EXPLANATIONS

TO ACCOMPANY

SHEET 128

(FORMERLY QUARTER SHEET 35 S.E.)

OF THE

MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTY OF KILDARE AND QUEEN'S COUNTY.

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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 at 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.

EXPLANATIONS

TO ACCOMPANY SHEET 128 (FORMERLY QUARTER SHEET 35 S.E.)

OF THE MAPS OF THE

GEOLOGICAL SURVEY OF IRELAND.

General Description.

This quarter sheet of the map includes a part of the Queen's County on the W., and a part of the County Kildare on the E., the River Barrow forming the boundary between the two counties, except for a certain space to the westward of Athy, where a considerable piece of ground on the W. of the river belongs to the County of Kildare. The principal places in the map are Athy, the assize town of the County Kildare, and the small town of Castledermot in the same county; with the little town of Stradbally and the villages of Ballylynan and Timahoe in the Queen's County.

1. *Form of the Ground.*

The most striking features in the form of the ground may be described as follows:—

The hills which make the northern edge of the Castlecomer table-land and the Cullenagh Hill run along the southern and western sides of the district. The highest point in the quarter sheet is one of 1,098 feet above the sea, on a hill called Fossy Hill, S.E. of Timahoe. This hill slopes very steeply to the north, descending to a level of 400 feet within the space of a mile and a-half. Near it is Knocklead, 1,058 feet high, and there are several other eminences of 900 and upwards. The summit of Cullenagh Hill is 1,045 feet above the sea. North and east of these hills is a band of country with several rocky heights, having altitudes of 700 and 800 feet, which is continued north of Stradbally up to the northern margin of the map. These may be spoken of as the Stradbally Hills.

The valley of the Barrow runs from north to south through the middle of the map, along the eastern foot of these elevations, separating them from some lower but still prominent hills running along the eastern margin of the map from Castledermot up to Narraghmore. These latter hills have a general elevation of 300 or 400 feet, one point rising to 469 near Castledermot, and another to 565 south of Battlemount House.

To the westward of Narraghmore is a great flat, part of that which spreads through the sheet on the north, No. 119, and thence into the centre of Ireland. The highest point of this, within the limits of sheet 128, is one of 240 feet above the sea.

The level of the water of the Barrow where it enters the map on the north is 190 feet above the sea, and it falls to 175 feet where it issues from it on the south. The ground included in this map is drained entirely by the River Barrow and its tributaries, with the exception of the hills in the S.W. corner, the drainage of which is

carried into the Nore by means of the Little Knocklead river and the head waters of the Clogh river. The Knocklead river rises at a height of above 1,000 feet, but falls very rapidly to 500 where it leaves this sheet of the map.

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

The loftiest hills, just spoken of as Cullenagh Hill and those forming the northern edge of the Castlecomer table-land, are composed of black shales and dark sandstones, which belong to the series of rocks known as the Coal Measures, from their occasionally containing beds of coal. The Stradbally Hills are composed of limestone known as Carboniferous or Mountain Limestone, which comes out to the surface from underneath the Coal Measures. In Sheet 137, or the one immediately to the southward of that on which we are now engaged, the upper part of this limestone forms the lower part of the hills of which the Coal Measures comprise the upper portion; and the same relations are continued into this sheet as far as Ballylynan, and round by Timahoe and Lamberton House. To the northward of that line of country, however, the upper part of the limestone is not covered by any part of the Coal Measures, and itself forms the Stradbally Hills, which, though lower than they would have been if capped by Coal Measures, are yet of respectable height and remarkable aspect. The country around Stradbally greatly resembles parts of Derbyshire and other districts of England, where this limestone, there appropriately called Mountain Limestone, always forms lofty ground, while in the south of Ireland it is generally found only in the valleys and lowlands. Even here this hilly character of the limestone ground is confined to the immediate neighbourhood of Stradbally, and to the upper beds of the limestone, as the lower portions of the formation are occupied by the valley of the Barrow, and the great boggy flat which stretches off to the N. and N.N.E. of Athy through the major part of the County of Kildare.

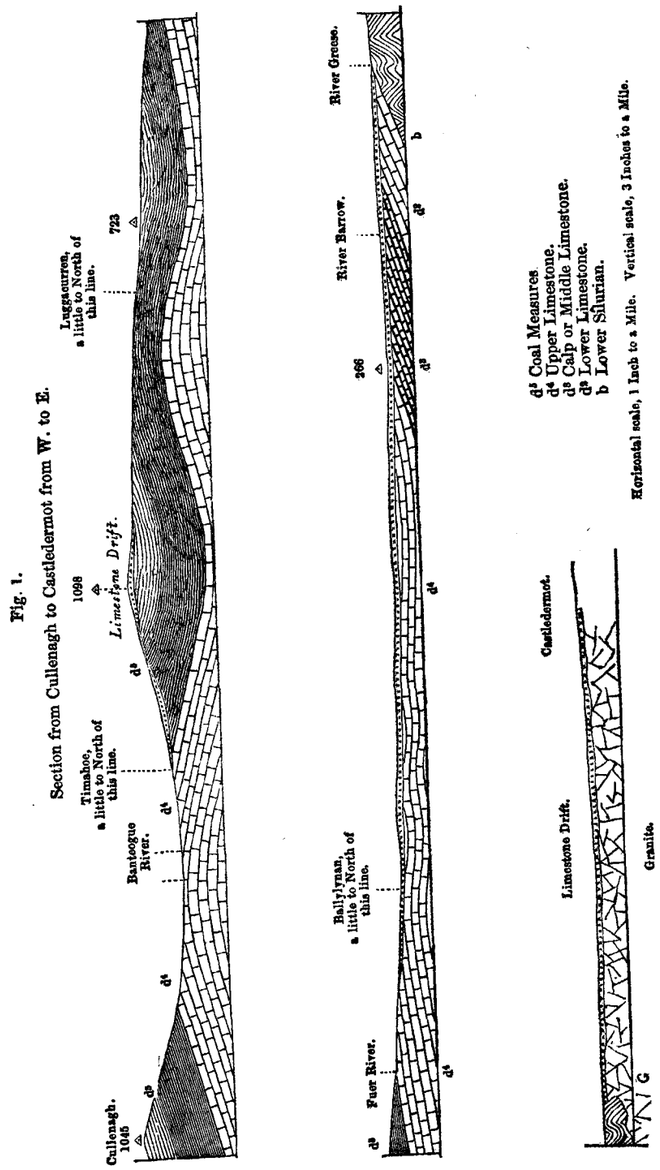
The hilly ground which runs along the eastern margin of the map is composed of rocks which rise up from underneath the limestone. Those at the extreme S.E. corner, within a mile and a-half of Castledermot, are composed of granite, while the higher and more abruptly undulating ground which runs by Bushfield, Bolton Hill, Brownfield House, and thence to Narraghmore, is formed of slates and grits which lie between the granite and the limestone, and belong to the group of rocks known as Lower Silurian.

Here, as elsewhere, the present form of the surface of the ground is the result of long and complicated geological agencies acting upon different varieties of rock, and thus producing different results in different places. A succinct abstract of the history of these geological events may be given in the following words :—

The slates and grits just spoken of as Lower Silurian were originally deposited in the sea as mud and sand; they were subsequently compacted and hardened into rock, and after that were affected by a peculiar influence which gave them that tendency to split in a uniform

Fig. 1.

Section from Cullenagh to Castledermot from W. to E.



direction into slate, which is known to geologists as "cleavage." They were also penetrated by the granite, which was originally a mass of deeply-seated molten matter, that after being thrust from below for some distance upwards into the mass of the slates, cooled and consolidated without reaching the surface.

During this intrusion of the Granite into the Lower Silurian rocks, or subsequently to it, probably both, the rocks were affected by powerful disturbing forces which gradually tilted their once horizontal beds into highly inclined positions, and contorted and dislocated them. Simultaneously with this elevating and disturbing action, or after it, probably both, the rocks were acted upon by a denuding agency, the result of moving water, which removed large portions of the Lower Silurian rocks, so large in some parts as to allow of the appearance of the granite at the surface of the ground. This denudation and removal of rock from our area was taking place while in other places, which now form parts of Ireland, and also of England, a deposition was going on, and the rocks known as Upper Silurian and Old Red sandstone were being formed, parts of them being probably composed of the very materials thus removed from our area.

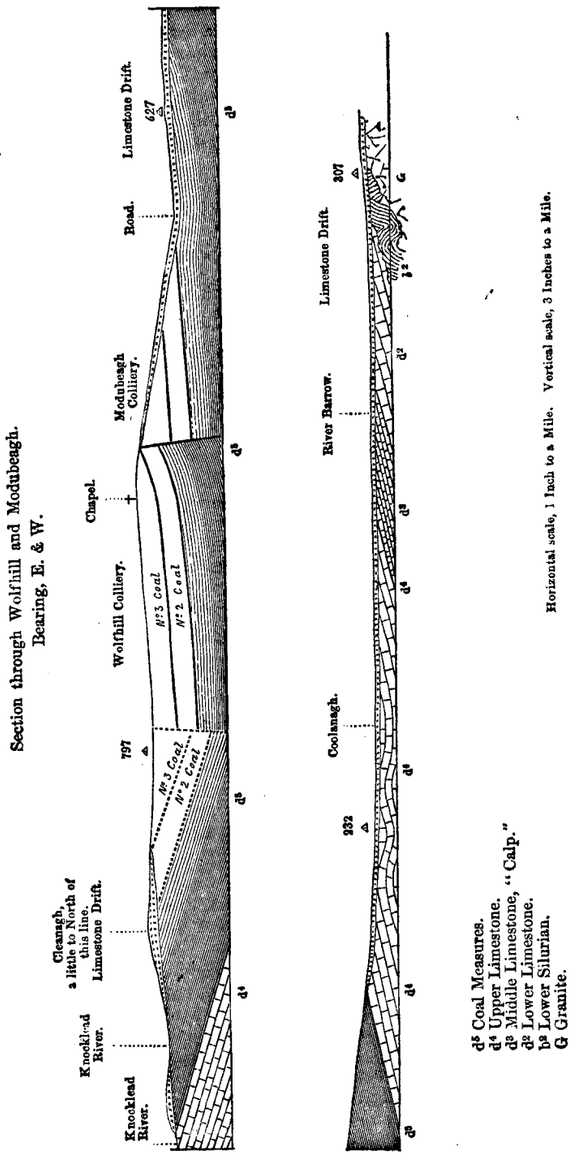
In this way a surface of ground was produced which, after, perhaps, existing some time as dry land, became ultimately depressed, and formed the floor of a sea in which were deposited many hundred beds of limestone forming the mass of calcareous matter now known as the Carboniferous limestone. The deposition of pure calcareous matter was varied occasionally, especially during the middle of that period, by the deposition of beds of black mud, forming the present shales of the Calp. After the deposition of the whole of the limestone, beds of mud and sand were deposited in this sea to a thickness of many hundred feet, interstratified eventually by thin beds of coal. These beds, both those of the Limestone and those of the Coal Measures, certainly once extended much further than their present limits, spreading over the Lower Silurian and Granite ground which is now visible on the east of them.

That this was so is obvious from a mere inspection of fig. 1, which is a section drawn across the country from Cullenagh to Castledermot; since it is plain that a regular succession of beds deposited under water could not have terminated so abruptly as these now do at the present surface, and must have been deposited originally in a horizontal position. Since the deposition of these upper beds, therefore, they also have been tilted into an inclined position, and broken through and dislocated by a renewed energy in the action of the subterranean elevating and disturbing forces, and have been eroded and worn down, and large portions of them removed by the action of moving water, and the present surface of the ground ultimately produced.

There is nothing in the district to give us any evidence of the period during which this latter elevation and denudation took place. Judging by analogy, however, from what is known by geologists of the general structure of the British islands, it is probable that the period was a very remote one, and that the chief part of the disturbance and of the denudation was complete before the New Red sandstone was formed, or at the very commencement of the great Secondary Epoch of the Earth's history.

Fig. 2.

Section through Wolfhill and Modubeagh.
Bearing, E. & W.



d^5 Coal Measures.
d^4 Upper Limestone.
d^3 Middle Limestone, "Calp."
d^2 Lower Limestone.
b^3 Lower Silurian.
G Granite.

Since that time the district may, for any thing we know to the contrary, have remained as dry land until a very recent Tertiary period, when it, in common with the rest of Ireland, was depressed beneath the waters of the Glacial sea, and the "Drift" was deposited which now intervenes here and there between the solid rock and the actual soil. This "Drift" consists of clay, sand, gravel, and boulders, derived from the wear and tear of the subjacent rocks, and will be described more particularly further on.

J. Beete Jukes.

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3. *Formations or Groups of Rock entering into the structure of the District.*

Aqueous Rocks.

	Name.	Colour on Map.
	Bog, Alluvium, &c.	*Pale sepia.*
	Drift (Limestone Gravel.)	*Engraved dots.*
Carboniferous.	d^5 Coal Measures.	*Indian ink.*
	d^4 Upper Limestone.	*Prussian blue (dark.)*
	d^3 Calp, or Middle Limestone.	*Indigo.*
	d^2 Lower Limestone.	*Prussian blue (light.)*
Old Red Sandstone.	c Quartzose conglomerate.	*Indian red.*
Lower Silurian.	b^2 Blue and Green Slates and Grits (? Caradoc and Bala beds.)	*Pale purple.*

Igneous Rocks.

Lower Silurian.	D. Greenstone.	*Purplish red.*
	Ds. Greenstone Ash.	*Red dots.*
	E. Elvan.	*Carmine (dark.)*
	G. Granite.	*Carmine (light.)*

G. *The Granite* is generally coarse-grained. Its original colour is white, but it weathers to a dirty yellow. It is rarely a good or handsome building stone, since it soon decomposes; and, from the comparative abundance of iron in its composition, it is apt soon after it is exposed to the atmosphere to become blotched with patches of an ochreous colour.

E. *Elvanite.*—These rocks are of two kinds. Those that were found near the Granite are coarse-grained, composed of all the constituents of Granite, with a remarkably large proportion of quartz. In some places they have all the appearances of the neighbouring granite. The other kind of Elvan is very fine-grained, nearly entirely made up of feldspar, with very little quartz or mica in it.

D. and Ds. *The Greenstone and Greenstone Ash* are described as part of the Silurian Rocks.

b^2. *The Lower Silurian Rocks* belong probably to one of the lowest parts of that formation. They consist of green, purple, blue,

and gray rocks, and both clay slates and sandstones, or gritstones. Interstratified with these rocks are some that are more or less of an igneous origin, greenstone, greenstone ashes, and ashy grits. Where these ashes occur, the other rocks are usually black, or dark blue shales and slates. Near the granite the rocks are all indurated and changed, either into a kind of Mica schist, or, in some places, into a rock resembling a Felstone.

c. *Old Red Sandstone.*—The only rock of this series that is found in this quarter sheet is a quartzose conglomerate, which lies unconformably on the Lower Silurian rocks.

The Carboniferous Rocks.—This series of rocks admit, in the first place, of a subdivision into two principal groups, the Limestones below and the Coal Measures above. The limestones may again be subdivided into sub-groups, of which the lowest subdivision, that of d^1 *The Lower Limestone Shale*, is wanting in this district. The rest have their representatives, although the boundaries between them are not very easily determinable, nor are their characteristics very distinct.

d^2. *The Lower Limestone* is of a gray and blackish gray colour, sometimes compact, sometimes crystalline, generally thin-bedded, and often argillaceous. It is almost always full of cavities lined with crystals of bitter spar, carbonate of lime, and quartz. Most of this dark limestone is more or less magnesian, in some places being a true dolomite when it is sometimes red or brown, very highly crystallized, and having, at first glance, a sandy aspect. Its thickness must be several hundred feet, but, from want of continuous sections, is not exactly determinable. Fossils are very abundant, being principally of the genera Spirifer and Producta, with a few Euomphali, &c.

d^3. *The Calp or Middle Limestone* is a dark blue or black argillaceous fœtid limestone, generally thin-bedded, with thin partings of calcareo-argillaceous shales between the beds. In places there are layers and nodules of chert; the chert is generally gray, but sometimes smoky, black, pink, yellow, and rarely blue and red, the latter hues arising from discolouration. Fossils are scarce in the Calp when compared with the quantity found in the Lower and Upper limestones, and there seem to be more fossils in the partings between the beds, and on the upper surface of the beds, than in them. Some of these partings look more as if they were formed by the percolation of water down through parts of the beds, taking the calcareous matter with it, and leaving the argillaceous matter behind, rather than by mere original deposition of non-calcareous mud. The limestones of the Calp are occasionally magnesian, but not so frequently as those of the Lower limestone.

The thickness of the Calp may be taken as probably about 400 feet.

d^4. *Upper Limestone.*—This limestone is of a gray, blue, or whitish colour. The lowest beds next the Calp are not any where exposed to view. Above these the limestone is generally of a light gray or blue colour, usually massive, but sometimes thin-bedded, with layers and nodules of chert. These chert layers generally lie between the beds, but in some places there may be seen in the centre of a bed, a layer of chert, which will suddenly come to an end—that which at first appeared as if it were two smaller beds, becoming obviously one

large bed. This is very well seen at the S.W. of the Rock of Dunamase. These chert layers are sometimes so frequent that they make the rock nearly an entire mass of chert. In places we find, in the Upper Limestone, blue argillaceous fœtid limestone, thin-bedded, and very like the Calp beds. In the upper beds, near the Coal Measures, the limestone becomes of a dark blue colour, being more argillaceous than below and distinctly crystalline. The surfaces of these beds are generally very irregular, being filled with roundish holes, in which is a purplish red earth, in places very like red hæmatite, in others, of a shaly nature.* The beds immediately next to the Coal Measure shales are nearly an entire mass of chert, having a thickness of from 30 to 50 feet. In consequence of the numerous flexures which traverse this formation here, it is difficult to estimate its thickness, but it is supposed to be about 500 or 600 feet thick.

d⁵. *The Coal Measures* are made up of grits and shales, with fine clay and coal occasionally, and some seams and nodules of clay ironstone.

The following is the general section of those which are to be found in the district included in this sheet of the map :—

	Ft.	In.
7. Top beds,	160	0
IV.—Coal,	0	10
6. Intermediate beds, about	140	0
III.—Coal,	1	6
5. Intermediate beds, about	150	0
II.—Coal,	1	0
4. Intermediate beds, about	250	0
I.—Coal,	0	4
3. Grits and shales, about	640	0
2. Flagstone series, about	60	0
1. Lower shales,	500	0
About,	1,903	8†

The lower shales here grouped as No. 1 are, at Luggacurren, not more than 300 feet thick; while to the east, at Maiden Head, and to the west, at Timahoe, they increase to 500 feet. In these latter places there are thick grits in them, while at Luggacurren the grits are interstratified with the shales, as will be seen hereafter when these sections are described in detail. Goniatites, Aviculopecten, and Posidonomya occur sometimes abundantly in these shales, as also in some of the beds above them.

No. I. Coal is about 1,200 feet over the limestone. It has been found only on Cullenagh Hill, where it is about 4 inches thick.

No. II. Coal is from 1,430 to 1,500 feet above the limestone. It has been found at Aghadreen and Modubeagh. At the latter place it is a very good sweet coal about 10 inches thick. At the former place it is a slaty kelve and culm, 18 inches thick. At Modubeagh this coal has been worked to a small extent.

* These partings are very universal in the south of Ireland, as whenever I have examined the limestone near the Coal Measures I have found them.—G. H. K.

† The numbers for these coals correspond with the numbers of the coals in the Explanation of sheet 137, No. I. Coal being the same in both.

The group No. 7 in the General Section is thicker than the beds over No. IV. Coal in the Lordship colliery, County Kilkenny. See General Section in the Explanation of sheet 137.

No. III. Coal is from 140 to 200 feet over No. II. Coal, and is found at Wolfhill, Modubeagh or Ballylehane, and Mullaghmore. At Modubeagh and Mullaghmore it is said to be a good sweet coal, from 12 to 18 inches thick. At Wolfhill, to the north of the colliery, it has the following section :—

Section No. 1.

	Ft.	In.		Ft.	In.
Coal.	0	9	to	1	0
Clearing,				0	2
Culm,	1	0	to	2	0
				3	2

While at the south it is very like Modubeagh Coal.

No. IV. Coal is about 140 feet over No. III. Coal. It is found in Wolfhill and Modubeagh collieries. To the north of both these collieries it is very thin, being only from 3 to 6 inches thick; while at the south it is about 12 inches thick.

In the shales over the Wolfhill Coal there have been found shells belonging to the genera Aviculopecten, Goniatite, and Bellerophon (?) Over No. II. Coal, at Aghadreen, there are large reed-like plants and ferns in the shale. At Luggacurren, in the flagstone series, No. II. in the General Section, on the surface of the flags, are numerous tracks, described below by Mr. Baily.

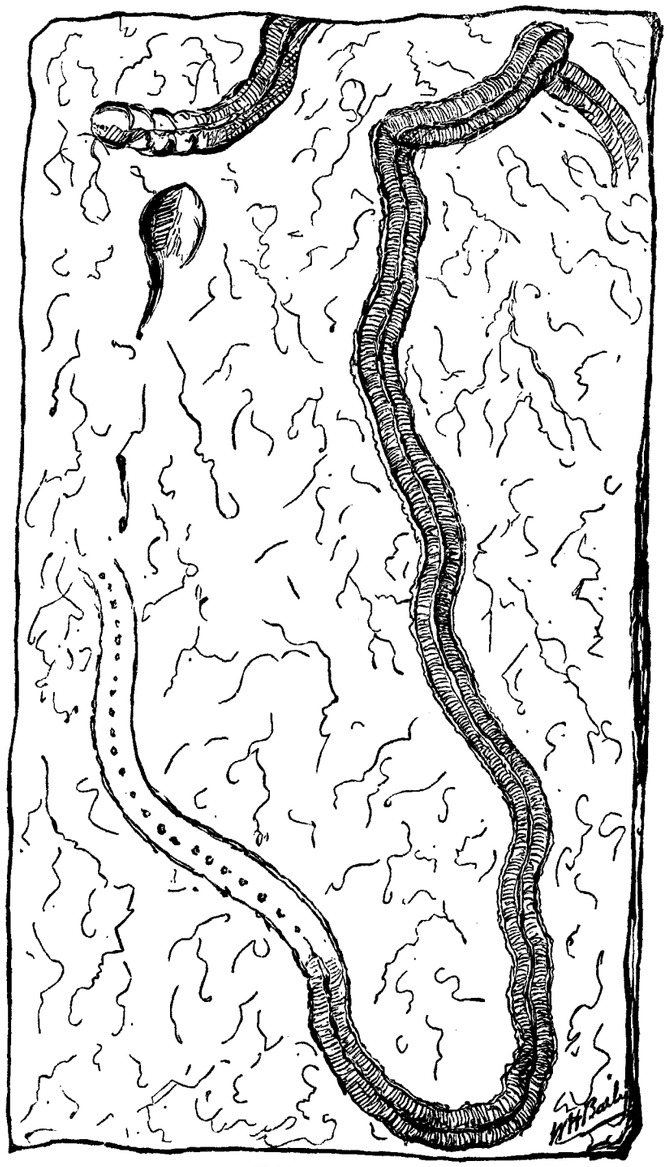
The Drift.—In this sheet as in the one to the southward, the limestone gravel and boulders are to be found in great quantity, not only over the low ground formed of limestone, but spread over the flats and lying in the hollows of the Coal Measure hills, up to a height of 1,000 feet above the sea. The whole of the Lower Silurian and Granite ground is also covered with it.

Bog.—In the north-eastern part of this district we find very extensive bogs, and small bogs are scattered over the rest of the map. On the hills the bog is generally very shallow, but it all makes good turf, though it is generally impregnated with sulphur, burning with a blue flame and giving off a strong sulphurous smell. On the lowland the bogs are generally very deep—in places over 30 feet. There is a great deal of waste in the cutting of them for turf. They have first to "clean the bog," that is to cut off and throw away about 4 feet of the top, which will not make turf. This lies on the top of what they call white turf—a soft light turf which burns very quickly, and gives out very little heat; this is about 3 feet thick. Under this they get the brown and black turf. The turf is generally better the deeper the bog is, though sometimes, where it is shallow, a good vein of turf will run. Turf is called "stone turf" when it is hard and heavy. A great waste of the raw material is to be seen at all these bogs, as they have no regular system for cutting the bogs, and they are not properly drained.

Alluvial Flats are to be found along the River Barrow and some of its tributaries—some of these are very extensive. None of them are very remarkable, all being formed by the silt and other matters carried down by the river during floods.

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

Fig. 3.



Half natural size.

4. *Palæontological Notes.*

A few fossil localities near Maryborough were casually examined, mostly situated in the Townland of Dysart, Queen's County, and belonging to Upper Carboniferous Limestone.

The most numerous fossils were Zoophyta or Corals; those observed belonging to the families Favositidæ and Cyathophyllidæ; two of the most important and characteristic groups of true polypi, the forms of which are so abundant in this formation. They included large masses of Cyathophyllum regium, *Phillips*; Lithostrotion striatum, *Fleming* (*L. basaltiforme of Phillips and M. Edwards*); and Lithodendron fasciculatum, *Fleming*, sp.—this species being also found in chert at the same locality.

Crinoid joints of the genus Actinocrinus were particularly abundant, accompanied by small Corals (*Lithodendron irregulare*, &c.), weathered out on the surface of the beds and between the joints.

Brachiopoda were not numerous at this locality, excepting in a quarry of compact blue limestone, at West Park, Upper, the top bed of which was full of Productus scoticus, *Sowerby* (*hemisphæricus* of the same author).

The following is a list of the species observed:—

ZOOPHYTA.

Cyathophyllidæ.

Lithodendron	fasciculatum,	*Fleming*, sp. (and in chert.)
,,	aggregatum,	*McCoy.*
,,	junceum,	*Fleming*, sp.
,,	irregulare?	*Phillips.*
Lithostrotion,	Portlocki,	*M. Edwards.*
,,	striatum,	*Fleming.*
Cyathophyllum	regium,	*Phillips.*
Acervularia	pentagona,	*Goldfuss*, sp.

Favositidæ.

Syringopora,	ramulosa,	*Goldfuss.*
,,	geniculata,	*M. Edwards.*

ECHINODERMATA.

Crinoidea.

Actinocrinus,	joints abundant.

MOLLUSCA.

Brachiopoda.

Productus	scoticus,	*Sowerby.*
,,	cora,	*D'Orbigny.*
,,	Martini,	*Sowerby.*
,,	margaritaceus,	*Phillips.*

October 22, 1858.

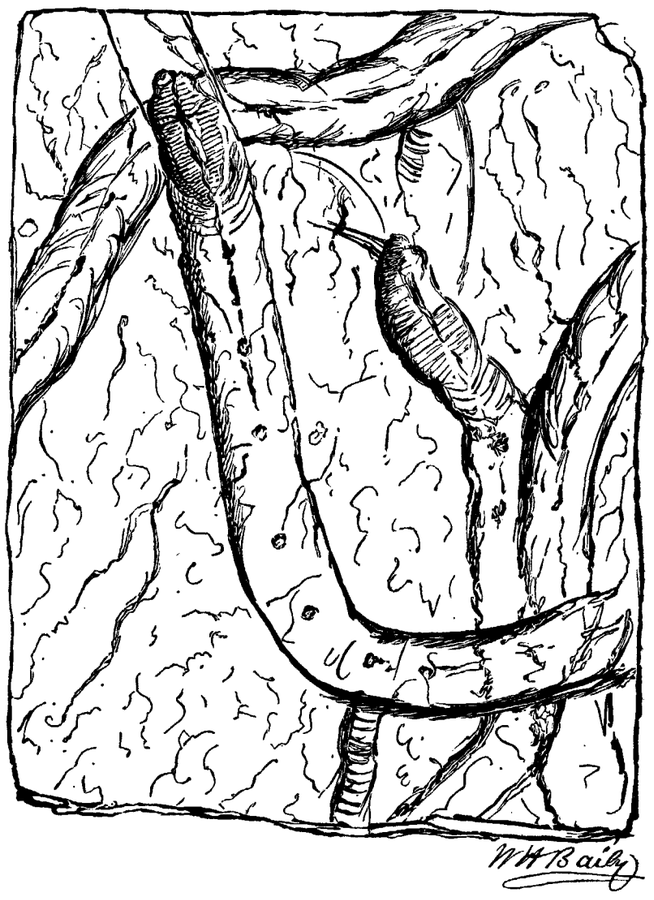
We are indebted to the kindness of the Rev. J. M. Emerson, of Ballickmoyler, Carlow, for some beautiful slabs of slightly micaceous sandstone from the Coal Measure series, the surfaces exhibiting tracks or trails of marine animals of various kinds. The larger continuous tracks may possibly be caused by Mollusca, whose slow movements over or beneath the surface of the moist sand, creeping or gliding along by the muscular action of the under surface of their body, or foot, as it is termed, might have produced markings such as these.

On one side of the slab, which is less than a quarter of an inch thick, the tracks appear in the state of casts, being elevated from the surface, like that represented at figure 3, which is reduced to half the natural size, and taken from part of the surface of a thick flaggy sandstone collected by Mr. G. H. Kinahan, and with the others

before-mentioned, now in the Museum of Irish Industry. The surface of this slab, which is about three feet square, exhibits several of these large elevated markings, curving in various directions, sometimes at a very acute angle, and crossing each other. They have a prominent central ridge, radiating from which, on each side, are curved lines, very close and regular. Towards what may be considered the termination of the track, the centre is punctated at regular intervals, which gradually cease, first a broken, then a continuous ridge taking their place.

Figure 4, of the natural size, represents the probable termination of one of these furrows, showing a peculiar wrinkling which

Fig. 4.



may have been caused by the action of the muscular disk of a molluscous animal, who, in gliding slowly along, threw up a slight ridge of sand on each side; this track is continued at a slightly higher level, as if the sand had hardened during the stoppage of the animal at that point, the track as it is continued being much fainter.

The whole surface of each of these slabs is covered by much smaller markings, as shown in the outline figures, which may probably have been caused by small sea-worms of the Annelidan type.

On the one side of the thin slabs the large markings occur as furrows, the smaller ones being ridges; whilst on the other side it is reversed, the large markings being ridges, and the smaller ones, furrows. The surfaces of each side, however, do not correspond with regard to the position of the markings.

Tracks and markings of a similar character from the same locality have been described by the Rev. Professor Haughton at the Geological Society of Dublin, and alluded to as being possibly of Annelidan or Molluscan origin.*

W. H. Baily.

November 4, 1858.

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* Since writing the above, an article has appeared in the "Annals and Magazine of Natural History," 3rd Series, Vol. II., No. 12, December, 1858, by Mr. Albany Hancock, whose opinion is, that these worm-like markings are the runs or tracks of crustaceans. He has figured at Plate XVIII. a track of the same description as the Wood-cut Fig. 3; this he alludes to as being the prevailing form in the Coal Measure flagstones of Northumberland, measuring as much as six feet in length, and was probably much longer, the extremities not being present.

Detailed Descriptions.

5. *Position and Lie of the Rocks.*

[The eastern side of this sheet was surveyed many years ago (under Professor Oldham, LL.D., now Superintendent of the Geological Survey of India) by Mr. A. Wyley, who is now engaged in making a Geological Survey of the Cape Colony. The rest of the sheet, except the south-west corner, was surveyed by Mr. Jos. O'Kelly, A.B. Mr. G. Henry Kinahan completed the western portion, revisited the old work, and compiled the following description from the notes on the six-inch maps, adding at the end such additional information as he obtained.]

Granite.—Beginning at the south-east corner of the map we have Granite *in situ*, to the south-west of Castledermot, in the townland of Dairyfarm. Some of this Granite was considered so good that it was sent to Dublin for columns. To the south-east of Castleroe crossroads, in the townland of Knockroe, where the height 307 is marked on the one-inch map, there is exposed some fine clear white Granite, with black mica. To the north of Castledermot, in the townland of Skenagun, Granite appears at the surface very much decomposed and rounded. To the south of Bushfield House, in the townland of Hallahoise, white Granite with black mica is again to be found.

Lower Silurian Rocks.—To the N.W. of Castledermot, and to the N. of Castleroe House, there are greenish, brownish, and purplish gray grits and slates to be seen. Some of the greenish-gray beds are very ashy looking. All these beds dip to the S.E. at angles varying from 55° to 80° and 90°. To the N.W. and S.W. of Bushfield House the rocks are indurated and changed. Some of them pass into a substance nearly resembling a felstone. They dip S.E. at from 50° to 90°. To the east of Bushfield House there are the same indurated grits and shales, dipping to the S.E. at from 40° to 85°.* In this latter place two Elvan dykes come to the surface of the ground. These Elvans are coarse, irregularly grained, and very quartzose in places having the same appearance as the neighbouring Granite, from which they undoubtedly proceed. A little to the north of Kyledownanan Castle there are very hard coarse massive gray grits, which dip to the S.E. at an angle of 80°. Where the road that runs due north from Castledermot divides into two, S. of Bolton Hill, there is a quarry in which are black slates and grit, which dip E. at from 40° to 60°. A little to the north of this, where the parish boundary crosses the old road, there is bluish-black slate, with a bed of green stone ash, which dip to the N.W. at an angle from 70° to 80°. To the south of Lord Aldborough's Temple, on the road that leads to Bolton Hill crossroads, there is a mass, seemingly a bed of greenstone, full of crystals of feldspar, in places forming an amygdaloid. To the east of Bolton Hill crossroads there are some peculiar beds, black and very much resembling coal shales, which are twisted, crushed, and contorted round beds of ashy grit in a very extraordinary manner. The ashy grits are hard nodular like masses, while between them are soft black shales, full of nodules of quartzose ironstone—the shales being very much crushed, so as in some places to have been almost entirely squeezed from between the ash beds. A quarter of a mile to the north of these contorted beds there is an Elvan dyke which is fine-grained and felspathic.† A little to the south of this are green grits, dipping

* It is worth observing that the dip of the Lower Silurian rocks here is all to the S.E., or *towards* the granite, a relation between the two rocks which seems to be the usual one in this part of Ireland, except with respect to those beds which are actually in contact with the granite. J. B. J.

† This is the only Elvan dyke hereabouts that is to be seen; but it seems likely that there are a great many more undiscovered, as the county is scattered over with pieces of that rock. G. H. K.

E. at 50°. To the E. of Moone Rath is a bed of dull olive greenstone ash, dipping S.E. at 50°. To the E.N.E. of Powersgrove House there are alternations of green and purplish gray slate, with micaceous grit, dipping N.W. at from 50° to 75°. Underneath these are green and purplish gray compact grits and shales, undulating with very sharp curves—the axes of the curves running S.W. and N.E. To the N.W. of Powersgrove House, where the height 374 is marked on the one-inch map, are very compact gray grits and purplish and green slate, dipping S.E. at 80°. A short distance to the north of this last named place are gray and purplish grits, dipping S.E. at from 50° to 60°. To the N.W. of Ballindrum House are some highly micaceous gray and purplish grits and slates, dipping S.W. at 15° and S.S.E. at 50°. The strike of the cleavage of the slate runs E. 40° N., and it dips at an angle of 50° to the S.E. To the south of Glassely House there are to be seen some hard, massive, gray, and purplish-gray grits, dipping to the S.E. at from 30° to 45°. Some of these beds are very micaceous; and in places there are thin green chloritic shales between the grit beds.

To the south of Battlemount House are to be found green slates and grits, nearly vertical, with a slight dip to the S.E. To the north of Narraghmore House, alternations of green slate, with massive grit beds, were observed, which dip to the S.E. at from 30° to 35°; while to the south of Kilrush Rath are some green and brownish-gray micaceous grits and slates, dipping similarly to the S.E.

c^1. *Old Red Sandstone.*—There is a small patch of this formation to be found to the south of Glassely House. Its exact boundaries could not be traced; and it may extend much farther to the east than is marked on the map. The evidence of its existence is a mass of quartzose conglomerate, lying unconformably on the Lower Silurian rocks, in the road that runs from Glassely House to Mullamart House. It dips to the S.W. at 5° only. There are also some similar quartzose conglomerates at St. Patrick's Well, which dip south at such a low angle as to be nearly horizontal. These conglomerates are very ferruginous, and seem to have a slightly calcareous base.

Lower Limestone.—Of the Lower Limestone very little is to be seen, the country under which it lies being almost universally covered with deep Drift. To the north-east of Athy, at Russellstown crossroads, blackish gray, impure, thin-bedded limestone is to be found, dipping S. at a very slight angle. To the W.N.W. of the village of Narraghmore, in the townland of Ballymagasson, there is some blackish gray, partially crystalline, impure limestone, some of which is magnesian, also dipping south at a very slight angle. To the south of Skerries House, in the townland of Rathgrumley, may be seen dark gray thin-bedded crystalline limestone, with vertical joints, coated with spar. A little to the east of this, in the townlands of Ardnagross and Ballynabush, regularly bedded sub-crystalline limestone, with thin calcareous shale partings, is quarried, the rocks dipping nearly west at an angle at from 3° to 4°. A little to the S.E. of Skerries House are quarries showing blackish gray, impure, partially crystalline, limestone, and calcareous shales, full of fossils, dipping W. at from 0° to 6°. To the north of Fontstown House, there is magnesian limestone, dipping S.W.; but being nearly horizontal. At the Seven Stars there are black impure limestones and limestone shale, with sparry cavities, dipping E. at from 8° to 10°.

Calp.—In the Calp district, rock *in situ* is almost as rarely to be seen as in that of the Lower Limestone. At Levitstown Lock there is a quarry in which some gray and dark gray crystalline limestone, full of fossils, may be seen.* To the south-west of Athy, in the townland of Roundhills, are some black, partially crystalline limestones, thin-bedded—the beds being from one

* It would have seemed to me more proper to have reckoned these quarries as a part of the Lower Limestone than the Calp. G. H. K.

to two feet thick only,—with thin shale partings between the beds. These dip nearly south at 8°. To the west of Athy, in the townlands of Woodstock, Coolroe, and Quarry, there are quarries of black and blackish gray limestone, often very compact, with very even and regular beds, from one to two feet in thickness, with partings of "argillaceous and arenaceous calcareous shales" between the beds. This limestone is much jointed by two regular sets of joints running at right angles to each other, and to the surface of the beds. The limestone undulates, but in such a way as to be nearly horizontal, or with a general dip not exceeding 5° to the W. At the north of Courtown House we have dark gray compact limestone, the beds varying from 6 inches to 2½ feet in thickness. Some of these beds are olive gray and crystalline (magnesian). A little chert is found in the limestone, and there are shale partings between the beds. To the N.E. of Kilberry Castle are two limestone quarries. All the above-mentioned localities are in the county of Kildare.

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

In the Queen's County the lowest rocks are the Calp. Beginning where the Barrow river leaves the map, on the south, there is one quarry affording the only evidence for the existence of the Calp in the part of the Queen's County traversed by the valley of the Barrow. This quarry is situated to the west of Ballyfoyle House, and exhibits thick-bedded and flaggy dark bluish gray, and gray compact and crystalline limestone, very fossiliferous.*

In the N.W. corner of the map there is a patch of Calp, of which some beds are well shown in a quarry to the N.W. of Maryboro' Great Heath, consisting of dark gray and black, compact, earthy, thin-bedded limestone, with shale partings, and layers and nodules of chert. The beds are from 2 to 18 inches thick. Some fossils are to be got in this quarry.

Upper Limestone.—Beginning at the southern portion of the map, the first beds of this group seen *in situ* occurs to the south-west of Ballyfoyle House, near Killabban old church, and consist of thick-bedded, gray, and dark bluish gray limestone, flaggy at the top of the quarry, dipping E. at 15°. To the west of this, near Ballynagar House, the limestone is exposed in a number of quarries, and is thick-bedded, gray, and dark bluish gray, abounding with fossils. In one of these quarries there are two beds of blackish shale at the bottom of the quarry. Bands and nodules of chert are generally to be seen on the surface of the beds. The beds dip S.W. at from 5° to 8°. To the south and south-east of the village of Ballylynan the limestone is exposed in a number of quarries. It is hard, compact, dark bluish gray, and light gray in colour, very fossiliferous, the fossils being principally Productæ, Spirifers, Encrinites, and Corals. The pale gray beds are generally more or less magnesian. In one quarry in the townland of Oldcourt there is again a bed of black shale in the limestone, the dip being to the S.W. by W. at from 5° to 8°. To the N.W. and W. of Ballyadams Castle there is limestone to be seen *in situ*, which is thick-bedded, of a gray and bluish gray colour, and dips S.W. at 5°. This same limestone is continued up to the N.W. of Southfield House.

Half a-mile S.W. of Tallyho House, at Cobbler's Castle, at a height marked on the map 668, there are hard, compact blue limestones lying both under and above massive pale gray and bluish gray limestone, which is in places crystalline. These rocks dip to the S.W. at 5°. Half a-mile due west of Cobbler's Castle, at Windy Gap and north of it, in the quarries, are some pale gray and lightish blue thick-bedded limestones. To the south of the ruined church that lies S.E. of Stradbally there is thick-bedded, pale, and light bluish gray limestone, flaggy-looking on the top of the quarry. This limestone has in it a little chert. The beds are undulating, but in such a way as

* The limestone in this last mentioned quarry seems to me to have more of the character of the Upper Limestone than the Calp. G. H. K.

to be nearly horizontal. Here there are fossils which are principally Productæ and Spirifers. To the west of the same church are thick-bedded pale gray limestone.

From Stradbally south to the village of Luggacurren there is a very good section. Beginning at Windy Gap, there are thick-bedded, pale, and bluish gray limestones, with fossils, principally large Productæ; these beds dip W. Over these beds are pale gray, crystalline, fœtid limestones, and light bluish limestones, which are in places slightly magnesian. On the top of these lie thick-bedded, light bluish gray, fœtid limestones, one bed of which is dark and compact; in these limestones there are bands and nodules of chert; they dip to the S.W. at 5°. Next in ascending order there are dark bluish, crystalline limestone, and thick-bedded, pale gray, fœtid limestone, with chert, dipping also S.W. at 5°. These lie underneath some dark bluish, crystalline, cherty limestone, which is nearly horizontal, but with a slight dip to the S.W. Over these last-mentioned limestones are dark blue, compact, and pale gray, crystalline limestone, on the top of which come more dark blue, crystalline, and pale gray, fœtid limestones, with chert, also lying nearly horizontal. Over these are compact, dark bluish gray, flaggy limestones, with bands and nodules of chert, nearly horizontal, or with a slight dip to the south; and on the top of those again pale gray, thick-bedded, coarse, fœtid limestones, with nodules and irregular pieces of chert, the beds undulating, but in such a way as to be nearly horizontal. We then come to gray, pale gray, and light bluish gray, partially crystalline, fœtid limestone, with bands and nodules of black and white chert, above which are some dark bluish gray and gray limestone; and at Luggacurren there are thick-bedded, dark bluish gray limestones, with band and nodules of chert and red earth partings, dipping to the S. at 5°. Going back to Stradbally, to the west of it, in Stradbally Hall demesne, there are some pale gray, thick-bedded flaggy, crystalline magnesian limestones, dipping S.E. at 20°. To the E. of Ballykilcavan the rocks consist of dark bluish gray, and brownish gray, thick, irregularly-bedded, partially magnesian limestones, dipping to the S.S.W. at 5°. At the church, a little to the north of the last-named place, the limestone is dark bluish and pale brownish gray, in thick beds, some of which are magnesian; they dip to the W. at from 5° to 15°. To the north of the church, and west of Balylymanus House, there are dark bluish and pale gray limestones, in irregular thick beds, a few of which are slightly magnesian. To the north of Stradbally, in the townland of Knocknanbroher, there is dark gray and blue limestone, with nodules and layers of chert, slightly magnesian in places. The beds are thick and irregular, and dip to the S. at 15°. Three-quarters of a mile N.W. of Vicarstown Bridge there is dark gray limestone and brownish gray magnesian limestone, the dip of which is not determinable. A mile and a-half north of Cahernacopols House, where 718 is marked on the one-inch map, there is pale gray, thick-bedded limestone, with many small nodules of white and black chert, and many fossils. It dips both to the W. and S. at 5°. To the north of this, in the townland of Kilmurry, is a quarry, on the top of which there are bluish gray and pale gray, thick-bedded limestones, one bed of which is magnesian, while at the bottom of the quarry the limestone is dark blue, argillaceous, and thin-bedded.* These dip N.W., N., and N.E. at an angle of 10°. At the Rock of Dunamase the limestone is dark bluish gray and pale gray, sometimes flaky, and in places full of chert. The beds undulate with sharp curves, but with a general dip of 5° to the S.E. This Rock is a striking object from all parts of the neighbourhood, rising with nearly perpendicular sides to the height of 200 feet above the surrounding ground. To the south of the Rock there is a trace of Red Hæmatite, which will be hereafter spoken of. To the east of the Rock the lime-

* The bottom beds of this quarry look very like beds of the calp series, but they are not so, as the same kind of limestone is found to the S.W. on Hewson's Hill, and will hereafter be spoken of. G. H. K.

stones are dark blue and pale gray, with thick, irregular beds, in which are nodules and bands of chert. The beds dip south at such a low angle as to be nearly horizontal. To the north of the Rock, and to the south of Heath House, the limestone is dark bluish gray, cherty, in places of crystalline structure, and at one place consists of a mass of coral. The beds are undulating at a very low angle, being nearly horizontal, with a slight general dip to the south. To the south of the Mail Coach Stables there are hard, dark blue and dark gray earthy limestones, with chert bands and nodules; part of it slightly magnesian; the beds dip to the N.W. at 30°.

G. H. K. from J. O'K.'s Notes.

To the south-west of the Rock of Dunamase, and to the east of Pigott's Castle, there is blue limestone, slightly magnesian in places, with chert beds and nodules. The beds are undulating; first they dip to the S.E. at from 10° to 20°, then to the S. at so low an angle as to be nearly horizontal, and lastly to the N.N.W. at 55°. At the north of Hewson's Hill there is a thick-bedded, bluish gray and pale gray limestone, lying nearly horizontal, with a slight dip to the S.S.W.

To the west of Hewson's Hill, between it and the old Fair Green, the limestone is blue, with a little chert, and dips W. at 5°. To the west of the Fair Green the uppermost beds of the limestone are found *in situ;* they are nearly a mass of chert, and dip W. at 50°. To the east of the old road which is on the eastern side of the Fair Green there was an old iron mine, which will be spoken of hereafter; and hereabouts there seems to run a N. and S. fault, having an upthrow to the west. On the top of Hewson's Hill the limestones are bluish gray, with a little chert, and dip to the N. at from 0° to 10°. A little to the south of this the limestone is so full of chert that scarcely any pure limestone can be seen. These cherty beds dip to the N. at from 10° to 30°. Under these are bluish gray limestones, with scarcely any chert, dipping to the N.E. at 5°. On the southern slope of Hewson's Hill, a little to the north of a boreen, there is dark blue argillaceous thin-bedded limestone, which seems to be the same beds as were before remarked in the quarry in the townland of Kilmurry. They dip to the N.E. at 5°. Under them are bluish gray thick-bedded limestones, lying nearly horizontal, with a slight dip to the N.N.E. To the east of Hewson's Hill there runs a N. and S. fault, which is well shown by part of the limestone being cherty; it is an upthrow to the west. To the south-west of Hewson's Hill, in the townland of Raheenanisky, there are blue limestones in the northern quarry, dipping to the S.E. at 15°, while in the southern quarry they dip S. at so low an angle as to be nearly horizontal. In this latter quarry the limestone is cut by two regular sets of nearly vertical joints—one set running N. and S., and the other E. and W. To the west of this, along the road that bounds Lamberton Demesne on the east, the limestone near the Coal Measures is to be seen. It is dark blue, with black and white chert in layers and nodules, dipping W.S.W. at 5°, W. at 10°, and W.S.W. at 10°. To the east of Cullenah Abbey, close to the lower black shales of the Coal Measures, there is some gray granular magnesian limestone. To the south-west of Timahoe, near where the second S in Fossy stands in the map, gray granular magnesian limestone, and blue limestone, with chert layers, are seen in a quarry, dipping W. at 20°. To the S.S.W. of Timahoe, and at the E. of the townland of Garryglass, there is granular dark blue and gray limestone, full of calc spar veins, with nodules and layers of chert, and red argillaceous partings and nodules along the surface of the beds. The beds a little to the south, at the junction of the limestone and the Coal Measures, are nearly one mass of chert. The dip hereabouts is all S.E. at an angle of about 15°.

G. H. K.

To the east of Timahoe the limestone is gray, dark gray, and bluish gray, in places crystalline, and occasionally cherty. Proceeding to the southward from these last-named beds, and therefore approaching the Coal Measures, the

limestone first becomes dark gray, and bluish gray, and argillaceous, but generally crystalline; and then, on reaching the junction, the rocks are found to be nearly an entire mass of chert. The dip here is S. at from 5° to 20°. To the N.E. of Raheennahown House, the junction between the limestone and the Coal Measures is again to be seen. The upper beds of the limestone are of a dark gray colour, flaggy, full of nodules, and layers of chert, and are dipping S.W. at 10°. To the north-west of Corbally House the limestone may also be seen near the Coal Measure boundary, being thick-bedded, coarsely crystalline, of a gray colour and very cherty. To the north-west of Ballylynan, between Corbally and Rahin House, there is much limestone exposed. It is generally pale gray and light bluish gray in colour, very compact, cherty in places, and generally fossiliferous—the fossils being large Productæ, Corals, &c. In the bottom of the quarry, to the west of Rahin House, there are some beds of dark blue, compact limestone. All the beds in this locality dip S.W. at from 5° to 8°.

To the west of Ballylynan, and north of Miltown House, there are dark blue compact limestones, crystalline in places. To the west of Castletown, and south of Coonbeg, a small patch of limestone is brought up into the very line of the Coal Measure boundary, which is deflected to the south by two faults. To the west of Brook Cottage, limestone near to the Coal Measures may be seen, of a dark blue (in places nearly black) colour, and crystalline texture, dipping S.W. at 10°. To the north of this, in the townland of Oolanowle, and on the eastern side of the townland, pale gray and bluish gray thick-bedded limestones were observed, while on the western side of the townland the limestone is dark bluish gray, full of bands and nodules of chert, all dipping S.W. at 5°.

G. H. K., from J. O'K.'s Notes.

Coal Measures.—The Coal Measure district on the southern margin of the map is the continuation of the Castlecomer coal field, forming its northern termination. On the western side of the map there are two outliers, one forming the hill of Cullenagh and the high grounds to the west of Lamberton House, the other a very small, but most remarkable one, on the west side of Hewson's Hill, where the old church of Dysert stands. The Hewson Hill outlier is situated more to the north than any of the Coal Measures hereabout. Too little evidence is obtainable to enable us to mark accurately its limits, the place being covered with deep drift; but just to the east of the old church the uppermost beds of the Upper Limestone make their appearance, being nearly one mass of chert, dipping at a high angle (50°) to the west; and immediately to the west of that, in the boreen leading to the church, were found the lowest shales of the Coal Measures, dipping at a high angle (70° to 75°) to the N.W.

This proves the existence of Coal Measures here, but no farther evidence could be found elsewhere, so that its boundary on the N. and W. is a matter of inference. It is separated from Lamberton Hill by a valley, which almost certainly cuts into the limestone, as, although no rock is to be seen in it exactly between the supposed Coal Measure boundaries, limestone appears immediately to the north, striking through it, and is also seen a little to the southward, just in that line of strike. There have been trial pits sank in this outlier in search of coal, but, I need scarcely say, without success, as there could not be in it more than a few hundred feet thick of the lowest shales, in which no coal has ever yet been found.

Cullenagh and Lamberton Hills are separated by a valley which may, very likely, be traversed by an E. and W. fault. Very little rock *in situ* is exposed about Lamberton Hill: on the north side of it, along the road, the lower shales may be seen dipping south at a very low angle, and on the top of the hill a few grits were found. It is impossible, from these scanty data, to form an estimate of the thickness of the Coal Measures in this hill, but they can

hardly be more than 700 or 800 feet thick. On the part of Cullenagh Hill, which is included in this sheet, there is also but little rock to be seen *in situ*, except on the top of the hill, although on the north-west face, which lies in sheet 127, there is a very good section, and by it we are able to estimate the thickness of Coal Measures contained in it as over 1,200 feet. This is a thickness sufficient to bring in No. I. coal, and this coal was accordingly found to exist near the top of the hill.*

The shales under this coal are rather rich in clay ironstone, and they were formerly very extensively worked. No accounts of the beds passed through in the old pits hereabouts are now to be got, but the following section was noted in a ditch near the top of the hill :—†

Section No. 2.

		Ft.	In.
12.	Flags and flaggy olive shale, thickness not known, but over	20	0
11.	Olive and blue shale,	22	0
10.	Black fire clay,	0	3
9.	Coal smut, No. I. coal,	0	5
8.	White fire clay,	0	6
7.	Sandy indurated clay, full of stigmaria,	0	8
6.	Olive flaggy grit,	2	0
5.	Gray shale,	3	0
4.	Kelve or smut,	0	5
3.	Hard white coal seat, Flaggy olive grit,	6	0
2.	Black shale,	12	0
1.	Massive gray and olive grit,	—	
		67	3

The remains of two old pits sank on the outcrop of bed No. 9, in the above section, are still to be seen.

Proceeding to the Coal Measures on the south side of the map, in a stream due south of Timahoe, a good section was observed, of which the following are the particulars, commencing with the highest beds :—

Section No. 3.

			Ft.	In.
30.	Black shale,	horizontal, about	30	0
29.	Olive shale,			
28.	Olive grit,	S. at 10°, about	160	0
27.	Black shale,			
26.	Olive flagstone,			
25.	Olive grits and shale,	S. at 20°, about	188	0
24.	Olive grit,			
23.	Black indurated clay,			
22.	Olive grit,			
21.	Olive sandy shale,			
20.	Olive grit,			
19.	Olive flaggy grit,			
18.	Olive and black shale,	S. at 10°, about	140	0
17.	Olive grit,			
16.	Olive flaggy shale,			
15.	Olive grit,			
14.	Black and olive shale,			
13.	Flaggy grit,			
12.	Black shale,			
11.	Olive grit, S. at 10°, about		8	0
10.	Olive grit,			
9.	Olive shale,	S. at 20°, about	68	0
8.	Olive grit,			

* Griffith's Report on the Leinster Coal Field, pages 68 and 69, is the only source from which information is now to be got as to the old workings for coal on the hill of Cullenagh.

† The numbers in this and all other sections are arranged according to the order of deposition of the rocks, the lowest number being attached to the lowest or first formed bed.

			Ft.	In.
7.	Black nodular shale, with a few grits,	S.S.E. at from 20° to 45°, about	267	0
6.	Black and olive shale,			
5.	Black carbonaceous shale,		111	0
4.	Olive shale, S.S.E. at 45°, about		15	0
3.	Olive grit, S.S.E. at 45°, about			
2.	Olive and black shale alternating,	S.S.E. at 10°, about	70	0
1.	Black carbonaceous shales, supposed to be those resting directly on the limestone.			
			1,047	0

By this section we see that the beds overlying the limestone to the top of the black shales (No. 7), have a thickness of at least 453 feet, and that the grit and shales above them, forming the rest of the section, are about 594 feet thick. Above the beds included in this section are grits with very few shales, the thickness of which is unknown, as there is but little rock to be seen *in situ*, the little we do find being horizontal. If we now proceed S.S.E. across the hill to the stream which runs to the E. of Cleanagh, grit and shales would be seen in it alternating regularly with each other, in the same way that they usually do in that part of the Coal Measure series which contains beds of coal, the shales, that is to say, having a greater thickness than the grits. In the Knocklead River, a mile due north of the village of Cleanagh, flags and flaggy olive shales are met with very like those which ought to be under No. II. coal ; and in the stream before mentioned, which lies to the east of Cleanagh, there is an impure coal, which seems to be its representative, in the townlands of Knockacin and Aghadreen. The smut of this coal has been worked by basset work (*open work*) by some of the inhabitants, and a pit was sunk on it in the townland of Aghadreen. The following section was noted in the townland of Aghadreen :—

Section No. 4.

		Ft.	In.
5.	Fine black shale, with thin beds of black pyritous grit and clay ironstone, thickness not known, but about	34	0
4.	Slaty kelve and culm, No. II. coal,	1	8
3.	Fire-clay,	0	5
2.	Indurated black clay,	5	0
1.	Seat rock (olive grit),	—	
		41	1

To the south of this, near the boundary between Aghadreen and Moyadd, the representative of No. III. coal ought to be found ; but after careful search I was unable to discover a trace of it. Between the outcrop of No. II. coal just spoken of, and the southern margin of the map, I believe that there is an E. and W. fault (as marked on the map), which must be an upthrow to the south. This belief is based on the fact that, a little to the south of this sheet, in sheet 137, there was a pit sank in the Moyadd iron mines, 90 feet deep, without finding any coal. Now, this could hardly have been the case without a fault such as supposed, unless, indeed, No. III. coal is wanting there.

In the stream to the south of Luggacurren, there is the following section :—

Section No. 5.

			Ft.	In.
13.	Olive flaggy grit and shale,	horizontal,	46	0
12.	Flaggy olive shale,	dipping S. at 15° to 40°,	102	0
11.	Flags and shale,			
10.	Olive grit and black and olive shale,	S. at 20°,	63	0
9.	Ditto,	ditto, S. at 8°,	102	0
8.	Ditto,	ditto, S. at 20°,		

		Ft.	In.
7. Dark shale,			
6. Olive grit,	S. at 6°, . . .	68	0
5. Carbonaceous black shale,			
4. Hard black shale, S.S.W. at 10°, ...		52	0
3. Cherty shale,			
2. Black shale,	S.S.W. at 5°, ...	87	0
1. Cherty Limestone, S.S.W. at 5°, ...		—	
		520	0

It will be seen by this section that the lower shales are not so thick as in the former one (No. 3), and are more interstratified with grits than at the south of Timahoe. This last section ends at about three-fourths of a mile south of Luggacurren, and from that there is very little evidence to be obtained, until the Mullaghmore colliery is met with.

G. H. K.

A little to the west of this section, in the south-east corner of the townland of Luggacurren, there are flag quarries from which they raised flags, which are sent into the market under the name of "Carlow flags." These flags are on the same geological horizon as those got at Lackan in sheet 147. All along the front of the hills from Luggacurren to the south of Grovefield, there are black, olive, and carbonaceous shales cropping out, dipping S.S.W. and W., generally at a very low angle. Some of these black, carbonaceous shales are very like coal smuts, and have caused a great expenditure of money by the different landholders and companies sinking into them, in the expectation of finding coal, without apparently taking any notice as to the place of these black shales in the series, or determining whether they belonged to the upper coal-bearing part of the Coal Measures, or the lower part resting directly on the limestone, in which no coal has ever yet been found in the district. The fossils known as Aviculopecten, Posidonomya, and Goniatites are found in these shales, and may, in the absence of counter evidence, be taken as indications of their being below and not above the place where beds of coal are to be found.

G. H. K. from Notes by J. O'K.

Wolfhill Colliery.—Wolfhill Colliery is situated due south of Stradbally, at the foot of the map. In it No. III. coal is being worked; all, except a little at the north, having been taken out down to the depth of the present level. A company are now running up a new level, which they expect will be able to drain most, if not all the colliery. To the E. and N.E. the coal crops out, as marked on the map. To the N.N.W. there is a fault, which, near the outcrop is a downthrow of one yard to the N.; 800 feet to the W. of this it increases to seven yards. To the S. and W. the extent of the coal has not been proved. At the north of the colliery they are taking out some coal which still remains over the old level. The following section is one of a pit near the outcrop, given me by one of the colliers that was working at it :—

Section No. 6.

	Ft.	In.
6. Clay, ...	6	0
5. Bind, ...	30	0
4. Coal, ...	0	9
3. Clearing, ...	0	1
2. Impure slaty culm, ... 1	0 to 2	0
1. Black stone, . . not penetrated	—	
	38	10*

* These colliers are under an agreement to give all the coal they raise at 6*d.* per cwt. to —— Grace, Esq., of Gracefield; the culm they sell for 3*d.* per cwt.

Some of this coal has a beautiful colour, like peacock copper. At the south of the colliery the new proprietors are sinking a pit at about two furlongs to the S.S.E. of Wolfhill Roman Catholic chapel. J. M. Meadows, Esq.,* furnished me with the following table of the strata that they have at present gone through :—

Section No. 7.

	Ft.	In.
9. Clay and gravel, ...	12	0
8. Slate, ...	40	6
7. Crow coal, No. IV. coal, ...	0	2
6. Seat and seat rock, ...	5	0
5. Close-grained, compact, gray sandstone, locally called "green rock," . .	30	0
4. Sandstone parting, with coal rods and coal indications, . . .	2	6
3. Black slaty parting, ...	2	0
2. Clay ironstone, ...	0	9
1. Black indurated shale, partaking of the nature of a grit, very hard, and in beds which vary from half an inch and less to nine inches in thickness, locally called *Black Rock*, ...	75	1
	177	0

In the lowest three feet of No. 1 there is a slight change, the shale becoming more siliceous. The old colliers believe that at about 6 feet greater depth they shall come to the "slate," and that under 24 feet of the latter they will find the coal.

In this part of the colliery the representation of No. IV. coal is only two inches thick, and is supposed to be from 150 to 160 feet above No. III. coal. In the part of the colliery that is now worked out, the distance between these coals varied from 120 to 140 feet. In Section No. 7 the group of beds called No. 1 is thicker than it was found to be in any other part of this colliery. It consists of black cherty shale, and is the terror of the colliers, as they are only able to sink a few inches in it daily. It is only found over No. III. coal in the collieries of Wolfhill, Modubeagh, Glen, and Pauliteen. The two latter are situated in sheet 137. No. II. coal has not as yet been proved in this colliery.

Modubeagh Colliery.—Modubeagh or Ballylehane colliery lies to the E. of the last, and is situated partly in this and partly in sheet 137. In it Nos. II., III., and IV. coals have been worked; No. III. rather extensively; No. II. there were pits sank on near its outcrop, and a little coal taken out; No. IV. coal was also only worked a little. The section here given of Tilly's pit was communicated by J. M. Meadows, Esq. :—†

Section No. 8.

(Tilly's pit, from accounts of Captain Chegwin and J. Doyle.)

	Ft.	In.
13. Clay and gravel, ...	5	0
12. Slate (loose)	21	0
11. Compact, hard, black slate, ...	63	0
10. Compact sandstone, ...	54	0
9. Slate over crow coal, ...	12	0
8. Crow coal, No. IV. coal, ...	0	10
7. Seat rock, compact and quartzose, ...	3	0
6. Black slaty bind, ...	12	0
5. Compact slaty sandstone, ...	60	0
4. Black rock (indurated siliceous shale), ...	42	0
3. Slate, ...	15	0
2. Slate, with bed of mine and impressions of shells, . . .	6	0
1. Coal, No. III. coal, ...	1	6
	295	4

* To Mr. Meadows I am indebted for most of the information about the collieries in this map.

† The place where this section is taken is in sheet 137.

In this colliery the distance between Nos. III. and IV. coals is about 140 feet. No. IV. was worked a little, but as there is no "clearing" under or over the coal it was given up, as it was too expensive to take it out. At the north of the colliery this coal is only a few inches thick. To the east of the outcrop of No. III. coal they say that the verge of two coals have been proved, and worked to a small extent. It is possible, if the two outcrops have been proved, that they are of the same coal, and that between them there is a N. and S. fault, that is, an upthrow to the west, which brings up the coal a second time to the surface of the ground.*

Between this colliery and Wolfhill there is a N. and S. fault, which is part of the main fault, which can be traced from Luggacurren down to Ardategle Colliery, in sheet 137. At Luggacurren it brings up the limestone at the west of the fault.

Mullaghmore Colliery.—Mullaghmore Colliery lies to the north of this, and the coal worked in it is considered to be No. III. coal.† This colliery was formerly worked on the edge of the coal. None of the sections of those pits are now forthcoming. The company are driving in a level, but as yet have not sank any pits.‡ This might be No. II. coal, as there seems to be a very small thickness of rock between it and the limestone; but, as there is no section to be seen, this may be deceptive. No Aviculopectens or Goniatites are found in the shale lying on the top of the coal, though they are in that shale at Modubeagh and Wolfhill; but under the coal there is fire clay, which is not to be found under No. II. coal at Kingscote or Hollypark, which are the nearest working of that coal of which information can be procured. On the other hand, no trace could be found of any coal to the east of its outcrop, or of the flagstones that underlie No. II. coal; and as they are well-developed to the south, at Kingscote Colliery, they ought to be found here.

The Mullaghmore coal is cut off at the west by the Luggacurren N. and S. fault.

6.—*Drift and Superficial Deposits.*

Drift.—The principal kind of Drift in this sheet is that which is made up more or less of blocks and fragments of limestone. This Drift covers nearly the whole of the district. At the west of the map we find it on the Hill of Cullenagh as high as 800 feet above the sea, only leaving the mere top of the hill uncovered. On the table-land to the south it is found on hills 1,059 and 1,079 feet high, even up to the summit; while hills on the same table-land, separated from those by a valley about a mile wide, have not a particle of limestone on them, though they are only 837 and 977 feet high. It is evident, therefore, either that some cause prevented the Drift from being deposited on these lower hills, or that, after having been deposited, a partial action of denudation has carried it away from off them.

The hills to the east of the map are all covered with the limestone Drift, the highest of them being only 547 feet high. This Drift at the east of the

* These may be the outcrops of separate coals, as there is a small coal above No. II. coal in that part of the coal field which lies to the south of this colliery. (*See section 8, bed 6, and section 6, bed 6, Explanation of Sheet 137*). In section 31, bed 6, Explanation Sheet 137, there is a coal about where this ought to be. This coal apparently exists only to the east of the coal field, as it is not found in any other sections that pass through these particular measures. G. H. K.

† Mr. Meadows has examined the roof slate, and says it is identical with that over No. III. coal at Modubeagh.

‡ They are now (January 9, 1859), working a two-foot bed near the outcrop of the coal, which is rather soft, but of good promise.—(*Communicated by Mr. Meadows.*)

map is rather remarkable, as large tracts of the country are covered with pure gravel and sand, which in some places is cemented together into a conglomerate.

To the S.E. of Kilkea Castle there are most remarkable beds of clay and sand running through the centre of the gravel, very well seen in a sand-pit there situate.

In the valley of the Barrow are found small patches of brick clay which are used extensively for brick and tile making. This clay seems to lie in pockets of the Drift; and though surrounded on all sides by Limestone Drift it seldom or ever has a fragment of limestone or any calcareous matter in it. On the table-land to the south of the map beds of brick clay are also found, which is made into tiles, to the south of the village of Luggacurren. Deers' horns were formerly found in the Drift at the Great Heath of Maryborough, but the exact nature of the deposit enclosing them is not now known.

In the western portion of this sheet there are some very characteristic *Esker Ridges.* This peculiar modification of the Drift consists of long narrow winding ridges of sand and gravel, sometimes expanding into wider irregular mounds. One of these Esker Ridges runs from Stradbally to the south-west, and is three miles long. This ridge is generally low, with gradual slopes at each side, and wherever a section is seen the layers of gravel that form the ridge seem to be parallel with the slopes of its sides. A very good section is seen across this ridge to the south of Stradbally Hall. In some places there are gaps through this ridge; and whenever that happens, the ridge always slopes down regularly and gradually to these gaps, and the gravel, where a section is seen, seems to be parallel to the slopes. This ridge, after passing Timogue church, turns towards the south, and ends in a low, long, broken line of hills against another Esker Ridge, which begins near Clopook House, and runs thence to the W.N.W. At the south of Clopook House it is hard to draw a boundary between the Esker and the common mass of the Limestone Drift that is spread over the country, since they there blend into one another. On going west, however, to Fallow Cottage, the ridge becomes well-marked, having steep slopes on both sides. A section of this ridge is seen where the road from Stradbally to Timahoe crosses it, and it is there apparent that the present steep slopes are not those that were first formed, since the ends of the different beds of gravel and sand crop out on the side of the Esker, instead of sloping down parallel to it, as they do where subsequent denudation has not affected them, as in the neighbouring Esker, which runs S.W. from Stradbally. This ridge, where the road above-mentioned crosses it, is 52 feet higher than the surrounding country, and stands on a base which is 200 feet wide.

When this ridge comes to the north of Timahoe it turns round at a right-angle to the north, and is almost immediately cut through to its base by the little river Banteogue. The ridge is then continued again to the north for about a mile, when it turns round to the west, widens out, and ends. The hill formed by this widening out is called Brockna. Brockna, on its top, is quite flat, except at its western part, where there is a cup-shaped hollow, a feature common to most of those expansions of the Esker ridges. The hill of Brockna occupies a space of about fourteen acres. To the north-west of Timahoe there runs a N. and S. Esker ridge, of which a very good section is to be seen in the road that leads from Timahoe to Cullenagh Abbey. In this section, on the east side of the ridge, the gravel is stratified, while on the west side it is in a confused mass.*

* I have seen a section exactly the same as this exposed a little to the south of Greystones, in the county of Wicklow, where a cut was made through the large shingle beach of that coast. There every tide added a layer to the beach, and at high tides, or in storms blowing from the east, the gravel and stones were rolled over the top of the beach, and poured down in a confused mass at the back of it, into the still, pent-up

I could not succeed in getting a particle of a fossil in any of these ridges, although a little to the north, near the town of Maryborough, in sheet 127, I found a few small fragments of broken shell in the very remarkable Esker ridge that is there to be seen.

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7. *Minerals.*

There are nine minerals found in this district; three ores of iron; three kinds of coal; two clays, and fragments of galena. The ores of iron are—*Brown Hæmatite*, *Clay Ironstone*, and *Iron Pyrites*.

The Brown Hæmatite is found in the Upper Limestone. There is a trace of it to the south of the Rock of Dunamase, in the cutting for the road, which seems to be a leader to a lode. To the east of Dysert old church there is an old iron mine from which this ore was taken.*

Professor Apjohn made an analysis of specimens of this ore for Lord Carew in 1854, which showed it to contain from 34 to 36 per cent. of iron.

The old iron mine is close to the outlier of Coal Measures before described. The vein seems to underlie to the N.W. in the same direction as the dip of the beds.† It is possible that at our present locality it may come in in a wedge fault, and be the lowest beds in the Coal Measure series. The following evidence is all that is to be met with at the surface of the ground: On the east side of the locality is the Upper Limestone, dipping to the N.N.E. at from 10° to 30°. On the west the lowest shales of the Coal Measure series appear, dipping W. at 50°, and under them the Upper Limestone, dipping W. first at 50° and then at 5°. In the centre, between the two supposed faults, iron ore is found. In an old pit, at the east of the road, there are highly siliceous black shales, interstratified with layers of red hæmatite. Both the shales and the iron ore are from one-half to three inches in thickness, and seem to lie horizontal. To the west of the road, in the side of an old pit, there are yellow ochreous clay, thin beds of red hæmatite, and the debris of the lower Coal Measure shale, all seemingly stratified. From the circumstances it might be inferred that the iron ore is part of the Coal Measures, brought in here by a wedge fault.

Clay Ironstone.—There were formerly very extensive works for clay ironstone on Cullenagh Hill, which was sent to Lacka furnace for smelting. At Wolfhill colliery there is also a great abundance of apparently good clay ironstone. This ore was formerly worked in both these places. It was principally got by basset work, all along the outcrop of the beds. At Cullenagh, in one place they had deep workings, and drove in a level to keep the works dry.

Iron Pyrites.—This is found in the different collieries, mixed with the coal; and in the shale, overlying the limestone; and in some of the other shales,

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water of a small river, whose only egress was by soaking through the beach as the tide fell. At the N.W. of Timahoe there seems to have once been a somewhat similar action going on—only at this latter place it must have been originally formed by the action of two currents of water meeting in a shallow sea, as the ground is low on each side of the ridge. After a bar was once formed in this manner, one side of it was probably exposed to a more open sea and heavier breakers than the other, on which there was comparatively still water. G. H. K.

* This mine was worked in the year 1730, and the ore was sent to Lacka furnace in the west of the Queen's County, to be smelted. G. H. K.

† The occurrence of hæmatite in this position is rather remarkable, as at about the same distance below the Coal Measures in the Limerick district, *Sheet* 142, I found the same kind of Iron ore. In Limerick it seems to be in a bed, as everywhere it is met with it is at the same distance below the edge of the Coal Measures; but neither here nor there are there sufficient of the old workings to be seen to enable any one to say whether it is in a regular vein, or whether it is part of the limestone formation. G. H. K.

in the shape of pyritic ironstone. There is, however, not enough of it anywhere to be of any commercial value.

The three kinds of coal are *Anthracite, Culm, and Kelve.*

The Anthracite is very hard, of a brownish black colour, with a strong metallic lustre, impregnated more or less with iron pyrites, which makes it give off a sulphurous smell when ignited.

Culm is a soft scaly coal, which is taken out of the pit in flakes, and crumbles when it is exposed to atmospheric influence. This culm is mixed with the breakage of the anthracite, and forms the culm of commerce.

Kelve is a ferrugineo-carbonaceous shale, having in some places so much carbonaceous matter in it that it can be used for fuel. It is generally very heavy, being impregnated with iron pyrites. On examining a piece of kelve it appears to be made up of layers of large succulent plants and fine mud. If the plants predominate, the kelve is good for burning; if the mud, the kelve will not burn. In some places it is easy to trace a shale until it gradually passes into a kelve.

The two kinds of clay are *Fire Clay and Brick Clay.*

Fire Clay is found under nearly all the coals. It has never been used; and it is either left in the working, or thrown down as spoil at the pit's mouth.

Brick Clay is found extensively in some places in the Drift, and has been already spoken of under that head.

Galena.—Pieces of galena have been found in the Drift at the north of the townland of Dysert, near the old road. They are worth mentioning, as probably pointing to the presence of veins of lead ore somewhere in the surrounding limestone.

G. H. K.

Glossary of Local Terms used in the Coal Field.

Back and incrack—Terms used by the colliers in describing the system of work: *backs* are N. and S. joints, *incracks* E. and W. joints.
Bind—Shale.
Bind Rock—Sandy shale.
Blue Rock—Siliceous shale, generally pyritic.
Basset work—Open work, where all the cover is removed before getting the coal.
Bury—Shale. This term seems to be obsolete. It is found in the old section, county Kilkenny.
Cat heads—Nodules of very hard, "curled," green, ferruginous, spheroidal grit, found in shale beds, with nodules of ironstone. These are sometimes called *boulder beds*.
Clearing—A smut on the top of the coal, which the colliers first take out. If there is no clearing they say it is an *unnatural coal*.
Coal leader, *Coal rod*, *Craw coal*, *Crow coal*, } A thin seam or film of coal. *Craw* and *crow* are also used to denominate coal that is in detached pieces in the drift, or sometimes coal that has only a drift covering.
Curled—Rocks are said to be curled when they break with a conchoidal fracture.
End and board—Terms used by the master colliers in describing the system of work: *ends* are N. and S. joints, *boards* E. and W. joints.
Foundation—Used sometimes for the coal seat, but generally means the debris of rock between rock and drift.
Hard bar—Generally a pyritic grit.
Iron mine—Clay ironstone.
Kelve—Shaly earthy pyritic coal, or earthy pyritic carbonaceous shale.
Kennel coal—Slaty kelve, generally with so much carbon in it that it can be used for fuel.
Kind bind—Soft shale that is easily worked.
Leaf or book clay—Clay that has been deposited in thin laminæ.
Mine—Iron ore; either clay ironstone or pyritic ironstone.
Outgoing of coal—The outcrop.
Parting—Thin beds, generally of micaceous sandy shale.
Rock—Grit or sandstone.
Rock bind—Sandy or gritty shale.
Rock mine—Same as *cat heads*.
Sliggagh—Indurated sandy olive shale.
Slate—Compact shale.
Slate mine—Very poor clay ironstone.
Stone—Grits or sandstone.
Stone bind—Sandy or gritty shale.
Stone mine—Same as *cat heads*.
Trouble—Where sand, clay, or any other impurity has either replaced or got mixed with the coal and deteriorates its value.
Trecher or trucker—Loose broken shale.
Verge of coal—Same as outgoing.

G. H. K.

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