of C. Measures.)
L. Limestone.
Vertical Scale, 12 inches to 1 mile; Horizontal Scale, 6 inches to 1 mile.

Fig. 12.
Diagrammatic Section, running N. and S. through Loghill.



Vertical Scale, 3 inches to 1 mile; Horizontal Scale, 1 inch to 1 mile.

In Cannon Island the beds are traceable the whole way, from the southern to the northern extremity. In the middle of the island they undulate

slightly, and dip due W. at 30°. The best section is exposed at the southern end of the island, where the dip is N.W., at an average angle of 40°. As has been said above, the lower beds are dark gray fine-grained thin-bedded limestones, with occasional chert bands. Fossils are locally abundant.

As we ascend in the series the beds are much alike, thin-bedded, and either fine-grained or compact dark bluish gray, till we reach a little creek near the S.W. point of the island, from which a ravine runs inland in the direction of the strike of the beds, or nearly S.W. and N.E. Here are numerous chert bands in the limestone, which has become quite flaggy, and also a band of magnesian limestone, one foot thick.* Bands and partings of black and brownish decomposed shale are also interstratified with the flags.

These beds are also exposed on the N.W. shore of the island, dipping W. 25° N. at 20° to 30°. They are also to be seen on the eastern shore of Inishtubrid, where they are much contorted, but have a general dip of E. 25° S. at an average angle of 40°. Thus the channel between these two islands is in a synclinal fold.

At Knocknalenaun (the summit of Inishtubrid) higher beds than the last described, are seen dipping N.W. at from 25° to 45°; they are massive light gray compact fossiliferous limestone. Further westward, at the W. shore of the island, are still higher beds, dark gray and cherty, dipping N.W. at from 15° to 30°.

On Inishmacowney the same beds as the upper ones described on Cannon Island are exposed along the shore. On the eastern shore (that opposite Cannon Island) they dip S. 25° E. at 40° to 45°; at the south-western extremity of the island, S.W. and W. at from 30° to 45°; and along its N.W. shore, the average dip is N.W. at from 60° to 80°. Thus the beds on Inishmacowney form an anticlinal curve. The same is the case with the same beds on Shore Island.

Coney Island is principally composed of drift or debris of the limestone; but at its N.E. extremity are seen beds of dark gray fine-grained limestone, with occasional chert bands. The bedding is very obscure.

On Inishmore or Deer Island, at the eastern end, we see dark gray granular thin-bedded limestone, with occasional bands of chert, dipping W. at from 20° to 30°. Going along the N.E. shore these beds flatten, and then dip S.E. at 25°. In the middle of the island they dip S. 30° E. at 50° to 60°. Proceeding still westwards, along the northern shore, these beds are again seen dipping W. 20° N. at from 20° to 30°. They seem to continue to dip in this direction as far as they can be traced, viz.: a little E. of the ruined church on the W. shore of the island. Here are compact thin-bedded and flaggy limestones, with occasional shale partings, and also chert bands, dipping W. 20° N. at from 50° to 70°; these are very near the top of the limestone, as a little further W. may be seen the basal Coal Measure shales.

On the mainland, opposite the ruined church on Deer Island, the upper beds of the limestone are well exposed in the townland of Rosscliff. Where on hilly ground, they form an anticlinal fold, the dips being N.W. at 65°, and S.E. at from 30° to 40°. On the roadside at Dangan Castle and W. of it, are seen dark and pale gray massive limestone, the dip of which is very obscure. These beds abound in fossils. They must be near the top of the limestone, as close to them we get the basal shales of the Coal Measures.

The little Island of Inishmurry, about one mile and a-half S. of Killadysert, is formed of beds of dark gray crystalline and compact limestone, dipping N.W. and S.W. at from 20° to 40°.

Coal Measures, north of the Shannon.—We will commence the description of these rocks at the N.E. corner of the map, as there the best section is to

* These beds are apparently the same as those at Robertstown, on the S. side of the Shannon.—G. H. K. and F. J. F.

be seen. S.E. of the village of Ballynacally, in the townland of Rosscliff, the beds nearest to the limestone are black flaggy shales, very cherty (*some of them altogether chert*), emitting sparks on being struck with the hammer. They are each about three-quarters of an inch thick, and they dip N.W. at 40° to 45°. As we ascend in the series, going through the cutting in the little road leading to Ballynacally, the chert gradually disappears, and we have black or dark gray flaggy shales, easily divisible into innumerable laminæ, and abounding in posidonomya, of which many specimens exhibit both valves joined at the hinge. Some of these shales on being split present a surface all covered over with small posidonomya; there are also numerous other fossils.

The dip of N.W. at 45° increases to 80°, or nearly vertical. In one place in the cutting the beds are vertical. These upper flaggy shales are interstratified with soft black very finely laminated shales, much decomposed. They are also full of fossils, but on account of their soft nature it is not easy to procure and carry away good specimens.

At both sides of Ballynacally Creek, at the north side of the little road, soft black shales are seen, similar to the last-mentioned, and abounding in fossils; but they are apparently higher up in the series than the latter; they dip N.W. at 60°.

On the side of the little road, and west of the bridge over the creek, are black shales under dark gray sandy shales, with grit bands, dipping N.W. at 75°. The beds seen next above them (on the rising ground north-west of the Store), are olive grits slightly contorted, that is, at the N.E. end they dip S.E. at 20°; and at their N.W., they dip N.W. at 20° or 30°. This section gives us an *apparent* thickness of upwards of 700 feet of these basal shales.

In the little stream S. of Ballynacally a much contorted section shows the shales, with the overlying grit; and on the Ennis road, N. of Ballynacally, are still higher beds of grit flags and olive sandy shale, dipping W.; and still a little further north is the first grit bed (the same as that on the rising ground near the store), dipping S. at 30°; and further north, near Dangan Castle, are the upper beds of the limestone. Now, at the most, there cannot be more than 250 feet of shale between the grit and the limestone here (the only shale visible being a little patch of soft black shale on the roadside); therefore, as the adjacent rocks do not show any sign of a fault, either the shale must have thinned out from upwards of 700 feet to 250 feet in a distance of little more than half-a-mile, or the beds in the Rosscliff section must be highly contorted, and the tops of the ridges of the contortions cut away, so as to give the appearance of a continuous section. I consider the latter view of the question the most probable.

West of Dangan Castle the beds dip S.W. at 30°, and N.W. of it they dip W. at 30°; the basal shales are not seen. In the townland of Carrowkilla (in sheet 132), however, at S. side of the road, a pit was sunk for culm, which was not got, but at a depth of thirty feet the shales were found.

The basal shales are also seen in the following places:—on the shore of Deer Island, near the ruined church, where they dip W. at 30°. The soft upper ones are seen on the west point of the island and at Carrigaduffy rocks, opposite on the mainland, where they dip W. 20° N. at 15° or 20°; fossils are found here in abundance; on the shore, in the townland of Crovraghan, one mile and a-half S. of Carrigaduffy rocks, both the black flaggy shale and the upper soft shale, dipping W. at 30° or 40°; further S., on the west point of Inishtubrid, are the flaggy shales, dipping W. at 30°; and opposite, on the S. shore of Inishcorker, the upper shales are well developed, having a general dip of N.W. at from 20° to 30°; these have nodules containing crystals of iron pyrites and bands of ironstone. The uppermost are black splintery shales, several of the beds being full of Goniatites in iron pyrites. Above them, on the N. shore of the island, and on the mainland N. of Ballinacragga

Point, are the olive grits, nearly horizontal at the latter place. Further south, the upper part of these shales next the olive grits are seen contorted, on the shore N. of Caheracon Point, opposite the little island of Inishmurry.

The beds of olive grits, flags, and sandy shales which overlie the first grit beds are well exposed all along the main road from Ballynacally to Killadysert, and between it and the shore. In the latter place they are contorted, dipping E. and W. at 30°; but the road section shows a general dip of N. 25° W. at 30°. Half-a-mile west of Ballynacally, at Kilchreest Church, are gray flags, dipping W. at 10°; and further west and N.W. of the church, in the townland of Ardnagla, are several quarries of olive grits, flags, and sandy shales, dipping S. at from 20° to 30°. Further west, in the townland of Burren, and about a quarter of a mile N. and N.E. of Lough Lomaun are quarries on the roadside, and crags north of the road, showing a general dip of W. 25°, N. at from 30° to 50°. As we go further west, along the new road, the amount of dip decreases to N. 20° W. at 5°; the beds becoming nearly flat.

About one-third of a mile N.W. of Lough Lomaun, a pit was sunk some years ago, and coal was got. All I could learn about it was, that as it did not seem of a good quality, or in any great quantity, the work was abandoned. At the pit olive splintery shale is seen overlying black or dark gray shale, under which the coal lies.

One mile and a-quarter west of Lough Lomaun, in the stream which forms the south-western boundary of the townland of Leamnaleaha, coal is seen; it is probably the same as the last-mentioned. At the east end of the section the beds dip N.W. at 40°, and then turn round to S.W. at 20°, 30°, and further west, S. at 25°, 40°. The vertical section is as follows:—

Section No. 2.

		Ft.	In.
7.	Olive grit,	–	
6.	Black shale, about	30	0
5.	Coal?	–	
4.	Olive grits and flags, top bed a dark gray or blue grit,	10	0
3.	Dark gray shale, with from 1½ to 3½ inches of slaty culm, having plant in abundance,	0	4 to 6
2.	Alternating grits, flags, and shales,	10	0
1.	Strong quartzose olive grits,	–	

No. 5 is inserted with a query, as in other respects the section resembles others of the district where coal is seen here. Westward about a mile and a-half, in the townland of Bolooghra, are gray and olive flags and shale, dipping N.W. at 10°, 15°. They may underlie the coal. South of these, in the townland of Burreenfadda, near the trigonometrical point △ 374, are olive grits and sandy shale, dipping W. 20°, N. at 25°; and one-fourth of a-mile east of this, in the townlands of Shessiv and Craghera, crags of olive grit are seen highly contorted, but showing a general dip of W. and N.W. at 30° or 40°, and S. at 30°.

Again, starting from Ballynacally, and proceeding in a S.W. direction, on the side of the road which leads to Cloonakilla, are seen thin olive grits, dipping S. 20° W. at from 40° to 50°; and southwards, a little N. of Paradise gate-lodge, and also S. of it, and on E. side of the Killadysert road, the same beds dip W. at various angles from 20° to 60°. In the cutting of the new road, in the townland of Ballynagard, one-fourth of a mile S.E. of Cloonakilla House, are seen olive grits and partings of sandy shales, dipping W. at 20°. On the road at Cloonakilla House are olive grits and flags lying horizontal, and dipping S. at 25°.

As we go W. along the road, half-a-mile W. of Cloonakilla House, in the

townlands of Lack and Coolsuppeen, is a valley, narrow at its N.E. end, but widening out into a large tract of bog as we go W. It is caused by the rocks forming a synclinal fold. At the N.E. end or commencement of this valley the beds, which are olive grits and flags, dip W. at 25°; at the N. or N.W. side of it they crop out in crags on the hill-side, dipping S.E. at from 30° to 20° (this dip becoming S. at 30°, further west). On the S.E. side they also form high crags, having a general steady dip of N.W. at 50°. In the middle of the valley rises an abrupt hill with terraced side. On its side, fine-grained olive grit or sandy shale is seen. The dip is obscure, but it may probably be horizontal.

Coal was worked in this valley up to the year 1857. The following vertical section and information was obtained from Mr. Barry, who now lives on the abrupt hill above-mentioned, and who superintended the working of the coal:—

Section No. 3.

		Ft.	In.
5.	Local drift,	6	0
4.	Black shale,	33	0
3.	Culm (coal),	0	5 to 6
2.	Pyritic gritty shale,	1	?
1.	*Olive flags and grits,*	–	

The dip at the outcrop is S. at 15°.

Mr. Barry says that the coal appears to thicken along the dip. It seems to have been badly and expensively worked; yet it paid well for the working. The latter cost 4*s.* per ton, and the coal was sold at the pit's mouth for 10*s.*, and in Limerick for 15*s.* It seems to be a tolerably good quality of coal; it splits up into cubes.

It is seen again further west in the line of strike on the roadside at the stream bounding the townlands of Tonlegee and Lisnafaha, and about three-quarters of a mile S.W. of Lough Lomaun, the dip being S. at 30°; a little south of it, in the townland of Craghera, are seen superior beds, olive grits and flags forming crags, and dipping S. at 30°.

On the S.E. side of the valley no trace of the outcrop of the coal is visible, but the beds of olive grit which dip N.W. at 50°, are evidently below the coal, and probably not far below it.* They are traceable in a south-westerly direction along their strike for about three miles from the head of the valley, showing contortions in places, and varying in the amount of dip.

About half-a-mile N. of Gortglass Lough, in the townland of Glenconaun More, beds dipping similarly, but above them, and ? above the coal, form a craggy margin to the bog into which the valley widens. At the western side of this townland, at the turn in the road half-a-mile N. of Cloonsnaghta Lough, they form a small synclinal fold, dipping N. at 40°, and S. 20° E. at 25°.

About one-third of a mile south-west of the road, and nearly in the line of strike of these beds (but probably below them), and cropping up in the bog, are olive grits and flags, dipping S. 30° E. at from 20° to 50°. These beds can be traced for a mile and a-half along the strike. East of St. Becan's fort, on both sides of the road, they form high crags, dipping S. 30° E. at from 30° to 45°; but S. of the fort they dip S. at 30°.

The boundary between the townlands of Cloonkett and Cloonsnaghta, one-third of a mile S. of St. Becan's fort, is a rocky ravine; the beds in it being above those last described. Coal is seen at the edge of the stream. The following is the vertical section:—

* This is probably the same coal as that mentioned in the townland of Burren, see page 26.

Section No. 4.

	Ft.	In.
5. Black shale,	35	0
4. Coal,	0	3½
3. Olive flags, with shale partings and dark gray flags,	20	0
2. Gray shale,	20	0
1. *Olive grits* and flags,	–	

Where the coal appears, the dip is S. at 30°, and from this point the beds below it, as also the overlying shale in one or two places, are traceable for nearly a mile along their strike, the dip being S. at 30°. At this distance, in the townland of Cloondrinagh, between the road and the Cloon river, they flatten and then dip N. at 10°. To the N., the Cloon river shows a non-continuous section in contorted beds of olive grits and flags, the latter generally rippled and containing mollusc tracks. S.W. of Cloonsnaghta, the "Black hills" exhibit a section in contorted beds; the rocks crop out in rough crags, and the beds are traceable along the strike, the general direction of which is W. 20° S., and E. 20° N., for miles in several places. These contortions will be best understood by examining the section at the little Lough Athoya, in the townland of Clonulla. North of Lough Athoya, and forming high crags at the south side of Cloonsnaghta Lough, beds of olive grits and sandy shale dip N.W. at 40° or 50°. At the north end of Lough Athoya, they turn over and dip S. at 20°, and at the S. side of the lough N. 20° W. at 30°, thus forming, at the N. side of the lough, a small anticlinal and then a synclinal, in which the lough lies. Further S., at the N. side of the road, they turn over again, and dip S. at 70°, extending in crags for a considerable distance E. and W. (the direction of the strike). For some distance S. of the road, the dip is still S. at 70°; and then, half-a-mile S.E. of Lough Athoya, at the stream bounding the townlands of Gortnaha and Shannacool, it changes to S.W., W., and N.W., at from 15° to 20°. It should have been mentioned that all along the northern shore of Gortglass Lough, which lies a little N.E. of Cloonsnaghta Lough, are olive grits and gray flags, dipping S. 20°, E. at from 35° to 45°. At the N.E. corner of the lough, the dip is S. at 20°, and the topmost bed is a dark gray flag, with carbonized stems of plants: it may be the seat of the coal. Also, at the eastern end of Cloonsnaghta Lough, is a bed of dark gray shale with plants; it may possibly be the shale above the coal. On the road leading from Gortglass Lough to Killadysert, a non-continuous section is seen of beds of olive grits, flags, and shales, dipping N.W. at from 30° to 40°; and at the N. side of the road, near Smith's bridge, situated a little more than half-a-mile W. of Killadysert, similar beds are seen, much contorted. N.E. of Smith's bridge, at Ballylean Lough, the beds of olive grits and flags form a synclinal, in which lie the waters of the lough; those at the N.W. side dip S.E., at low angles, from 10° to 30°; those at the S.E. dip N.W., at from 70° to 80°.

In the townland of Ballyvohane, and somewhat less than a mile S.W. of Killadysert, are beds of olive and gray grit cropping up in rough crags. Near the stream, W. of Ballyvohane House, they dip N.W. at from 30° to 15°. The cleavage is well seen here; it is vertical, striking E. 20° N., and W. 20° S. Further west, S. of Ballyvohane House, at the south side of the road, these beds dip N.W. at 40° to 50°, and a seam of decomposed coal is seen in the cutting. The following is the vertical section:—

Section No. 5.

	In.
4. Black shale, ? thickness,	–
3. Decomposed coal,	5
2. Fireclay,	1
1. Olive grit,	–

Going N.W. from this superior bed of olive grits, flags and sandy shale are seen (along the new road) contorted; but the coal does not appear, nor is it seen westward, although beds of grits and flags and sandy shale are traceable for two miles along the road leading to Labasheeda, dipping N.W. at from 30° to 60°; they are probably below the coal. On the S. side of this road, in the townland of Cappanavarnoge, and N.E. of Effernan Lough, the rocks form craggy knolls, and are much contorted. At Effernan Lough, the beds on the north side dip S. 30°, E. at 20°, 25°, curving round until, at the east of the lough, they dip S.W. at 15°, and then W. at 30°.

I shall now describe the section seen along the Shannon shore at Cahiracon, commencing at the point opposite the little island of Inishmurry. Above the first grit bed, we have olive grits, flags, and sandy olive shale, dipping W. at 40° to 50°, as far as Cahiracon Point; a little west of the point they are contorted. The continuity of this section is destroyed by intervals of deep drift. A little N.E. of the garden wall between Cahiracon Point and House, are gray and olive grits and flags and gray sandy shale, dipping W. 20°, N. at 50°. At the boat slip, near the house of Cahiracon, are olive shale and gray flags and shale, with thin bands of ironstone, dipping S.W. at 10°. Further S., from a point about one-third of a mile N. of the Ferry-house, the section is continuous for a considerable distance through beds of olive grits and flags, and gray sandy shales with ironstone bands, dipping S. at 15°. At the high cliff over the Ferry-house, the beds are horizontal, and there is a bed of black shale with goniatites. Southward from the Ferry-house, the same beds are seen for nearly a mile, as the direction of the shore is the same as their strike; they dip inland or N.W. at from 0° to 20°. Further S., some lower beds are seen by a slight change in the direction of the dip, which becomes N. 20°, W. at 15°, 20°. A little E. of Rinealon Point are two small faults. At the point where the stream flows into the little creek, E. of Goleensallagh bridge, there are strong olive grits, which dip N.W. at 10°. About half-a-mile N.E. of this, in the townlands of Shannakea More and Shannakea Beg, coal was worked up to a late period. The following vertical section was obtained from an old collier, named Michael Frawley:—

Section No. 6.

Strata.	Colliers' Terms.	Thickness. Ft.	in.
5. Black Shale,	"Pincil,"	27	0?
4. Finely laminated dark gray shale, with asteriform crystals of (?) sulphuret of iron, on surfaces of laminæ,	"Binder,"	3	0
3. Coal,*	"Culm,"	0	10 to 14
2. Hard black gritty band, with quartz veins,	"Spar,"	0	1½
1. Blue fireclay,	"Clay,"	3	0 (more than).

Northwards, N.W. of Clifton House, are beds of olive grits, dipping N.W. at 20°, the angle increasing as one goes E. to 50°. These beds—those last-mentioned, E. of Goleensallagh bridge, and those on the N. and E. shore of Effernan Lough—are probably below the coal. At Clifton House, and on the road south of it, are olive grits, dipping W. at 10°, 15°. They are a guide in tracing the direction of the outcrop of the coal. West of Goleensallagh bridge, at the road cutting and on the shore, are olive grits and flags and bands of olive shale, dipping N.W. at from 5° to 15°. Further west, a good section is exposed in the stream which flows into the Shannon at Goleen bridge. Near this bridge are black shales and olive grits and flags, with shale partings (and strings of impure coal), dipping S. 25°, W. at from 10° to 0°.

* This coal is said to have been worked by the Danes. It is not a good quality of coal. The fireclay, No. 1 is good, and brings ready sale in Limerick.

This dip of 10° continues for half-a-mile N. of the bridge, and then increases to 20°. A little further than half-a-mile N. of the bridge, the bed of coal again crops out. The vertical section, obtained from M. Frawley, is as follows:—

Section No. 7.

Strata.	Colliers' Terms.	Thickness. Ft.	in.
7. Drift,		–	
6. Greenish gray or olive grit,	"Green Grenat,"	3	0
5. Black shale, with nodules,	"Pincil,"	56	6
4. Finely laminated dark gray shale, with asteriform yellowish crystals on the surfaces of the laminæ,	"Binder,"	8	6
3. Coal,	"Culm,"	1	1
2. Dark gray hard gritty shales, with quartz veins,	"Spar,"	0	1
1. Blue fireclay,	"Clay,"	–	

At the E. side of the stream, in the townland of Erribul, this coal is said to have been worked by the Danes. There is still visible the remains of a wide trench, running for some distance in the direction of the strike of the beds, and called "the open cast." The miners thus worked along the outcrop. An old shovel, with the handle, was found in the rubbish; it crumbled to dust on being touched. This coal has been worked of late years, from near the village of Labasheeda to the west end of the "open cast." In the same stream that exhibits the coal section, and at the north side of its outcrop, about three-quarters of a mile N. of Goleen bridge, olive grits and flags (below the fireclay No. 1) are seen, dipping S. 25° E. at 20°; and further north, in the same townland, apparently the same beds dip N. 10° W. at 10°; while further north, a little N. of Kilfiddane church, apparently the same beds (black shales and flags) as those seen near Goleen bridge are seen dipping N. 10° W. at 20° to 25°. The outcrop of the coal is probably then less than one quarter of a mile S. of Kilfiddane church, and this is probably the same coal as that mentioned as seen at Ballyvohane (see page 28). Near Labasheeda, in the townland of Cloonkerry West, two small N. and S. faults, about fifty yards asunder, give a downthrow of about two feet to the mass between them, or, as the miners say, the "Culm sank through the seat." N. of these faults, in the same townland, are olive grits, dipping N. 20° W. at 15°, probably the seat of the coal on the other side of the anticlinal. On the roadside, a little S.W. of Cloonkerry House, are seen olive grits, dipping S. 20° E. at 15°. They may probably be No. 5 of the section.

At Labasheeda Point are olive grits and sandy shales, forming a flattened dome, being nearly horizontal. North-west of Labasheeda Point, between the village and the shore, a pit was sunk, and coal was raised. West of this, nothing is known or seen of the coal. Proceeding along the shore S.W. of Labasheeda, in the townland of Mountshannon, at the south side of Killanna Point, olive grits, flags, and shales, dip S. 25° E. at 20° to 25°. At Redgap Point, they become horizontal, and then dip N.W. at 10°. At Mountshannon Point, they again lie horizontal; in the shale are numerous nodules and bands of ironstone. South-west of Mountshannon Wood, similar beds dip N.W. at from 5° to 15°; a little inland, they are nearly or quite horizontal. About half-a-mile E. of Colman's Point, the beds are contorted, dipping S. at from 30° to 45°, and N. at 20°; and then, for a mile along the shore, they dip N. at low angles, being contorted in several places. A little more than half-a-mile W. of Colman's Point, they dip N.W. at from 50° to 65°. From this to Kilkerrin Point, there is a gap in the section; about half-way, are olive grits, dipping N. at 25°. At Kilkerrin Point, are olive grits and rippled flags, horizontal, with a few slight undulations; N. of the point, these beds dip S. at 20° or 25°, and then E. at 10°. One mile N.E. of the point, and traceable along their strike for half-a-mile, are seen olive grits and black shales, dipping N. 15°, W. at from 20° to 30°. The shale contains plants and shells. The road from the shore, which runs nearly N. and S. through the townland of Kilkerrin, presents a section of olive grits and some black shale, dipping N. 15° W. at 20° or 30°. Near St. Kerreen's Altar, these beds are horizontal, and then dip S. 20° E. at 20°; and this dip continues as far as the road which leads from Labasheeda to Kilkerrin Point. Further east, along this road, are seen, for more than a mile, olive grits and flags, dipping N. or N. 20° W. at 10°. In the townland of Ballina, on the road leading to the shore, are olive grits and shales, dipping S.E. at 15°; and at the shore, in the same townland, are olive gray grits and black shales, contorted, but having a general dip of W. at 15°. In the townland of Ballyartney, at the turn in the road leading from the shore, and half-a-mile W. of Ballyartney House, olive shale is seen, dipping S. 10° E. at 30°; and at the cross-roads N. of Ballyartney House, beds of olive grits and shale form a little anticlinal, dipping S. 30 E. at 40° or 45°, and N. 30° W. at from 30° to 50°.

At the waterfall at the head of the creek, S.E. of Clonderalaw House, are olive grits and shales, dipping N. at 20°, and slightly contorted. At Clonderalaw Castle, similar beds dip S.E. at 20°; and a little northwards and west of Thornberry House, olive gritty shales form a synclinal, dipping S.E. at 15°, and N.W. at 10°. North of Thornberry House, all along the brow of the hill, and stretching in the direction of the strike from the road to the W. end of Derrygeeha Lough, are olive grits, overlying black shale, having a general dip of N. 20° W. at 20°. Apparently the same beds are seen about one mile N.E. of the eastern end of the lough (at the Cloon river), dipping S. 30° E. at from 35° to 50°; and also on the hill E. of the river, where they are traceable for half-a-mile.

On the road leading N. from the W. end of Derrygeeha Lough, about a quarter of a mile from the latter, are olive flags, dipping N. 20° W. at 10°; and further N., at the southern boundary of the townland of Derryshaan, are olive gray rippled flags, dipping S. 15° E. at 50°. Further north, at the northern boundary of this townland, and one mile from Derrygeeha Lough, are olive grits, dipping N. at 5°, and becoming horizontal; these beds are cleaved vertically, the strike of the cleavage being E. 20° N. and W. 20° S. In the stream S.W. of the church of Kilmurry M'Mahon, are gray and olive grits and flags, dipping N. at 10°. Northwards at the west side of the stream, in the townland of Carrowniska South, trial pits were sunk and coal was obtained, but not worked to any extent. I could not obtain any satisfactory information as to the section, &c., &c. A coal smut an inch or two in thickness, is visible in the stream under the alluvial deposit; the waste heap brought up in sinking the pits, consists of black shale with curious nodules of ironstone, containing crystals of alum. (?) On the road running N. from the church, some quarries exhibit finely laminated black shales, abounding in Goniatites and Aviculopecten, over olive sandy micaceous shale, full of plants; and under these (there being here a gap in the section) olive gray flags. At this gap there may possibly be coal. These beds are nearly horizontal. Further north, at the edge of the bog, and on the roadside, crags show olive grits and some shale partings, dipping S.E. at 25°. Further N. at the cross-roads S.W. of Gortnagan Lough, and in the townland of Derrynaleeka, the rocks (olive grits) crop out in rough crags. At the trigonometrical point 226, they are horizontal, and on the S.E. side of the point, they dip S.E. at 20°, and south of it they dip S. at from 10° to 50°. North of this, and W. and N. of Gortnagan Lough, the same beds (?) form an elongated hill in the bog, and dip N. 20°, W. at 10°; and about one-third of a mile N. of the lough, similar beds dip S. 30° E. at from 20° to 30°, also forming low hills.

About one mile and a-half further N., and east of Corraige Lough, the Ballyduneen River exhibits in a rocky gorge, olive shales and gray micaceous

rippled flags, nearly horizontal, but dipping S. 30° W. at 30°, as we go north along the stream, and then near the Kilrush and Ennis road dipping N.W. at 30°, and N.E. at 10.

On the road at the north side of Knocka Lough, are olive gray flags and shales, dipping S. at 30°.

South of the village of Kilmihil, on the new road, are seen olive grits and shale, dipping S. at 10°; and in the ravine, in the townland of Lack West (at Derrycrossan Castle), formed by the Doonbeg river, are olive grits and flags, dipping S. at 30°. The same beds are seen eastwards at Goulbourne bridge, having a similar dip. Half a-mile S. of the latter, and forming a long low hill in the bog, are olive grits and flags, dipping N. 20° W. at 20°. And further S. at the east side of the road in the townland of Crossbeg, are similar beds, dipping S.E. at 20°. South of these other patches of rock are seen, but the dip is obscure.

In the townland of Tullycreen, a little S. and S.W. of Tullycreen bridge, are seen olive grits, flags, and shales, dipping S. at from 15° to 20°. And at the south corner of the same townland, one mile S. of the bridge, the beds dip S. 10° E. at 35°. Other quarries of olive grit are seen in this townland, in which the beds dip N. and S. at various low angles. About one-fourth of a mile S.E. of Tarmon Lough, and close to the western end of the townland of Breaghva, are olive grits, dipping W. at 10°, and over them some dark blue clay, and a coal smut about one inch thick. About three-quarters of a mile east of this, at the S. boundary of the townland of Breaghva, are olive grits and black shale, dipping S. at 10°. There is no trace of coal, but report says that it was once found here.

Southward, in the townlands of Cassarnagh and Carrowbane, one mile N. of the village of Knock, and extending east and west across both townlands, are beds of olive grits, dipping N. at 10°. They are cleaved in places; the dip of the cleavage being S. 20° E. at 80°.

The sections above described will serve to show the structure of the country from N. to S.

At the shore of Clonderalaw Bay, E. and S.E. of Kilmore House, are seen olive gray grits and flags, dipping S.E. at from 35° to 50°. A little west of Kilmore Point two small seams of coal are seen. The following is the vertical section :—

Section No. 8.

Strata.	Thickness. Ft.	In.
7. Black shale,	–	
6. Pyritic clay,	0	1
5. Coal,	0	4
4. Yellow clay (? fireclay),	0	1
3. Coal,	0	3
2. Olive shale,	0	2
1. Gray grit,	–	

These beds dip S. 30° E. at 50°. From this as far as the village of Knock, are olive grits and shale partings, dipping S. 25° E. at 50°.

West of Knock the dip is S. at 50°. Near "Blackrock," we have black shale, pyritic clay, and ironstone nodules. West of Knock, in the townland of Burrane Upper, for more than half a mile, beds of olive gray grits and flags form crags, dipping S. at 40° to 50°. And at the western extremity of the townland at the roadside, is black shale and pyritic clay, and probably the coal may also be here. At this place and S.W. of it the dip seems to change from S. at 40° or 50°, to S.W. at 20° or 30°.

At Rusheen Point, S.W. of Knock, are olive and gray sandy shales, dipping S. 30° E. at 25°. At Burrane Point, and both N.E. and W. of it, are olive grits and shales, nearly horizontal, or dipping S. and S.E., at 5°. Further

west the dip is S.E. at 15°. South of Besborough House are seen olive grits, dipping N.W. at 5°; and at the west side of the boat quay, with a dip of N.W. at 10°, is an olive grit bed, the surface of which abounds in fine specimens of Stigmaria Ficoides; over it is a bed of black shale with Ferns. We have then shales and thin grits alternating, the black shale with pyritic clay, and between it and the drift a kind of breccia of fragments of coal and black shale. The section probably contains a coal bed, although the outcrop is not seen. South of this, towards Moneypoint, and dipping N.W., at from 10° to 20°, are black shales and olive flags; the latter being abundantly covered with tracks of marine animals. This completes the description of the coast section.

Northwards from the shore, on the roadside N. of Doonnagurroge Castle, is seen olive shale, dipping N.W. at 10°.

At the hill N. of St. Senan's Lough, are beds of olive grits, flags, and sandy shale, dipping S.E. at 10°, then becoming horizontal, and dipping N. at 30°. On the hill in townland of Knockerry, at the R. C. Chapel, the beds form an anticlinal, being horizontal on the top of the hill, and dipping N. and S. at low angles. They are principally flags with tracks of marine animals, and the quarries are extensively worked. There is also a bed of black sandy shale, with nodules of ironstone, and a seam of black clay, like decomposed coal, containing fossils.

Northwards at the boundary between the townlands of Gortnaskagh and Tullagower, one mile N. of the R. C. Chapel, are olive flags and black shale, with nodules of ironstone, dipping N. at 10°; and on the hill in the latter townland, at Trig: point 294 △, are olive grits and flags, dipping N. at from 40° to 50°. At the eastern extremity of this townland, about one mile and a-half E. of the Trig: point 294 △, olive grits and flags, dip N. at from 10° to 20°.

In the townlands of Brisla East and West, and round the Trig: point 155 △, beds of olive grits and flags crop out in knolls and form a synclinal, dipping N at 10°, and S. at 35°.

Coal Measures, south of the Shannon.—South of the Shannon, in the county Kerry, the small stream at the north side of the road, about one mile W. of Tarbert, exhibits a section in beds of dark gray and olive shale, gray sandy flags and olive grits. At the north end of the section these beds dip S. at an average angle of 20°. Near the road they undulate to the N.W. and N.E. at angles of 15° and 10°, respectively; the flags contain fragments of the stems of plants. North of this, along the shore, beds of olive grits and sandy shale are seen, having a general horizontality or undulating at low angles. At Massy's Hill, and opposite Tarbert Island on the shore, are olive micaceous flags and sandy shale undulating in all directions at various angles from 10° to 35°. Between this and Tarbert, on the hill, are several quarries in beds of olive grit and gray shale, dipping S.W. at 15°, and W. at 5°.

On Tarbert Island, at the lighthouse, black shale dips N.W. at 15°. At Cook's Point are beds of gray sandy shale, which dip N. at 25°, and S. at 20°. Between Cook's Point and the Coast-guard Station, are olive shales and flags, with a band of ironstone; these beds dip S. at 30°.

South and S.W. of Tarbert, the country is covered with the local debris of Coal Measures, grits and shales, to such an extent, as to hide the subjacent rocks. In the small stream two-thirds of a mile W. of Tarbert R. C. Chapel, beds of dark gray shale are seen dipping N.E. at 5°, or lying nearly horizontal. South of Shanaway, at the southern edge of the map, is a quarry in black shales which dip S. at 10°.

F. J. F.

County Limerick.—The junction between the Limestone and the Coal Measures is not exposed in this part of the district. The upper part of the lower Coal Measure shales, however, is very well seen on Foynes Island. At

Gammarel Point, are black shales abounding with calcareous nodules, some of which are full of fossils, principally Goniatites. To the west of the point, one of these shales has a prismatic structure, the sides of the prisms being perpendicular to the plane of the bed. Over these is a massive olive-coloured bed of shale, full of nodules, giving to it the appearance of a conglomerate. The nodules have a nucleus of iron pyrites which has usually replaced a fossil. This bed is well seen round the east coast of the island. At the north of the island, this bed dips N.W. at 30°, and is seen to lie under grits and shale that alternate and dip N.W. at 50°. The next beds met with are thin olive grits, with shale partings, that dip N.W. at 45°. Over these are black shales, and at Leck Point, are found coarse flagstones and olive grits, dipping N.W. at 65°; over these are black shales, above which are grits and black indurated shale, that dip W. at from 50° to 85°.

On the mainland, going W. from the village of Foynes, there is a good section exposed along the shore of the Shannon. Beginning a little to the east of the railway station, there are black shales full of iron pyrites and fossils, that dip W.S.W. at 45°. The next rocks met with are purplish blue shales, in which are a few grits; these beds are nearly vertical. To the north of this, where the Tarbert road turns to the west, there is an anticlinal curve, the apex of which points to the W.S.W.; the beds are composed of blue grits and shale, under extremely hard indurated purplish shale, and dip S. at 40°, and N. W. at 45°. To the north of this are olive grits with shale partings, they dip N.W. at 35°; in the shales are impressions of plants. From this to the Poultallin Point, are black shales and gray grits, with shale partings, all dipping N.W. at 55°. To the west of this point, are purplish blue shales, under blue grits and black shales, they dip in a similar direction at the same angle. To the N.W. of Leahy's Lodge, there is an anticlinal curve formed in olive and black grits and shales, which dip S.E. at 50°, and N.N.W. at 45°. From this there are no rocks seen along the shore till Mount Trenchard is passed.

To the south of Foynes, on the hill where 427 is engraved on the one-inch map, there are strong olive grits cropping out, and dipping W. at 30°. On the western slope of this hill, are thick black and olive shales, which dip W. at from 10° to 20°.

On the east face of Knockpatrick, a good section is seen of the basal beds, of which the following is a section, the thicknesses being calculated :—

Section No. 9.

			Ft.	In.
6.	Black shales, ...	dipping W. at 10°	100	0
5.	Olive grits, ...	,, W. at 20°	130	0
4.	Greenish grits and blue shales, . .	,, W. at 15°	200	0
3.	Olive, brown, and gray grits, with a few thin shales,	,, W. at 25°	276	0
2.	Black shales, with a few thin grits near their base,	,, W. at 30°	450	0
1.	Black shales, ...	,, W. at 20°	144	0
			1,300	0

On the road that runs west from Shanagolden, there are black shales underlying olive grits and shales; they dip W. at 15°, the black shales are very rich in fossils. A little to the north of this, the same grits crop out forming a steep escarpment on the east face of Mount David.

Going now to the N.W. of Mount Trenchard, on the Shannon shore opposite the west entrance to that place, there are olive and black grits and shales lying above olive concretionary grits; these dip S.S.E. at 45°. The axis of an anticlinal curve runs under Loghill church, and at the N.W. of it along the shore, are seen olive grits, standing nearly vertical. The next rocks met with going west, are olive grits and nodular shales, which dip N.W., first at 75°,

then at 40°; over these are olive slaty grits, which are the seat rock of the coal called the *Coal Hill vein*, and then black and olive shale; these beds all dip N.W. at 40°. Above the olive shale are olive grits and shales, and greenish grits and coarse flagstones; these continue out to Coalhill Point, and dip N.W. at 20°. On some of the flags are a few large tracks of marine animals. To the south of Loghill church, there are strong olive grits, dipping S.E. at 40°. A little further south, there are another set of strong olive grits, which have a similar dip; these last-named are the seat rock of the *Hard seam*, which was proved here by the side of the road sixty years ago.* To the south of the road are black shales, lying under olive grit, over which are black shale, these last-named are covered by olive grits and shale; all these rocks dip S.E. at 40°. The next rocks seen are olive grits, dipping S.S.E. at 45°. A little farther south, olive grits and shale were found, over which is a coal two feet thick, that was worked here in the Knockbooly colliery. Above this coal are black shales, in which are a few thin olive grits; on the top of the black shales are olive shales; all these beds dip S.S.E., at 20°. This last-named bed lies in the concave of a synclinal curve. S.W. of this there is another section visible, but it is exactly the same as that just gone over, being the other side of the synclinal curve.

To the west of this in the White river, there is a good section. To the south of Ouvane House, a coal was worked in the Coalhill colliery; under it are olive grits, which are well seen to the E. of the Police-barracks, they dip nearly N. at 30°; to the south of this are olive nodular grits with a similar dip. The next beds met with are thin-bedded olive grits, olive sandy shales, black sandy shale, and olive grits, all dipping N.N.W. at 35°. Under these are olive shales, which rest upon black shale, in which there is an anticlinal curve. To the south of this curve the same beds are seen dipping S.S.W., first at 30°, then at 45°. A little to the south of this, where the farm-house is marked on the map, there is a thin coal, over which are black and olive shales, covered by olive and blue grits and flagstones in which are a few shales. More south still, where the stream runs into the White river, there is another coal, which was worked here along its outcrop. The rocks are undulating from this to the south for some distance, bringing up this same coal three additional times, once at the N. of Woodcliffe Wood, and twice to the south of it. From the most southern outburst of the coal to near Ballyhahill, the rocks have a steady strike; they dip first at 15°, and then at 30° to the N.W. A little to the north of Ballyhahill there is a slight undulation. To the south of Ballyhahill, in the west branch of the White river, there are olive and gray grits and shales, dipping at 30° to the N.N.W. Here a little below where the first C in Chapel is engraved on the one-inch map, there is a black shale, under which there seems to be the smut of a coal;† they dip N.N.W. at 30°; this is above some gray grit which dips N.N.W. at 25° and 15°, and S. at 25°. To the south of this, where the White river enters this map, there are indurated shales, and olive and gray grits and flagstones, in which annelid tracks and plants were seen; these beds dip S. at 45°.

To the west of Loghill, at the N. of Fairy Lawn, there are olive grits, dipping N.N.W. at 30°; over them is a bed of coal which lies under black and olive shales. To the north of this on the Shannon shore, are olive grits and flagstones, with a few shale partings, these dip N.W. at 45°. The top bed of these grits is very remarkable, being full of round nodules from the size of a nut to that of a small apple; this bed seems to be the seat rock of a coal. Above this coal are black shales which were worked formerly for the clay-

* This was communicated to me by a collier named James M'Mahon, who when a boy assisted his father in sinking a basset pit on its outcrop at this place.

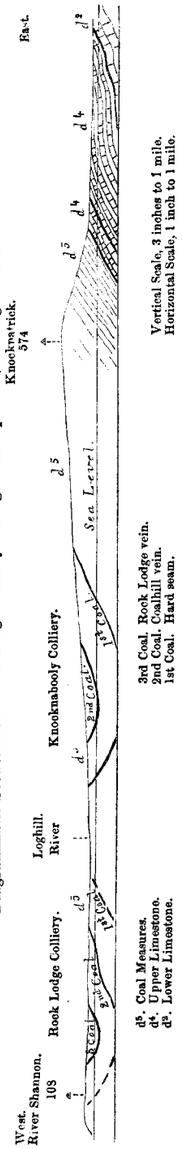
† If there is a coal here it would seem to be lower than any of the coals in the general section. (*See fig.* 2.)

ironstone that they contain. In these shales there is a *coal rod* two inches thick. These shales lie in the trough of a synclinal curve, to the north of which the same beds are again met with, except that the outcrop of the lower coal was not actually observed, but it would apparently come in a little to the north of Rock Lodge, where the broken thick black line is marked on the map. This lower coal can be traced along the north face of Prospect Hill. On the south slope of this last-named hill there are olive grits, which dip S. at from 15° to 30°, these are the seat rock of a coal which was worked here along its outcrop. Over this coal are black shales, which underlie olive grits and flags, rolling in undulations to the south. A little to the S.W. of this, there is a quarry opened for obtaining the flags, in which the beds are lying perfectly horizontal. To the west of this, in the little river that flows into the Shannon at Glin, there are gray grits and shales, dipping N. at 20°, covered by black shales, over which are blue flagstone and black shales; these latter rocks are nearly horizontal, but with a slight dip to E. A little to the north of this there is a slight fault, a downthrow to the E. Here the rocks, which are olive and gray grits and shales, dip N. at 30°. The next rocks met with going north are black shales that lie above a coal, the seat rock of which is a strong olive grit that overlies olive and black shales. Farther down the river, where it is crossed by the road from Glin to Ballyhahill, there are black nodular shales, which dip E. at from 5° to 15°. To the north of these are blue grits, that dip N.N.E. at 15°. To the north of the Union Workhouse are black shales resting on olive grits, and dipping nearly N. at 35°. To the east of Glin, in the river, are black shales, that dip E.N.E. at from 15° to 25°. At the old castle of Glin, are gray grits and shales, dipping S. at 40°. Near the R. C. Chapel, and north of the church, are blue and olive shales and grits. To the west of Westwood, are olive and gray grits, lying under ribboned shales and thin bedded grits, they dip S.S.W., at 15°. A quarter of a mile to the south of this, there are olive grits dipping south at 15°, these grits look very like a coal seat; above these are black shales in which are a few olive grits.

Rock Lodge Colliery.—A mile to the east of the village of Loghill is situated the Rock Lodge colliery. In it were worked Nos. II. and III. coals of the general section. (*See fig.* 13).

Fig. 13

Diagrammatic Section from Rock Lodge Colliery through Knockpatrick, bearing E. and W.



No. III. coal has been worked on its north and south outcrops. On its north

outcrop it was worked ten years ago by Lord Clare, none of the pits were deep. The bed was one foot six inches thick, and entirely culm. On the south outcrop it was worked by Lord Clare and Mr. Slevin. The following section of one of the pits was given to me by a collier who worked in those sank by Mr. Slevin :—

Section No. 10.

		Ft.	In.
6.	Black shale (*pencil*), with nodules and a band of clay ironstone, *over*	42	0
5.	Blue pyritous grit (*binder*),	0	3
4.	Culm 1 ft. 2 in. to 1 ft. 6 in. } No. III. coal,	1	9
3.	Impure coal, 3 in. }		
2.	Bluish black fireclay,	1	6
1.	Olive clunch seat, not sank into,	–	
		45	6

In bed No. 6, there is a "coal rod" two inches thick. This is only seen in the coast section due west of Rock Lodge, as all of the pits sank on No. III. coal were too near its outcrop, and none of them were deep enough for it to be found, as it lies about fifty feet over the coal. This shale also contains nodules and thin seams of clay-ironstone, for which it was formerly worked rather extensively, the remains of the old working being still traceable from Doon to Rock Lodge. In the shale over the coal are quantities of bivalve shells, apparently allied to Unio, they are generally crushed. (See note on No. III. coal in the description of the General Section.)

Fig. 14.

Plan.

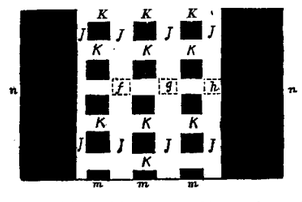
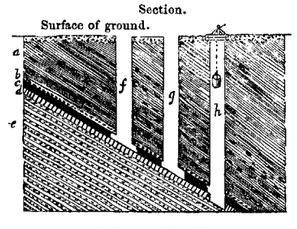


Fig. 15.

Section.



Plan and Section of workings at the south of the Rock Lodge Colliery on No. III. Coal.

a.	Black shales and clay-ironstone.	*d.*	Fire-clay.	*h.*	Pumping shaft.
b.	Blue grit.	*e.*	Olive grit.	*j.*	Galleries.
c.	Coal.	*f.*	Working shaft.	*k.*	Cross courses.
		g.	Working shaft.		

m. Pillars to support roof.
n. Unworked coal.

Scale, 40 feet to 1 inch.

The workings were carried on in the following way (*see figs.* 14 and 15), three pits (*f, g, h,*) were sunk in the line of dip, the deepest (*h*) was for the purpose of drainage, a cross course was then run from *f* to *h*, as a passage for the water, the courses (*j*) along the strike and cross courses (*k*) down the dip, the coal being taken at each side as these courses progressed, leaving pillars (*m*) five feet square to support the roof. These courses were carried along the strike each way, as long as the air remained pure.*

No. II. coal was worked twenty-five years ago by Captain Hewson, R.N. On its southern outcrop at the north of Fairy Lawn, the bed was one foot thick. In the shale over this coal, are Goniatites and Calamites. In the coal are Stigmaria, which are usually crushed, their interiors being filled with crystallized quartz, and the external surface converted into a thin layer of coal. The north outcrop has not as yet been proved, but it seems to run where the broken black line is marked on the map at the north of Rock Lodge.

* The colliers were paid at the rate of 10*d.* per bucket, for all the coal they sent to grass. The bed No. 3, was broken up and mixed with the culm.

Coal Hill Colliery.—This colliery lies to the N.E. of the village of Loghill. No. II. coal was worked in it about fifteen years ago by Captain Hewson. He drove in a level about a quarter of a mile to the E. of Coal Hill Point for the drainage of the works, and used a horse-whin for raising the coal. All the coal in the east of the colliery down to the level was taken out, the roof being supported after the colliers by stones. That part of the colliery was shortly afterwards abandoned, as the men in care of the pumping neglected it at night, and the water rose in the pits. Captain Hewson then erected a water wheel near Ouvane House, and began to work there, but the level of the wheel was too low, and, therefore, would not work during spring tides, on which account the waters rose in the pits, and they were abandoned. None of the coal near Ouvane House has been "taken".*

The following section of the winding pit on Coal Hill was given me by James M'Mahon:

Section No. 11.

	Ft.	In.
5. Olive shale (*gray pencil*),	17	0
4. Black shale (*pencil*),	73	0
3. Pyritous grit (*binder*),	0	3
2. Coal, No. II. Coal,	3	0
1. Olive clunch seat,	–	
	93	3

The coal bed No. 2 is only one foot six inches thick near the outcrop, but it increased as the works got deep.† In the coal are stems of Stigmaria, and in the shale over the coal are the impressions of ferns and grass-like plants.

Knocknabooly Colliery.—Due west of Loghill is the Knocknabooly colliery in which No. II. coal‡ was worked, but only along or near its outcrop. The following section of one of the pits on its southern outcrop, was communicated by James M'Mahon.§

Section No. 12.

	Ft.	In.
6. Black shale (*pencil*), with a few thin grits,	45	0
5. Black grit (*binder*),	0	3
4. Coal, 1 ft. 6 in.‖ } No. II. Coal,	2	0
3. Culm, 0 ft. 6 in. }		
2. Blue clay,	0	4
1. Olive clunch seat, not sank into,	–	
	47	7

In bed No. 6, there are most beautiful minute univalves.

This colliery includes parts of the townlands of Mount Trenchard, Loghill, and Knocknabooly. In Mount Trenchard it was worked fifty years ago by the late Mr. O. Rice, by means of bell pits.* In the townland of Knocknabooly it was worked about the same time in a similar manner by Mr. Griffin. About fifteen years ago it was again worked in this last-named place by Captain Hewson, who worked on the plan described at the Rock Lodge colliery. (*See fig.* 14.) Captain Hewson sank pits in the townland of Loghill about the same time, but they chanced to tap an old working which flooded them out. To the N.E. of this colliery, in Mount Trenchard Fox cover, No. I. coal was worked about seventy years ago, it was six inches thick, and is said to be nearly a standing vein (dipping at 60°); being found to be unprofitable it was abandoned. This coal was proved to the east and west of this last-named place. To the S.E. of Knocknabooly colliery, the smut of this coal was noted in a small stream. (*See map*).

Carrowbane Colliery.—Due south of the village of Loghill, at the southern extremity of the townlands of Carrowbane More and Beg, a coal was worked along its outcrop, on the same plan as before described. (*See fig.* 14). This bed was one foot two inches thick, and entirely culm. It is supposed to be the continuation of the same coal as that which was worked at Knocknabooly (No. II. coal). This colliery seems to be on the north outcrop of the west end of the same basin of coal, as that on which the last colliery described is situated. Its south outcrop has not been proved, though it must necessarily run near where it is marked on the map. A little to the north of this colliery, at a lime-kiln, there is a thin coal six inches thick, lying between a hard seat and roof, it is supposed to be No. I. coal. There seems to be a fault between this and Loghill.

Fleanmore Colliery.—Due south of this, where the southern extremity of the Woodcliff plantation joins the river, the smut of No. II. coal was remarked; its cover rock can be traced for two miles to the east, where there is found, due south of Prospect Hill, the remains of an old colliery that was worked along the outcrop of this coal.

Glin Colliery.—Due west of this is the Glin colliery. No information can at present be obtained about these workings, as all the colliers that were employed came from the county of Cork. The shale over this coal is rich in most beautiful ferns, and grass-like plants. In the coal were fragments of Sigillaria and Stigmaria. This coal can be traced to the south-west along the south face of Tullyglass Hill.

G. H. K.

5. *Drift, Bog, and Alluvium.*

The Drift on that part of the map that lies to the south of the Shannon is limestone gravel, except on the top of a few of the hills, and on some of the low land in the south-eastern part of the sheet, where the limestone itself comes to the surface of the ground. In the drift associated with the limestone, are boulders of granite, syenite, and trap, as well as of gritstone; these are very plentiful in the hill to the north of the village of Glin. In the White river that flows into the Shannon at Loghill, large blocks of granite and trappean breccia are abundant. To the east of Foynes, in the townland of Oorla, there is a deposit of good sand; it is also found in the townland of Tiermore, which lies about two miles S.E. of Shanagolden, and to the S.E. of Ballycullen House, and at the S.E. of the sheet, due north of Newbridge.

At the north side of the Shannon there is only a small quantity of limestone drift. It only extends westward a little distance beyond the boundary between the Coal Measures and Limestone; and whenever it is seen over the

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* For this information I am indebted to James M'Mahon, an old collier, who worked in all the collieries in this neighbourhood.

† Since the above was written I have received a letter from Captain Hewson, whose information differs from that of M'Mahon's, as he says "the coal was never more than six inches in thickness, the rest of the vein being a soft pindy culm."—G. H. K.

‡ This coal is considered by M'Mahon the collier, not to be the same coal as that at Coal Hill, because here there is coal and culm, and a clay between the seat and the coal, while at Coal Hill he says that it was all coal up to its outcrop, and it lies on the seat.

§ All the information that I obtained about this colliery, I am indebted for to Mr. Thomas Connor, of the Mount Trenchard Model Agricultural School, and James M'Mahon.

‖ Captain Hewson, in the letter mentioned in the note to the preceding page, says the coal was never six inches thick.

* Bell pits are shallow pits along the outcrop of a coal, widening from the mouth downwards, so as to get as much coal as possible from the bottom till the sides will no longer stand or till the water rises and floods out the colliers.

Coal Measures, it is much mixed with the debris of that formation. South of the village of Killadysert, a gravel pit shows it to be of considerable depth just there. At the south of the river in Kerry occasional boulders of limestone occur in the debris of the Coal Measures.

Bog.—At the south of the Shannon, bog is only found on the Coal Measure hills. Usually there is very little natural waste in cutting it. It is very rich in tar, and is often impregnated with sulphur, when it burns with an offensive odour.

North of the Shannon, several large patches of bog occur at intervals over the Coal Measures. The most important are those W. and N.W. of Killadysart, and S. of Kilmihil. It is generally free from sulphur, and forms very good fuel.

Alluvium.—There is a a large plain of alluvium to the east of the village of Foynes, which seems to be the debris of the limestone, as it is principally calcareous marl. In it there are an abundance of marine bivalve shells of the same species as those that at present inhabit the lower Shannon. Besides this there are to the W. and S.W. of the above, small patches of alluvium full of shells, but they are principally univalves and all of them freshwater.

To the north of the Shannon the alluvial flats are so inconsiderable as to be unworthy of notice.

7. *Minerals.*

In this district there are eight mineral substances worthy of mention, independent of the limestones and flagstones, viz.:—two kinds of coal, three ores of iron, white wavellite, and two clays.

The two kinds of coal are *anthracite* and *culm.* The anthracite is of a brownish black colour, has a highly metallic lustre, and usually a cubical fracture. The coal when burning gives out intense heat, but as it is often impregnated more or less with iron pyrites, it gives off offensive gases when ignited.

The culm is a black soft laminated coal. It is taken out of the pits in large masses that crumble into small flakes when exposed to the atmosphere.

The ores of iron are *Siliceous Hæmatite, Clay Ironstone, and Iron Pyrites.* The Siliceous Hæmatite is found in the bank of the little stream that flows through the village of Shanagolden, about a quarter of a mile to the south of that place. It is found in beds in yellow ochreous clay, and seems to lie in the beds of the Upper Limestone, but enough evidence is not here seen to enable us to say for certain whether it is a bed or a lode.

Clay Ironstone.—The shales that overlie No. III. coal in the Rock colliery, were formerly extensively worked for iron along their outcrop; that they were worked for the ironstone is proved by none of the old working being sank to the coal. There were also old working to the S.E. of Glin, where there was a furnace for smelting the ore. Associated with the coals, *Iron pyrites* is found sometimes in large quantities. In the lower shales, No. 1 of the general section, it is abundant, forming large bands and nodules of pyritous ironstone. There is not a sufficient quantity and the ore is too poor to be of any commercial value.*

Wavellite of a white colour was found cementing together quartz crystals at the south of Shanagolden; they are associated with the Siliceous Hæmatite before-mentioned.†

* None of these substances are of much value. The coals are locally useful, and may be worked with profit when near the surface, the ironstones are very poor in quality, and in too small quantity to make them of importance even if they were richer.—J. B. J.

† Monsieur Alphonse Gages mentions it in a paper read by him before the Geological Society of Dublin (*See their Proceedings, vol.* 8.)

The clays are *Fire clay* and *Brick clay.* Under some of the coals there is a bed of *Fire clay.* In the shallow pits that were sank on these coals, it was very thin, but it might possibly be thicker and of rather more value if there are ever deep pits opened in this district. At the Labasheeda colliery it was three feet thick, and from these it is sent to the city of Limerick to be made into bricks for the lining of furnaces, &c.

Brick Clay.—This clay of a very good quality is found extensively near Tarbert, and is made into brick and tiles.

Besides these minerals beautiful quartz crystals were found at the same place as the Wavellite,* and at the N.E. of the Glebe House that lies to the S. of the village of Foynes. These crystals are black, smoked, white, violet, pink or blue in colour, the pink and white being commonest. Sometimes large bunches of these are found that seem to be fragments of large geodes.

G. H. K. and F. J. F.

* Mr. Thomas Connor, of the Mount Trenchard Model Agricultural School, first called my attention to this place.

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