

EXPLANATIONS

TO ACCOMPANY

SHEET 175 OF THE MAPS

(OMITTING THE COAL-FIELD W. OF KANTURK, WHICH IS DESCRIBED IN
THE EXPLANATION OF SHEET 163, &c.)

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PART OF

THE COUNTY OF CORK.



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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, and 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 175 OF THE MAPS
OF THE
GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

THE whole of the district comprised in this Sheet of the map belongs to the county Cork. The principal places in it are, the towns of Mallow and Kanturk, with the villages of Ballyclough, Cecilstown, Banteer, and Glantane.

1. *Form of the Ground.*

The district is divided by the valley of the River Blackwater into two portions, the southern and the northern. The southern half of the district is more or less mountainous, the ground rising in many places into lofty detached summits. The highest of these is Bweeng, 1,372 feet, near the centre; several other eminences round it varying from 815 to 1,190 feet. The deep valley of the Glen River separates this group of hills from another similar one farther west, the highest of which is Carrigduff, 1,331 feet above the sea. At one part the valley of the Glen River makes an abrupt turn towards the west, north of which turn rises the bold hill of Mount Hillary, 1,287 feet high, forming a prominent feature, in consequence of its standing out to the north of the other hills. To the E. of Bweeng the ground gradually lowers towards the valley of the Clyda River, between which and Bweeng we may mention the summit called Beennamweel, 859 feet high, and the hill called Carrigcleenamore, which is 640 feet.

The valley of the Clyda River, and that of its tributary, the Peas-tinagh River, cut deeply through this high ground, the latter valley having been taken advantage of in forming the line of the Great Southern and Western Railway. To the eastward of this valley the ground rises again to form the elevation called Bottle Hill, 1,028 feet high; and the rounded summits which extend northwards from it towards Mallow, of which Moynass Mountain is 921 feet and Knock-aroura 857 feet high.

The valley of the Blackwater runs through the middle of the district in a gently winding course from W. to E., along the northern base of the mountains, receiving both their drainage and that of the lower ground in the northern portion of the district. The river enters the map at an elevation of 256 feet, and leaves it at that of 138 feet above the sea, thus showing a fall of about six feet two inches per mile. The principal tributaries to the Blackwater, from the north,

are the rivers Alloce and Awbeg, which drain the Kanturk district, and a number of minor and nameless brooks between Roskeen and Carrig bridge. From the S. it receives the Rathcool River, the Glen River, the Glengarriff River, the Clyda River, and the Fiddane stream.

The ground lying to the north of the Blackwater is comparatively low and undulating, seldom reaching to the height of 400 feet above the sea, and at only one locality to the N. of Kanturk, attaining to 490 feet. Kilmaclenine Hill, which lies at the distance of about two miles to the north of Ballclough, is only 480 feet in height, and yet it forms a conspicuous feature in the country. The same remark will apply to Subulter Hill, which lies at the distance of three miles to the E. of Kanturk, and which is only 448 feet in elevation.

J. B. J. and G. V. D.

2. Geological Formations of Groups of Rock entering into the Structure of the District.

AQUEOUS ROCKS.

	Name.	Colour on Map.
	Bog, Alluvium, &c.,	Pale burnt sienna.
Carboniferous.	d ⁵ . Coal Measures,	Indian ink.
	d. Carboniferous Limestone,	Prussian blue.
	Md. Dolomite, deposited,	Prussian blue, with yellow lines.
	Md. Dolomite, Metamorphic,	Prussian blue, with yellow dots.
	d ¹ . Lower Limestone Shale,	Prussian blue and Indian ink.
Old Red Sandstone.	c ³ . Upper Old Red Sandstone,	Indian red (dark).
	c ² . Old Red Sandstone,	Indian red (light).

IGNEOUS ROCKS.

D ¹ . Trappean Ash,	Crimson, with dark dots.
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c². *Old Red Sandstone.*—The general character of these rocks over the district is that of a brownish red, or purple and greenish gray grit and sandstone, with beds of dark purplish red, or liver-coloured shales and slates. In the apparent lower portion of the deposit, beds of greenish gray compact grit, of variable thicknesses, and which are sometimes conglomeritic, are occasionally to be met with. At one locality in the upper part of the deposit, a few beds of conglomerate occur, the pebbles of which are well-rounded fragments of vein quartz, and dull purplish quartzose grit.

c³. *Upper Old Red or "Yellow Sandstone."*—These beds consist of the upper 600 feet, or thereabouts, of the Old Red sandstone, and are, therefore, incapable of being well defined, as a distinct geological group. Their chief characteristics are their colour, which is generally a pale brownish yellow or red, and the silty character of many of the shales and soft sandy layers, which frequently contain well preserved plant impressions. Thick beds of dark purplish, or liver-coloured slates, shales, and sometimes sandstones, in no way differing

from those of the ordinary Old Red sandstone, frequently appear in this group.

d¹. *Lower Limestone Shale.*—These beds occur as a thin band, extending along the top of the yellow sandstone, and consist of dark gray earthy and splintery shale, with brownish sandy flags, and thin hard gray calcareous flaggy grits, or impure limestones. As a whole, this deposit is fossiliferous, the genus *Fenestella* being that which is most abundant. Thickness about 170 to 200 feet.

d. *Carboniferous Limestone.*—In this district it is impossible to subdivide this group, from any marked difference in its lithological character. As a mass, it is usually dark gray, compact, or sub-crystalline. It becomes more massive, and of a lighter and browner colour, in what may be its middle part; regaining its dark gray colour, and becoming cherty in the upper portion. In the northern portion of the district it is frequently metamorphosed into a pale brown dolomite, or magnesian limestone, and decomposes rapidly into a gritty sand. In the neighbourhood of Mallow the limestone is often destitute of any marked planes of stratification for the distance of many hundreds of yards; it is of a pale gray colour, and full of strings and veins of carbonate of lime. In Mallow Castle deer park it is flaggy, and contains numerous evenly deposited layers of black chert, and thin beds of greenish yellow shale. The thickness of the limestone is not ascertainable with certainty.

d². *Coal Measures.*—These consist of thick beds of very dark gray, almost black, earthy shale, friable and fissile. It is often greatly cleaved, and sometimes has a concretionary structure, which causes it to weather out in spheroids. Bands of gray olive grit, often obliquely laminated, are common throughout these shales, and these increase in thickness and aggregate bulk towards the centre of the part of the formation which is to be seen in the district. Thick and thin beds of dark bluish gray fire-clay frequently occur, most usually beneath a thin layer of "pindy," or coal mud. Thin nodular layers of dark olive gray pyritic grit are found in connexion with these fire-clays. Not far from the southern boundary of the deposit in the railway cutting, near Mallow, is a bed of what is now soft, rusty, fossiliferous, fine-grained grit; but which, doubtless, when undecomposed, would resemble an earthy impure limestone. The earthy beds often exhibit a distinct cleavage; but owing to want of cohesion in the particles of the rock, these beds do not form slates, but at once break up into small pencil-shaped chips, or slender, splintery, and angular fragments.

d¹. *Trappean Ash.*—On the north of the district, at Subulter Hill, this rock is dark gray, green, and purplish in colour, flaky, hornblendic, and often highly calcareous. It sometimes weathers into small hollows, and is, in places, finely conglomeritic, the pebbles being well-rounded pieces of scoriaceous greenstone, hard grits, and quartz. On the southern side, at Carrigcleenamore, the ash is dark greenish gray in colour, coarsely conglomeritic, the paste being slightly calcareous; the pebbles chiefly well-rounded fragments and lumps of grit, and rarely one of gray crystalline limestone.

3. Relations between the Form of the Ground and its Geological Structure.

The southern or mountainous portion of the district is formed entirely of the Old Red sandstone. The uppermost beds of this group extend along the flanks of the hills on the N., forming that band of "yellow sandstone" which is indicated on the map by a darker red than the rest. In the middle portion of the district, these rocks

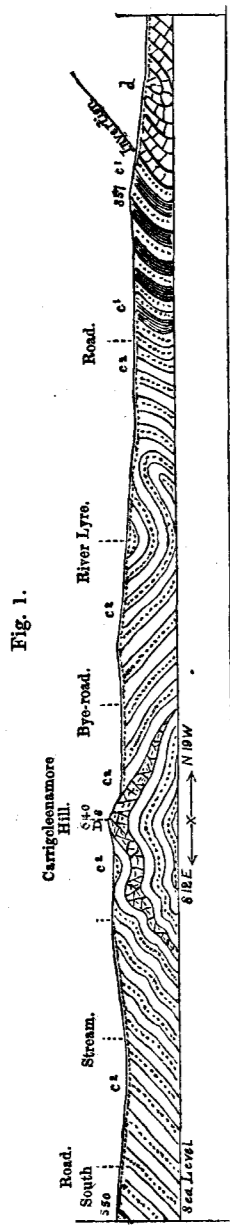
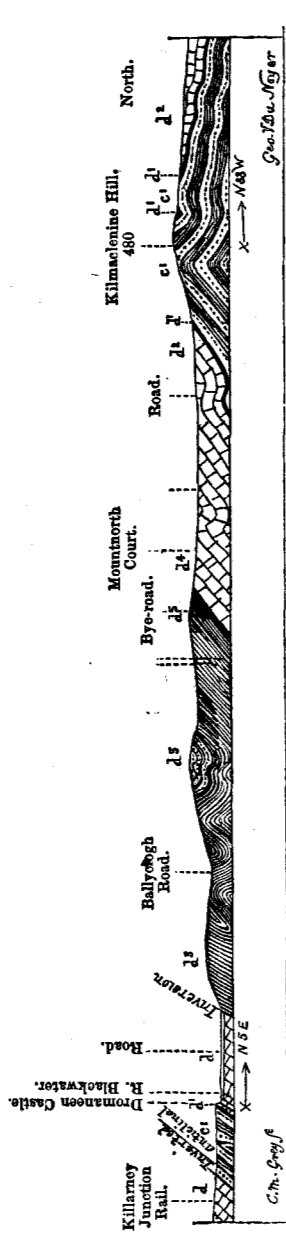


Fig. 1.—continued.



Section from South margin of Sheet 175, through Carrigcleenamore Hill to Dromaneen Castle on the Blackwater, and from thence to Kilmacleanine Hill on the North. Scale, 1 inch to 1 mile for distances, and 3 inches to 1 mile for heights.

occupy the southern side of the valley of the River Blackwater, the direction of which agrees with the line of their strike. The remaining portion of the Blackwater valley has been excavated out of the limestones which overlie the Yellow sandstone, and in the low escarpment which bounds this river valley on the north are found the dark gray shales and thin gray grits of the Coal Measures.

The low but well marked elevation in the valley of the Blackwater, three miles to the W. of Mallow, which is crowned by the ruins of Dromaneen Castle, is formed by a bulging up, and inversion of the Yellow sandstone, in the midst of the Carboniferous Limestone. The hill of Kilmacleanine, four and a-half miles to the north of Dromaneen, is similar in geological structure and position to that, except that there is no inversion. We are not, however, to regard these protrusions of lower rocks through those which lie above them as evidences of local upheavals merely; they are, in fact, only portions of great rolls or contortions in the mass of the rocks beneath, the sandstone having been laid bare by subsequent forces of denudation, producing a fresh surface, as the land was gradually brought up to higher and higher levels above the sea.

The Coal Measures form a ridge extending from the N.E. corner of the district, in a S.W. direction to the neighbourhood of Mallow and Two-Pot-House village, from thence they strike westerly along the north side of the valley of the Blackwater, in a still wider band, and then spread out so as to occupy the entire N.W. corner of the district around Kanturk. These beds form a low undulating tableland, and are distinctly escarped throughout every portion of their line of junction with the limestones. The raised plateau just described, is traversed from N. to S. by numerous open valleys and river courses. The low ground on the north of this plateau is entirely formed of limestone, with the exception of the space occupied by the Yellow sandstone forming Kilmacleanine Hill, 480 feet, and the summit of Subulter Hill, near Kanturk, 448 feet, which consists of a thick deposit of trappean ash conglomerate, both of which have resisted the forces of denudation better than the surrounding limestones.

The prominent position which Mount Hillary occupies, when viewed from the neighbourhood of Mallow, standing out, as it does, far in advance of the range of mountains to the south, and rising so abruptly from the low land on the N., is, doubtless, due to the fact, that a fault with a downthrow to the eastward ranges along the eastern side of the hill in a N.W. and S.E. direction. By means of this dislocation, the ends of the beds of each formation are made to abut in succession against those of the upper or lower series, as the case may be. Thus, the Coal Measures and Limestones on the N.E. side of the fault, strike against the Yellow sandstone, and the Old Red sandstone on its S.W. side; and as the Old Red sandstone resists the action of denudation better than the other rocks, that of Mount Hillary forms a prominent hill with low ground stretching from its eastern side, and the valley of the Blackwater follows the low land.

The comparatively low but craggy elevation of Carrigcleenamore, which rises from out the midst of the rounded knolls of Old Red sandstone at the distance of a mile and a quarter westwards of the summit of Knocknastooka, and about seven miles to the southwards

of Mallow, is clearly due to the occurrence of thick beds of trappean ash conglomerate, which has withstood the denudation better than the surrounding sandstones.

Fig. 2.



Carrigcleenamore from the south, showing the Trappean ash beds at the summit of the hill.

DETAILED DESCRIPTION.

[The district was surveyed by Mr. W. L. Willson, now of the Geological Survey of India, and by Messrs. DuNoyer, Kinahan, Foot, and Wynne. Mr. G. H. Kinahan has described the Coal Measures to the W. of Kanturk, and the River Alloë, in the Explanation of Sheets 163 and 174. Mr. DuNoyer has drawn up the following detailed description of the remainder of Sheet 175, from the notes of the other observers, as well as those made by himself. —J. E. J.]

4. Position and Lie of the Rocks.

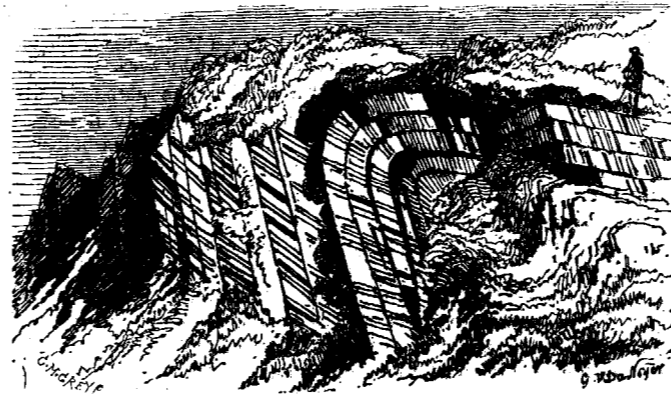
0². The Old Red sandstone of the southern part of the district.

The best exposures of the Old Red sandstone are to be seen in the S.W. of the district, in the cuttings made by the Great Southern and Western Railway, and in the valleys of the Clyda and Peastinagh rivers, along the side of which the railway passes. The most northerly of these cuttings occurs near the termination of the long embankment over the alluvial flats of the River Blackwater to the W. of Mallow, running close to the northern boundary of the townland of Quartertown, Upper. A few light yellow flaggy sandstones and thin shales, the lowest beds of the Yellow sandstone are also brought to view here by a sudden contortion in the underlying purple slates and shales of the Old Red sandstone upon which they rest. The section which is exposed in the Old Red beds to the south of this, though 753 yards in length, is unimportant, as showing merely a repetition of the same purple earthy shales and sandstones, by a series of undulating contortions; the dip of the beds is to the N.W., the E., and the S.E. at 60°, as a maximum. At the southern end of this cutting the beds have a steady dip to the N.N.W. for the distance of a few hundred feet. On the road side S. of the viaduct, the section just alluded to is continued by the appearance in a small quarry of a few brownish grits and purple slates, dipping to the N.N.W. at 40°. Close to this spot the grits are rolled to the eastward at 10°.

The next cutting on the railway towards the south occurs on the E. bank

of the Clyda river, opposite Dromore House. Here the rocks are well exposed for a distance of 600 yards, and with the exception of a small contortion at the northern end of the section, they dip steadily to the S. at from 60° to 70°. They consist, in ascending order, of purple grits, earthy shales, pale greenish and dull greenish gray grits and shales; the thickness of the beds exposed being fully 700 feet. If we leave the railway and proceed to examine the glen of the Lyre river, a stream which joins the Clyda river from the west, at Dromore House, the first rock presented to us as we enter the glen forms the steeply escarped little knoll, called Dooneen, which rises from out the alluvial flats of the river above Dean Ville. These beds consist of purple slates and grits, and are contorted into a series of S shaped folds; on the N. of the knoll they dip to the S.S.E. at 70°, then to the opposite point of the compass at various angles up to 80°; and at the southern end they dip to the N.W. at 40°.

Fig. 3.



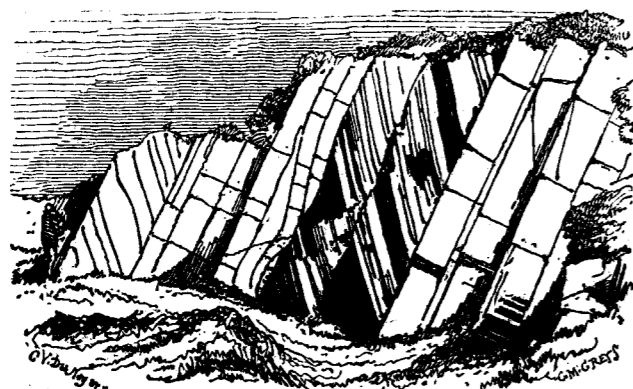
Dooneen Rock from the east, showing the radiation of the cleavage planes.

The view of this rock, fig. 3, is introduced to show the peculiar radiated arrangement of the slaty cleavage, which pervades all the softer and more sandy beds. Some of the cleaved earthy beds have been here quarried for roofing slates, which are of the worst quality, and of small size, as might be expected from the general structure of the rock.

Throughout the distance of half a mile higher up the stream, beyond Dooneen, the old sandstone rocks appear in several places, having a strike of E.N.E., the cleavage being well developed in the earthy and sandy beds, its planes dipping to the S.S.E. at 60°; here we find a thin band of dull gray massive grits dipping to the S.E. at 80°, with purple slates above and below them. Higher-up the stream, within 650 yards of the ford, at the road from Pendys Cross, we find pale green and purple cleaved earthy slates, the dip of which is not apparent, but the cleavage planes coinciding in strike and inclination with these last mentioned.

From Ballynamona bridge southwards, we find purple grits and slates of the ordinary Old Red sandstone type appearing at intervals, in the banks of the Clyda river, and in the adjoining cuttings, made for the Cork and Mallow road. For a distance of 630 yards from the bridge, the only dip seen is to the S. at from 20° to 30°; the beds then become contorted, rolling alternately to the northwards and to the southwards, at dips varying from 30° to 75°. The cleavage is persistent to the S.S.W., at 60°, in the more clayey layers; but it is not apparent in the grits or sandstones. The illustration, fig. 4, taken from a small quarry on the roadside between Ballynamona Church and Mourne Abbey, shows this interesting fact well.

Fig. 4.



Quarry in Old Red sandstone on road side between Ballynamona Church and Mourne Abbey, showing cleavage in earthy beds.

These beds dip N. 5° , W. 65° ; the strike of cleavage planes is N.E. and S.W., inclined 78° to the S.E.; the cleavage appearing only in the purple, earthy, or sandy beds, the adjoining hard grits or sandstones being totally unaffected by it. Many of the sandstones exhibit a very distinct oblique lamination.

In a small quarry, at the distance of 200 feet S. of the former, the beds dip in the opposite direction to them, that is to the S.S.E. at 30° ; the cleavage again appearing only in the purple, sandy, and earthy layers, and having the same strike, and nearly the same inclination as before.

South-east from this point to where the Clyda river is joined by the Peastinagh river at Jordan's bridge, the rocks exhibit frequent and sharp contortions.

Opposite Jordan's bridge we find a band of hard, thick bedded, dull, greenish gray grit, dipping to the S.S.E. at from 10° to 25° ; and as we follow the road up the northern bank of the Clyda river, we find these rocks underlain by a series of green slates, which pass down into purple slates; the average direction of the planes of the cleavage in the earthy beds being E.N.E. and W.S.W., inclined at 80° to the S.S.E.

If from this point we follow up the course of the Clyda river, the Old Red sandstone appears at intervals in the bed which the stream has excavated for itself, to the depth of nearly 100 feet in some places in the local drift, the dip of the rocks being for the most part to the S.S.E., though they are occasionally inclined to the N.N.W. at 60° . Above Millford bridge the course of the river is nearly from W. to E. past the old church of Kilquane; here we perceive purple and dull greenish gray slates, with some greenish gray grits and flags, the beds all dipping alternately to the S.S.E. and N.N.W. at 60° , the cleavage in the slaty layers being well defined, its planes inclined to the S.S.E. at from 60° to 70° .

Higher up the stream beyond Athnalacka bridge, south of the spot where it is joined by the Glashaboy river, there is a short section exposed, consisting of purple slates and grits, the dip of which is to the S.S.E. at from 40° to 50° , the slate beds exhibiting the same cleavage as before.

If we now return to Jordan's bridge, we find between it and Hacket's bridge on the S. a few beds of greenish gray grits, containing small plates of white mica, and these are overlaid by green and purple sandy slates, all dipping to the S.S.E. at 55° . The same or nearly the same beds appear to the E. in the adjoining railway cutting.

At a quarry on the road side, a few yards S. of Hacket's bridge, we find some cleaved, greenish gray, sandy beds, dipping to the northwards at 20°

To the S. of this in the alluvial flats of the Peastinagh river, near Ballyknockane Cottage, there are two bosses of rock on the E. side of the stream, exposing gray and greenish gray grits with purple slates, all dipping to the S.S.E. at 60° , the argillaceous beds exhibiting the usual cleavage inclined to the southwards at 70° .

The railway now crosses the mouth of the Leapford stream which joins the Peastinagh river S. of Ballyknockane Cottage, and in a deep cutting through the high ground in the northern end of the townland of Lissard. The section afforded by it is very interesting, the observed dip of the beds throughout being to the S.S.E. According to the dips, the lowest beds are at the northern end of the cutting, and from this point as we pass southwards, we have the following section: first, some purple slates with a dip of only 10° ; above them are a few beds of light greenish and brownish soft grits, in which the dip increases to 20° ; these are overlaid by liver-coloured reddish purple slates, having a dip of 30° ; and next above them are a series of brown and brownish yellow sandstone and flags, which in many places are decomposing to a sand; next, thin yellow and brown earthy shales and slates, with a few greenish brown grits; then, a thick bed of purple slate, brownish yellow felspathic sandstone and flags, a bed of purple slates, and lastly some yellow slaty shales and purple slates. This gritty series has throughout a close lithological resemblance to the Upper Old Red or Yellow sandstone beds. At this part of the cutting the section is interrupted by a viaduct for the road crossing the Peastinagh river, at Athnagloghbane ford, and the rocks are concealed for the distance of about 225 feet. The section is then resumed by liver-coloured cleaved sandy beds, purple slates, and dull purple grits, having a dip as before to the S.S.E. of 45° . For the distance of about 220 feet the slopes of the cutting are soiled over, and the rocks concealed; they then, however, appear again, and consist of purple grits and slates, dipping at 40° . Above these are brown and yellowish brown sandy grits and slates, with a few thin greenish yellow shales, much resembling beds of the "Upper Old Red," and lastly a series of purple earthy shales, also dipping to the same point of the compass at 40° , which completes the section. The total length of the rock cutting just described, is fully 2,300 feet; and if we allow 35° as the average dip of the beds, we have a total thickness of 1,311 feet for the beds seen in this section.

To the S. of Blackpool village, in the S.E. corner of the townland of Ballyhilloge, another cutting of about 200 yards in length appears on the railway. Here we have purple slates and grits, with dull purplish gray grits much contorted, the cleavage cutting up the softer beds, in a direction of E.N.E. and W.S.W. vertical, or with a strike of E. 10° N., inclined 65° to the south, irrespective of all contortions.

Where the railway leaves the district at its southern margin, a few beds of thin purple grits and slates are exposed by it. The beds on the N. dip to the N.W. at 55° , but they soon rapidly curve round to the W., and eventually to the S.S.W., with a dip of 20° . As we follow the section southwards, this angle of inclination increases rapidly to 85° , and at last the beds become vertical. Just beyond the south limit of the map, in Sheet 186, the railway affords another cutting of about 520 yards in length, through a series of purple grits and slates, the beds throughout dipping steadily to the N.N.W., at from 75° to 85° , thus affording an absolute thickness of rock of about 1,500 feet, the cleavage in the softer beds dipping as usual, 75° to the S.S.E. This northerly dip in an unbroken section of such a length as this is worthy of record, as it forms an exception to almost all the observed rock exposures over the rest of the district.

Four miles east of Mallow, in the lands of Rockforest House, we have an exposure of some of the Yellow sandstone, and to the S. of it, of some of the upper beds of the Old Red sandstone, in the stream course dividing the townlands of Lavally Upper and Rahan. In these sections we have evidence to

show that both sets of beds are inverted. At Rockforest the rock is badly exposed, the top only of the beds appearing above the soil. At the northern end of the section here we find some thick beds of purple slate, and brownish yellow earthy calcareous shale full of small cavities filled with ferruginous earth, which appear to have been segregations of calcareous matter. The apparent dip of these shales is to S.S.E. at about 30°, rather a low inclination for inverted beds. It is possible, however, that this is deceptive, and that at the depth of ten or fifteen feet below the surface the angle of dip may be much steeper. Next these shales on the south, the ends of yellow flaggy sandstones come to view, but their dip is not apparent, it is doubtless, however, nearly the same as that observed in the shales. On the road at either side of the entrance to Rockforest House, we find the ends of light yellow feldspathic sandstones, and dark, greenish, gray, splintery shale.

The Old Red sandstone beds which appear to the S. of Rockforest, on the slope of the hill, and in the stream course bounding the townlands of Lavally Upper and Bahaan, are the following, commencing at the N. end of the section: obliquely laminated, soft, rusty sandstone; purple flaggy grits; thin, hard, purple grits, with a few purple slate bands; obliquely laminated rusty sandstone. These beds are at first vertical with a strike of E.N.E., but they dip to the S.S.E. at 70° in the distance of about 130 yards.

The beds are now crumpled for the distance of a few yards, when the section is continued by thin bedded purple grits, and a few purple slate beds, occupying a further space of about seventy yards, the dip being to the S.S.E., at from 60° to 70°; so far the section exhibits a thickness of about 679 feet. The beds are now contorted, "en masse," and curved, so as to dip to the eastwards, at from 20° to 30°; this disturbance affects them for the distance of about 250 feet, when they dip to the N.N.W. at 60°. As we follow up the stream cutting we find that at the distance of about 200 feet, the beds once more become vertical, and they disappear at the southern end of the section with a dip of 60° to the S.S.E.

At the distance of about one mile and a half to the W.S.W. of this locality, and in the deep cutting formed in the local drift by the Fiddane stream, the Old Red sandstone appears in detached bosses. The most northerly of them is in the N.W. corner of the townland of Fiddane North, it exhibits flaggy purple sandstones and grits, dipping to the S.S.E. at 70°, which, on the opposite bank of the stream are overlaid by purple conglomeritic sandstones and grits; the pebbles in the former being small rounded fragments of purple slates and grits. A short way higher up the glen the stream cuts across beds of purple sandstones, slates, and grits, which are apparently vertical, and with the same strike as that of the beds first noticed. At the mouth of the small stream which flows from W. to E., through the adjoining townland of Knoppoge, two thick beds of fine purple conglomerate appear, the pebbles in which are principally quartz; both these beds have purple slates above and below them, and the dip of all is to the S.S.E. at 60°.

At the extreme southern end of the townland of Fiddane North, in a bye-road which leads to the main-road along the western side of the townland of Fiddane South, the rocks are superficially exposed for the distance of about 250 yards in length. At the northern end of the cutting we find a few beds of quartzose grit, containing small fragments of pink felspar, greenish brown, soft, feldspathic sandstone, dark purple slates, and lastly, light, green, fine-grained grit and purple slates.

At the distance of about one mile to the N.E. of this locality the hilly ground in the northern part of the townland of Fiddane North, is covered with numerous angular blocks of brownish and greenish gray and feldspathic conglomeritic grits, the pebbles being chiefly quartz and purple grit. In the northern end of the glen of the Belanagare stream, which extends round the northern side of the hill of Knockanannig, purple slates and thin purple

grits appear at intervals, dipping to the S.S.E. at 30°, and at the eastern part of the glen, to the N.N.W. at 40°, thus suggesting the existence of a large synclinal fold in the rocks. Throughout the clayey part of these beds the cleavage is persistent in its strike of E.N.E., its planes being inclined to the S.S.E. at an average angle of 55°. There are not any good exposures of rock over the hill of Knockbrack, which lies to the S. of the last locality. The only continuous section, which I could find there, appears in the small stream course which forms part of the S.E. boundary of the townland of Knockbrack, near to where the five roads meet, and again in the farm-road, which leads from these roads to the top of the hill. The rocks here exposed are purple slates and gritty beds, with a few light, greenish gray, flaggy sandstones, and a band of bright, greenish, gray slate in the central part of the exposed section. All the beds dip to the S.S.E. at 35°, and they may be traced here and there along a distance of about 600 yards.

On the northern bank of the Leapford stream, in the southern end of the townland of Island, a few beds of green and purple grits and slates appear dipping to the S.S.E. at 50°, and exhibiting a cleavage, the planes of which dip to the E.S.E. at 75°. The well-marked ridge, which terminates in the S.W. in the elevation called Bottle Hill, does not present any rock *in situ* over it, the whole surface being strewn with a thin covering of large and small angular or slightly-rounded blocks of purple grit, fine conglomerate, and purple slate, mixed with a sandy and gravelly clay, all which is clearly the result of the local disintegration of the rock beneath by atmospheric agencies.

If we now return to the neighbourhood of Mallow, we find some beds of the Upper Old Red sandstone appearing on the roadside between Bearsforest branch roads and Ballyellis Cottage; these consist of flaggy yellow sandstones, with purple and yellowish green shales, the strike of which is E.N.E., but the dip of the beds is not perceptible. To the west of this, on the railway cutting, close to Gooldshill Cottage, we again find some of the Upper Old Red or "Yellow sandstone" beds; here, however, they are much contorted—crumpled, in fact, so as to dip within the space of 100 yards to every point of the compass excepting the west, at angles of from 10° to 20°. The uppermost beds consist of soft micaceous yellow sandstone and yellow sandy shales, throughout which plant impressions are not uncommon. These pass down into purple shale and thin purple grits, with light brown micaceous flaggy sandstones and soft brownish and yellowish shales, the total length of section being not more than 175 yards. In the extension of these beds to the W. they are cut through by the railway, and form the upper or northern portion of that exposure of "Yellow sandstone," which has been before observed in the northern part of the townland of Quartertown Upper. We have to pass over a distance of a mile and three-quarters to the W. of the railway, before we again find a trace of either Upper or Lower Old Red sandstone. Here, however, on the roadside, near Danesfort, and in the eastern corner of the townland of Kilpadder North, the tops of some brown sandy grits, which dip to the northward at 60°, appear, and they are supposed to be the lowest beds of the "Yellow sandstone." Beneath them is a considerable thickness of purple slates and thin sandy grits, no doubt the topmost beds of the Old Red sandstone proper. The total length of this section is about 230 yards. At the distance of about a mile and a quarter to the west of this locality, in the stream-cutting dividing the townlands of Aldworth and Skarragh, the following section appears, commencing on the north with the upper beds:—

Yellowish green sandy shale.	Light green grits and sandy shales.
Brown sandstones and grits.	Purple slates.
Light green slates and grits.	Green grits and sandy slates.
Purple slates.	

These are the lower beds of the Yellow sandstone, having an inverted dip to the S. at 35°; the length of the section is 200 yards, and the thickness of

rock, 114 feet. It terminates in a thick band of purple slates, measuring 100 yards across, and supposed to belong to the Old Red sandstone group.

At the distance of over a mile to the W.N.W. of this place, and in the stream S. of and close to the village of Glantane, we find a section similar to that last described; and here the supposition of the thick purple beds being part of the lower Old Red sandstone is confirmed by the greater amount of those rocks which appear below the pale yellow series. At Glantane the dip is to the N. at 85° , or possibly the beds may be vertical. On the roadside, at the distance of two fields due south of Lombardstown House, yellow sandstone, purple slate, and light yellowish brown sandy shale appear. The occurrence of these rocks at this locality is of some importance, as they aid in determining the extension of the Old Red sandstone on the north into the flats of the River Blackwater.

Mount Hillary is entirely covered with a thick deposit of local drift, containing angular fragments of the subsoil rock. At its northern flank two small quarries have been opened in the southern end of the townlands of Clonmeen South and Duinch; the eastern one exposes a few beds of light yellowish brown sandstones resting on light purplish brown sandstones, through which are conglomerate layers, the pebbles being chiefly lumps or flaky chips of purple shale and small pebbles of quartz, and rarely one of jasper. These beds dip N. at 20° . The other quarry which is to the W. in the adjoining townland, exposes beds very similar to those just described; they also dip to the N. at 35° , but from this position they would appear to underlie the former. On the western base of the hill, on the banks of the Glen River, opposite the Banteer National School, we find a few beds of flaggy dull purple grit, apparently dipping to the northwards at 70° . On the south side of the hill, in the stream course just above the road, and to the E. of the collection of cabins called Tincoora, we find a few beds of sandstone which have a marked resemblance to those appearing in the two quarries on the north flank of the mountain. The beds here dip to the S. apparently at 75° , and are in descending order, as follows:—

Purple and green slates and light-green shale.

Irregularly laminated sandstone of a brownish yellow colour, through which are thin conglomerate layers, the pebbles being lumps and flaky chips of dark purple shale.

Small rounded pebbles of quartz, and rarely one of jasper.

Pale yellowish conglomerate, and

Pale purple and yellowish shales.

All these beds very much resemble those belonging to the Upper Old Red group, but their position here makes it difficult to include them within its limits.

The valleys of Glen River, and of its branches, the Fermoye River and the Nad River (the upper portion of which is known as the Ownagluggin River), have been excavated deeply into the Old Red sandstone, and afford sections through it for the most part of their course. That exposed in the valley of the Fermoye River extends from Fermoye Bridge to Lackloun Bridge, a distance of about one mile. Mr. Foot describes the rocks as consisting principally of greenish grits and slates, with a few purple beds, brought to view by one large synclinal fold; the top of the contortion appearing at the angle of the road in the glen close to Sunday Well. At the northern end of the section the beds dip to the N.W. at from 25° to 50° , and at the southern, to the E. or the E.S.E. at from 10° to 25° . The section in the valley of the Glen River, from Fermoye Bridge, past Glen Cottage, to near the small stream cutting known as Cummeratoreen Glen, exposes green grits and slates, with a few purple beds, and is very nearly in the line of strike of the rocks just described as appearing in the valley of the Fermoye River. The dip here is to the N. at from 50° to 85° , and to the southwards at from 10° to 30° .

The beds have been subjected to some sudden contortions at the eastern end of the section. Higher up the stream, where it turns to the southward, the purple slates appear to increase in thickness and frequency, and the grits are more gray than before. The beds roll to the northwards and southwards at from 20° to 45° .

In the glen of the Nad River, Mr. Foot has recorded some continuous sections, the strike of the beds being for the most part E. and W., with a general dip to the southwards; but here and there to the northwards, at angles varying from 30° to 70° .

At the distance of one mile and a quarter above Nad, and close to the stepping-stones, a few beds of purplish gray grits and slates are seen to be sharply contorted, the beds dipping to the N.W., W., and S.W., at from 20° to 70° . The rest of the section to the S. of this, in the course of the stream which now assumes the name of the Ownagluggin River, exposes the beds striking nearly E. and W., and dipping to the southwards at angles from 30° to 50° .

In the valley of the Glen River, S. of Nad, the rocks are rarely seen till we have traversed a distance of about one mile and a-half from Nad Bridge. Here Mr. Foot has again recorded what appears to be a very continuous and well-exposed section. It consists of alternations of purple slates and greenish gray grits in thick deposits. The beds all strike E. 10° to 15° S., with an invariable dip to the southwards at from 20° to 45° , increasing here and there up to 75° . The first or most northerly part of the section has a superficial extent of 1,100 feet; and allowing 70° as the average angle of dip, it exposes a thickness of 1,034 feet of rock. A space free from rock of 800 feet in extent then occurs, beyond which the rocks are again exposed, and continue visible for the distance of 3,300 feet. Here we may suppose the average dip to be about 25° , which gives us a further thickness of about 1,700 feet. Beyond this is another space free of rock, extending for the distance of 1,000 feet, when we once more find the rocks exposed for the distance of 1,000 feet, the beds dipping to the southwards at an angle of 25° , and thus giving a thickness of 420 feet. I see no good reason why we should not suppose that the three detached sections just described form portions of one continuous section, for which we have therefore a minimum thickness of 3,154 feet.

Along the small stream which runs westerly into the Glen River, between Best Hill and Esk South, green and purple grits and slates, and dull greenish gray and purplish brown beds appear, dipping with one exception to the S.S.E. at angles from 30° to 65° , the softer beds being cleaved in planes which, in strike, very nearly coincide with that of the beds, and which therefore dip to the S.S.E. at from 65° to 75° .

At the extreme western side of the district the valleys of the Rathcool River, Crinaloo River, and the Carrigduff River, all afford detached sections in the Old Red sandstone beds. The rocks differ in no respect from those which have been previously noticed; and like them, the general dip is to the southwards, at an average angle of 35° .

The evidence for the band of Yellow sandstone which extends from the northern flanks of Mount Hillary westwards is very scanty, its southern limit on that hill being determined by the two quarries in the townlands of Clonmeen and Duinch, before mentioned, and its northern, by the occurrence of a few brownish purple flaggy sandstones, with partings of purple shale, appearing in the E. bank of the Glen River, close to the railway bridge over that stream.

To the west of this, and S. of Banteer, on the summit of the little hill of Knockaun, there is a small quarry, where a few beds of yellowish purple sandstone, with embedded flaky fragments of dark purple clay, are exposed. The

apparent dip is here to the S. at 25°. From this observation it would appear that the inversion of all the beds, from the Upper Old Red to the Coal Measures inclusive, along the valley of the Blackwater, is prolonged to the westward of Mount Hillary, and this supposition is further strengthened by finding some beds of purple slates and grits, supposed to belong to the very top of the Old Red sandstone group, dipping S. at 30° in the southern end of the townland of Garrane, one mile and a quarter S.W. of the last locality.

Old Red Sandstone of Dromaneen.—The section afforded by the River Blackwater of the Yellow sandstone beds forming the isolated boss which rises from out the limestones at Dromaneen, is exceedingly interesting, proving clearly that both sandstone and limestone are here inverted. This interesting fact is seen in the cliff section under the old castle, the limestones, which are evenly bedded with nodular layers of chert, dip towards the Yellow sandstone, first at 50°, and lastly at 35°, at which angle they appear to be overlaid by the lower rocks. The Yellow sandstone does not here present any difference in lithological character from that which distinguishes it at the railway cutting, and over the country to the eastward. At this locality the section is better exposed, and is more continuous than elsewhere, and very possibly presents a thickness of about 490 feet of rock, if we suppose that all the beds seen along the river bank are on the north side of the inverted anticlinal, as it is highly probable they are.

The exact southern limit of the yellow sandstone here is not determinable, as the southern slope of the hill terminates in thick drift; but some limestone quarries close to Bettyville fix this point within the limit of about 300 yards. The superficial extent of this sandstone boss at Dromaneen has been estimated at about one mile from E. to W., by 700 yards from N. to S.

Old Red Sandstone of Kilmaclenine.—The Yellow sandstone has been bulged up a second time in the midst of the limestone, at the distance of about four miles and a half north of Dromaneen, forming the hill of Kilmaclenine. Here, however, the contortion is a simple upheaval, without any inversion of the beds. On the summit of the hill there is even a small synclinal depression in the sandstone, which allows a few beds of the dark gray Lower Limestone shale, dipping at high angles, to come in as a small basin in the sandstone. As we enter on the rise of the hill from the S., after passing a limestone quarry on either side of the road, we find at the farm houses on the E. of the road, the Yellow sandstone appearing at the surface; the stones used in the construction of the farm buildings having been raised on the spot. My informant there led me to understand that the sandstone dipped here to the S.S.E. at 35°, which is highly probable, as the limestones close at hand on the S., dip to the same point at 35°. At the distance of two fields to the N.E. of the cross roads, on the summit of the hill, and on its northern slope, the Yellow sandstone appears at the surface, and is seen to dip to the N.N.W. at from 15° to 20°, a fact in accordance with the appearance of dark gray flaggy limestone, with shale partings, appearing on the road side to the W. of this, and dipping to the N.N.W. at from 10° to 15°, thus overlying the sandstones just alluded to.

The Yellow sandstone again shows at the surface on the eastern flank of the hill, at the farm houses surrounded with trees on the S. side of the road, and near the northern boundary of the townland of Knockaunavaddreen, the beds, being on the S. side of the anticlinal, and dipping to the S.S.E. at 35°. Beyond this, to the E., the evidence for the Yellow sandstone, as defined on the map, is derived from information procured from the farmers living on the spot, and the form of the ground. Along that part of the cross roads which lead S.W. from the summit of the hill, the Yellow sandstone appears in five places; that near the branch road to Mountnorth Court showing the beds dipping to the S. at from 15° to 20°.

At the western extension of the hill, the limit given to the sandstone is purely inferential, as the last appearance of this rock *in situ* in that direction is close to the Rath, in the townland to Tullacondra.*

d¹. *Lower Limestone Shale of Kilmaclenine.*—It has been already mentioned that a few beds of this group appear on the summit of Kilmaclenine hill, in the form of a small trough in the Yellow sandstone, supposed to be about 800 feet in length, by 400 in breadth. The beds consist of dark gray earthy and splintery shale, with thin layers of compact, impure limestone. In the little gardens attached to some cabins on the road side these dip to the S.E. at 50°; but the corresponding beds on the other side of the synclinal are not exposed. At one time there was a search made for limestone at this spot, but it was soon abandoned.

Lower Limestone Shale of the Mallow District.—In the section exposed by the River Blackwater at Dromaneen Castle it is very remarkable that no evidence exists to show that the Lower Limestone shales were deposited at this locality; on the contrary, the limestone and the Yellow sandstone are observed in immediate contact. From this remarkable fact, therefore, I have not prolonged the Lower Limestone shale westerly beyond the meridian of Dromaneen quarry, though this deposit is clearly seen in the railway cutting S. of Mallow, and in several localities to the eastward, out of the limits of the map.

In the railway cutting these beds appear as thin layers of dark gray earthy shale, with flaggy, light brown sandstones, and thin gray grits, the Fenestella being the most common fossil in the shales. These beds appear to dip to the N.N.W. at about 10°, and are exposed for the distance of 400 feet. To the east of this these beds are concealed for the distance of a mile and a half, when they are seen again at the surface S. of the Mallow and Fermoy road, between Eastly Cottage and Yellow Bridge, where they are dark gray, earthy, splintery, and shaly.

As these beds are traced to the E., they appear with an inverted dip of 60° to 65° to the S.E. in the road cutting just beyond Yellow Bridge. Here they are associated with some beds of purple slate and yellow and red shales, with thin soft grits; evidently the passage bends upwards from the Yellow sandstone. We have now some evidence as to the probable thickness to be assigned to this band of rock, for in the adjoining bank of the River Blackwater, at "Brehon's Rock," we find the Carboniferous limestone dipping apparently beneath them at 10° and then 65°, while the Yellow sandstone appears to overlie them at the east end of the road cutting. From this evidence, therefore, we may allow about 160 feet as sufficient to include all the beds truly belonging to this deposit here.

In the section at Rockforest House, a mile and a half further to the E. we find precisely the same facts as those just described, the inversion of the strata from the Yellow sandstone to the Carboniferous limestone inclusive being equally well proved here.

If the Lower Limestone shale and Yellow sandstone which appear on the lands of Rockforest, close to the house on the N.W., were prolonged in their line of strike, the former beds would abut against the limestone which appears in the cliffs on the E. bank of the Blackwater; a small fault is, therefore, supposed to break the continuity of the beds here. As these beds are inverted, the fault now appears as a downthrow to the W.; but if the beds be

* From information which Sir Denham Norreys, of Mallow Castle, was kind enough lately to procure for me, I am led to believe that the Yellow sandstone of Kilmaclenine Hill does not extend quite so far to the westward as I was at first induced to suppose. It appears that in sinking a pump, at the dwelling house in the townland of Ballycushen, to the depth of eighty feet, the workmen passed through forty feet of drift clay, gravel, and boulders, and the remainder through dark gray limestone.—G. V. D. December, 1860.

restored to their true order of deposition and sequence, the fault would perhaps be a downthrow to the E.

d². *The Carboniferous Limestone of the Blackwater Valley.*—To the E. of Mallow there is a good deal of variety in the lithological character of this limestone, and the rock is very well exposed over that district, especially along the valley of the River Blackwater, from Mallow Castle to beyond the limits of the map on the east. The limestone throughout presents the remarkable fact of an almost universal dip to the southwards, or towards the sandstone which lies beneath it, for a width, in some places, of fully half a mile from its boundary. This, of course, tends more firmly to establish the fact of an extended inversion of all the beds from the upper part of the Old Red sandstone to the lower portion of the limestone inclusive, along the valley of the Blackwater. In the deer park of Mallow Castle, along the river bank, there is an interesting section exposed in the limestones for the distance of about 500 yards. According to the observed dips, which are to the S.E. at 20°, increasing in the upper part of the section to 45°, the lowest beds are those under the old castle, and the next in succession appear as we pass along to the east. The rock is a light gray, compact, evenly bedded, and finely-laminated, gray limestone, containing chert layers. Casts of encrinite stems are common in the finely-laminated beds, in which the carbonate of lime has been replaced by silica of a clear light gray colour. In the upper portion of this section there occurs a band of thin-bedded, light gray, and dove-coloured, compact limestone, containing nodular layers of white chert, and having thin beds and partings of pale yellowish green slaty shale through it; this shale is not calcareous. The occurrence of this shale is worthy of remark, because an analogous deposit appears in the Carboniferous limestone of the lake district in Killarney (See Explanation to Sheets 173 and 184).

On the S. side of the Blackwater, at Ballyellis, we find gray compact and cherty limestone again exposed, the beds dipping to the S.S.E. at from 60° to 70°. Similar layers appear in the river bank at "Brehon's Rock," and to the N.E. of it, over the alluvial flats of the river; here, however, the colour of the stone is of a darker gray, and the dip is to the S. at from 10° to 20°. On the opposite side of the river to this, at Carrigoon Cottage and Carrigoon Castle, the gray crystalline and compact limestone again appears dipping S.E. at 20°. In the townland of Ballymagooly the limestones undergo a very great change, especially where they appear around the house called The Garrison, in the field and along the road adjoining the church, and in the quarries on the E. of the road near the Blackwater; here for the most part the bedding in the limestone disappears, the rock becoming massive, and light gray in colour. In some beds near the river the dip is observed to be S. 10° E. at 10° to 20°, and the beds are traversed by vertical dyke-like bands of gray friable dolomite, having a strike of 10° W. of N. and E. of S.; in these portions of the limestone the bedding is totally obliterated. To the N. of this, on the N. bank of the river, in the townland of Lackanamona, and at Carrigoon, light gray, finely-laminated limestone appears, the dip, as suggested, by the lamination, being to the S.S.E. at 55°. These same beds appear in a quarry on the bounds of the adjoining townland of Carrig demesne. The limestone forms bold and rugged cliffs on the eastern side of the Blackwater, in the townland of Rockforest East. The rock is crystalline, its stratification not easily discerned, and its beds contorted.

On the opposite side of the river, in the glen at Carrig, the limestone is light gray and finely crystalline, unbedded and much cut up by joints; it is well exposed for the distance of half a mile. To the E. of this, as far as the limit of the map, there is no change in the character of the limestone from that just described.

To the north of Mallow the limestone is well exposed, particularly in the

Spa Glen, and over the high ground around Laurel Hill. At the former the rock is light gray and compact, and quite unbedded; but at the latter, in the quarries at the summit of the hill, it exhibits a distinct stratification, the beds being inclined to the S.S.E. at from 25° to 40°, the colour and character of the stone being the same as before. In the large quarry close to the Parochial School in Mallow, the beds are bent round, so as to dip to the S.W. at 30°.

The limestones which are observed quite close to the Coal Measures along the escarpment of these rocks, N.E. of Mallow, are both unbedded and bedded. They vary from a pale gray, hard, and sometimes finely crystalline rock, in the one instance, to a gray or dark gray compact one in the other. This circumstance, taken in connexion with the fact that the bedded limestone is discovered in two instances in close proximity to the Coal Measures, and to strike directly at them, induced me to suppose that the Coal Measures were brought against them by means of a fault. Mr. Wynne, during his examination of the extension of this boundary, from Torpy's cross-roads, N.E., to the neighbourhood of Doneraile, subsequently confirmed this hypothesis; for in a quarry of gray compact limestone, which occurs at the distance of three-quarters of a mile N.E. of Torpy's cross-roads, and on the very cut of the map, he found the beds dipping to the S.W. at 35°, and thus striking at the Coal Measures, which he supposes are not more than 150 yards distant from them on the N.W.

In the lands of Annakisha House the limestone is both gray and dark gray, compact, as well as finely crystalline, it dips to the S.S.E. at 80°, or away from the Coal Measures; but in the distance of a few yards to the S. it bends over to the S.E. in a sharp contortion. The Coal Measures are supposed to be present at the distance of 200 feet N.W. of these beds, and to have a dip and strike independent of them.

To the S.W. of this locality, at the distance of one mile, in the southern part of the townland of Cooldurragha, there are two quarries in the dark gray finely crystalline limestone, and close to the Coal Measures, which almost afford sufficient evidence to prove the existence of the fault. The more northern of the quarries show the beds dipping to the S.W. at 40°, and striking fair for the Coal Measure shales, which show at the surface at the distance of 200 feet from the limestone. The southern quarry exhibits 250 feet of limestone dipping to the S. at 40° and 35°, and striking right at the Coal Measures, distant 400 feet from them on the N.W.

As we approach Mallow, the limestones which are observed nearest to the Coal Measures are light gray compact or finely crystalline and unbedded; therefore, clearly not the same beds as those just described. They appear in the townland of Ballyvinter Lower, at the branch road to Mallow, the Coal Measures being observed within 300 feet of them, and supposed to be present at the distance of 100 feet; and again in the townland of Spa Glen, at the northern base of Laurel Hill, where the limestones are of precisely the same lithological character, and are exposed in many quarries.

The last locality, where the limestones appear in this line of strike, is close to the old toll-gate at the end of Beecher-street, in Mallow, but here the dip of the beds is very obscure. To the N.E. of Mallow, there are very many quarries, but they do not need any detailed description.

The limestones are well exposed by quarries on the S. side of the Blackwater, in the neighbourhood of Mallow. The general character of the rock is light gray compact and often finely laminated; and, as a general rule, they dip to the S.E. at from 40° to 50°, thus clearly indicating an inversion of the beds, and corroborating the conclusion drawn from previous observations. As we follow the limestones westerly, along the valley of the Blackwater, we find that as a general rule they dip to the southwards. This fact is evident in the beds which appear on the river bank below

Woodfort House, then west of that at Millfort, and again at Dromaneen House, and lastly at Dromaneen Castle, as before described. To the W. of Dromaneen Hill, dark gray compact limestones appear on the river bank in the townland of Mohereen; their dip, however, is not apparent. On the north bank of the Blackwater, in the townland of Carrigane, at the distance of nearly a mile and a half to the W. of the last-named locality, and the same distance S.E. of Roskeen Bridge, the limestone again appears, and has been here quarried into. The rock is bluish gray, compact, and in some of the beds finely crystalline. All the beds here exposed are very much contorted. They form a small boss, measuring half a mile from N.E. to S.W., and about 450 yards across, now denuded of the Coal Measures, but completely surrounded by them. This quarry was not being worked when I examined it in the summer of 1856.* On the S. bank of the Blackwater, adjoining Roskeen Bridge, and to the N. of Gortmore Cottage, the limestone is well exposed. Here we find a thick-bedded crystalline rock with a few gray shale partings dipping to the southwards at from 50° to 80°, but becoming vertical at the E. end of the section, where a bed of dark gray shale appears. To the W. of this the limestone rises in bosses from out the alluvial land of the river, throughout a distance of over one mile and a half, as far as the site of the Monastery and old court of Clonmeen. Over this area the rock appears to have lost its bedded character and to become amorphous. From Clonmeen westerly to the limits of the map, the presence of the limestone is inferred.

Carboniferous Limestone of the Northern part of the District from Kanturk towards Buttevant and Doneraile.—The limestones which appear to the E. of Kanturk are very well exposed in many quarries. Those to the S. of Spring Ville, in the townland of Ballintober, consist of thick-bedded pale bluish gray limestone frequently crystalline, the lowest beds, according to the observed dips, containing chert layers. In the large quarry close to and W. of the gate lodge of Bettyville, the beds are cut up by N. and S. vertical joints, and in two places metamorphosed into N. and S. vertical dyke-like masses of a pale brown friable dolomite. The quarries which appear to the E. side of the Awbeg River, E. of Assolas House, in the townlands of Lisduggan South and Lisduggan North, expose dark bluish gray limestone, which is often crystalline, and contains bands of chert which weather to a pale yellowish white colour. Wherever the rock is exposed over this neighbourhood, for a distance of nearly a mile from N. to S., it is observed to dip to the S. at from 25° to 45°. To the S. of Rockfield House, on the western flank of Subulter Hill, there are three quarries which expose bluish gray compact limestones dipping to the N.W. at from 20° to 40°. These evidently overlie a thick deposit of dark greenish gray trappean conglomeritic ash, which forms the main mass of the hill, and which will be described under the head of *Igneous Rocks*. To the north of Rockfield, in the townlands of Marybrook and Ballyhest West, beds which are on the same horizon, and which occupy the same relative position to the trappean ash as those just alluded to, appear in many quarries, the dip being to the N.W. at from 45° to 55°. To the N.E. of this, in the lands of Castlecor House, there are many quarries. Those to the N.E. of the House, and near the Coal Measures, expose pale gray limestone dipping to the N.W. at 75°.

* When I visited these quarries a mile and a half S.E. of Roskeen Bridge, in August, 1860, they had come on a bed of highly carbonaceous black shale (pindy), which appeared to have been a parting between two beds of limestone; but now as the beds are crumpled in, it is in a lenticular mass in the fold of the roll, being about twelve inches in its thickest part, and diminishing to nothing as it was followed S.W. and N.E. It did not extend more than five or six feet. In appearance it was like the "Connemara" under the Fourpenny Coal at Lisnacoon Colliery, and burned like it when put in the fire. There are also black shale partings from half an inch to four inches thick in other parts of the quarry, and all that were remarked are of a lenticular shape.—G. H. K.

while some of the beds in the demesne to the S. of the House dip to the S.S.E. at 20° to 35°. To the S. of Castlecor, and in the northern part of the townland of Ballyrusheen, the pale gray limestone is well exposed in a host of quarries, the beds all dipping northwards at from 20° to 45°. In the southern portion of this townland, and the eastern part of the townland of Subulter adjoining it, the gray limestones have been metamorphosed "en masse" into a pale brown friable and highly crystalline magnesian limestone or dolomite. In one quarry, close to the townland and parish boundary, and at the distance of 250 yards N.E. of the road leading to Subulter House, Mr. Willson describes "small patches of bluish gray limestone occurring in the midst of the magnesian beds." The same fact is noticed by the same observer in the dolomites which appear on the E. side of the road, at the extreme S.W. corner of the townland of Subulter. The bedding of the limestone which has been thus metamorphosed, and all the fossil remains, are quite obliterated. The sudden alteration from pure gray limestone to pale yellowish brown dolomite is well seen in a quarry on the W. side of the stream dividing the townlands of Twoneeves and Lisduggan, at the distance of about 300 yards N. of Keltragh Bridge and east of Connors cross-roads. The superficial extent of this dolomite has been determined by Mr. Willson at a mile and a quarter from N.E. to S.W., and 1,000 yards from N.W. to S.E.

To the south of this remarkable development of magnesian limestone the ordinary limestones are well exposed in bluffs on either bank of the valley of the Ardine River from the N. of Keltragh Bridge to Ardine Bridge, a distance of one mile, when the Coal Measures appear. In this extent the invariable dip of the beds is to the southwards at from 15° to 40°, with but one exception, at the distance of 600 yards north of Ardine Bridge, where they roll and dip to the N.N.W. at 40° for a short distance, thus lessening the thickness of the exposed section by about 200 feet at the most. The total thickness exposed in this section, deducting 200 feet for reversed dips, may be estimated at fully 2,000 feet, the dolomite being beneath, but its thickness not ascertainable. To the N. of the dolomites the limestone for the most part dips to the northward, and thus passes beneath the Coal Measures on that side of the anticlinal; to this, however, we find some exceptions in scattered quarries ranging from the S. corner of the townland of Curraglass, in a W.S.W. direction to the townland of Curragha, a distance of about two miles and a half. These beds are well exposed in the demesne of Castlecor, and all dip to the S.S.E. at from 20° to 45°. Though the superficial extent of the limestone on the north of the dolomite is greater than on the south, the thickness of 2,000 feet, assigned them at the latter locality, will be amply sufficient to cover it by supposing the existence of a few rolls in the beds. To the eastwards of the dolomite in the townlands of Ballyrusheen, Kilgilky South, Kilgilky North, and Garryduff, the limestones appear in scattered quarries. In the two last-named townlands the beds dip to the N.N.E. at from 55° to 75°, and on the two former to the S.S.E. at from 5° to 45°. They are evidently the same set of beds, and are described by Mr. Willson as pale bluish gray crystalline, sometimes thick-bedded, and not unfrequently metamorphosed to a pale brown friable dolomite. Between Cecilstown and Kilmacleanine Hill some of the limestones have been also converted into dolomite. In the neighbourhood of Cecilstown, both to the E. and W. of it, the uppermost beds of the limestone are well exposed. They are described as pale or bluish gray, evenly bedded, with occasional partings, and thin beds of gray and olive gray shales. As they approach the Coal Measures they dip to the S. at from 45° to 50°, beneath those rocks which appear in the low escarpment close at hand, on the S. side of the little valley of the Lohort stream.

On the north of Kilmacleanine Hill the limestones are also well exposed. The lowest beds are those seen on the road side on the northern slope of the hill,

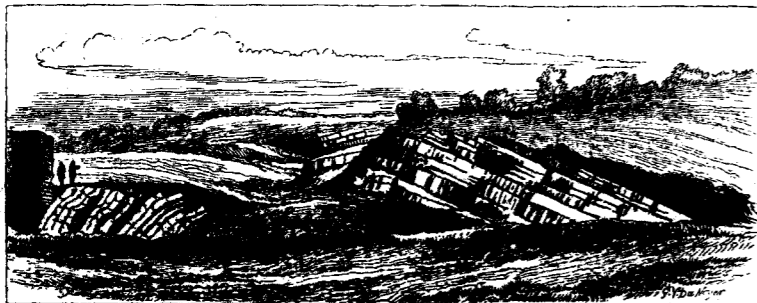
and are described by Mr. Wynne as "dark gray compact and sub-crystalline, shaly and flaggy." Above these the same observer notices "dark gray, sub-crystalline, granular, compact limestone, apparently slightly oolitic, passing up into dark and pale gray compact and sub-crystalline beds," which appear at the old castle of Kilmaclenine. All the beds dip to the N.N.W. at from 10° to 35°.

To the E. of Ballyclough, as far as the railway cutting, close to New Two-Pot-House village, a distance of three miles, the limestones are very well exposed in numerous detached quarries, the general dip being to the southwards at from 35° to 50°. On the bank of the stream on the lands of Ballyclough Castle, the exposed section through the limestones has a superficial extent of nearly 600 yards. The rock is described by Mr. Wynne as bluish gray, compact, in the lowest beds, or those to the N., passing up into the "Ballyclough marble," which is black, red, and variegated. These are overlaid by dark bluish gray sub-crystalline beds, sometimes containing thin layers of chert and quantities of large *Productæ*. The dip throughout this series is to the southwards at from 40° to 50°. If we allow, therefore, the average dip to be 45°, we have a total thickness of 425 feet for the beds exposed in this section.

The cuttings of the Great Southern and Western Railway, which traverses the district to the E. of this, expose light gray compact thick-bedded limestones on the uppermost beds of the deposit, or those nearest to the Coal Measures. These can be followed across the strike as far to the north of the Coal Measure boundary as the New Two-Pot-House cross-roads. Here Mr. Wynne's observations commence; and he describes the section in the railway northwards from this as exposing "pale gray compact limestone, apparently dipping to the south at 20° to 35°, and in many places becoming metamorphosed to a pale brown and yellow friable dolomite." In a large quarry in the townland of Grange East, the same observer notices dark gray sub-crystalline limestone, evenly bedded with N. and S. master-joints, and having some fossiliferous beds. The limestone is here contorted, and dips to the eastward at 10°, curving round to the N., and from that to the westwards at 10° to 15°; eventually at the south-east of the quarry the dip is to the N. at 40°. These dark gray beds are evidently in the lower portion of the deposit, as they occur directly in the strike of the Yellow sandstone of Kilmaclenine Hill, which is distant from them only half a mile to the west.

To the E. of the railway, in the townlands of Ballybeg Middle, Ballybeg East, Ballymague, and Banefune, some of the limestones have been changed to either a pale brown or a pale pearly gray sandy dolomite. In most of the quarries the original bedding of the rock is seen in the unaltered portions,

Fig. 5.



Junction of Carboniferous Limestone and Coal Measures. Townland of Caherduggan N. The Coal Measures are represented by the dark shading on top of the limestone to the right hand side of the view.

and over this area it dips to every point of the compass. To the S. of the last-named locality, in the townlands of Two-Pot-House and Caherduggan North, a very interesting junction of the Limestone and the Coal Measures is to be seen at the distance of about 200 yards E. of the road from Mallow. The beds are affected here by a contortion which causes them in one part to dip E., in another N.E., and in another N.N.W. at 20°, for a short distance.

The sudden transition from compact limestone to black, earthy, incoherent shale is remarkable, though not uncommon; the same fact being observed in the Coal Measures of the county Tipperary, between Killenaule and Clonmel (see Explanation of Sheets 155 and 156).

To the E. of this, Mr. Wynne describes gray and dark gray limestone appearing in detached quarries along the northern boundary of the Coal Measures up to the margin of the Sheet, the last observed quarries occurring to the N.E. of Hermitage, in the townlands of Ballyandrew and Castle-saffron; the dips, for the most part, being to the S.E., at from 15° to 40°.

d°. *The Coal Measures.*—The beds belonging to this group, which occur to the W. of Kanturk and the River Alloe, are described by Mr. G. H. Kinahan, in his Explanations of the Coal-bearing District, included in Sheets 163 and 174. The most comprehensive section in the Coal Measures to the E. of Kanturk occurs in the stream forming the townland boundary, to the E. of Corbally House, and is thus described by Mr. Willson, commencing at the lowest beds:—

Bands of gritty slate.
Gray shales.
Thick greenish gray grits.
Dark gray shales, and thick concretionary gritty shales, with thin bands of bluish gray slate.

Dark gray slate, with thick gray cleaved shales.
Pale gray grits, and earthy shales.
Hard, gray, gritty, concretionary beds.

With one exception, near the top of the section, where the beds are contorted and made to lie horizontally, the general dip is to the north, at from 60° to 70°. As the superficial exposure of rock amounts to fully 1,400 feet, if we allow an average dip of 60°, we have here presented to us a total thickness of 1,204 feet. On the south side of the limestone, and in the townland boundary E. of Bettyville, the same observer notices brown and olive grits and gray and dark bluish gray shales and slates, with thin flaggy grits, all beautifully contorted, so as to dip to the N.W., W., and S.W., at from 30° to 50°. At the distance of a mile and a half S.E. of this, on the N.W. border of the townland of Coolawaleen, is a section through beds on the same geological horizon, but on the opposite side of the anticlinal. It exposes, in ascending order, the usual dark gray and black shales, and slaty beds, with grit bands; and the observed thickness may be about 988 feet, the average dip being estimated at 50° to the south. Mr. Wynne thus describes some beds of culm, stated to exist between the small village of Gneevies and Croaghurigeen Wood:—"They are said to crop beneath the surface deposits, within a short distance of each other, and the southern bed is stated to extend for the distance of about one mile and a half from the E. bank of the River Awbeg to the lands of Cqoln-magh East. The strike of these beds, so far as could be ascertained, is nearly E. and W., and their stated dip is to the S., at 45°. The southern bed is said to have an average thickness of from sixteen to eighteen inches, in places however thinning out to six inches, and thickening to two feet. It is underlaid by hard grit 'seat rock,' and its roof is of dark gray 'slig' or

* The outcrops of these beds were transferred to our maps from maps formerly made by Sir R. Griffith, Bart., who kindly placed at our disposal all his maps of this district. J. B. J.

shale. A sinking to the depth of thirty yards has been made, to work this bed, and the culm raised is said to have been of good quality. A bed to the N. of this is said to occur on the S. side of the road, and of the narrow belt of plantation directly S. of Coolnamagh Cottage. It is reported to be only two inches thick. A third bed (or perhaps an extension of the second), which appears to underlie the former, is stated to come towards the surface on the S. side of Croaghurigeen Wood, and to extend in a westerly direction from that point into the adjoining townland of Coolnamagh. The evidence for these beds is merely the occurrence of the old pits and the verbal statements of the country people; and the culm does not appear to have been visible anywhere in its supposed line of strike. The relations of these culms to those occurring in the adjoining coal field to the W. of Kanturk have not been determined, owing to the scarcity of evidence."

To the S.E. of Ballydough village, in the townland of Curraghalehane, Mr. Wynne notices a number of culm pits, but remarks, that no evidence of the mode of occurrence, the thickness, or quality of the culm, was obtainable on the spot.

To the S.W. of this, and at the distance of 500 yards from the southern group of culm pits, and in the stream-cutting dividing the townlands of Curraghreen and Kiltranathan, I observed the following beds, in ascending order:—

Dark gray, earthy, concretionary shales,
Hard olive gray grits,
Concretionary shales,
Thick, hard, greenish gray grits, and gray flaggy grits.

} All dipping to the S.S.E.,
at from 55° up to 80°.

These would appear to overlie the culm beds mentioned above, but at a considerable distance from them.

In the lands of Roskeen, Rockview, and the adjoining townland of Pallas, on the S., the Coal Measures appear occasionally at the surface, but not sufficiently well to expose either their dip or strike. Their position with regard to the limestones to the west, on the southern side of the Blackwater, is evidence in favour of the existence of the fault represented as striking N.W. and S.E. past the eastern flank of Mount Hillary.

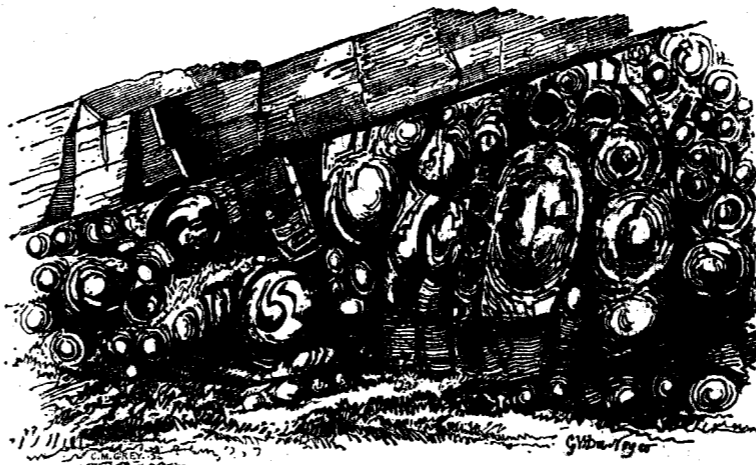
At the commencement of the old canal on the E. side of the Blackwater, in the townland of Pallas, we find a few dark gray splintery shales or "pencil," with thin bands of hard olive gray grits, exposed for the distance of about 160 yards, and dipping to the S.S.E. at from 40° to 45°. Without doubt, the limestones are not very distant from these beds on the S., and they therefore tend to confirm the fact, that along the valley of the Blackwater all the rocks are inverted.

Coal Measure shales and thin olive gray grits, appear in the townland of Dromrastill, and in the adjoining townlands of Woodpark and Gearanas-kagh; the beds are not, however, sufficiently exposed to show their dip or strike.

In the glen of the small stream to the E. of Newtown and Firville the Coal Measures appear at intervals from Glenreagh bridge to the alluvial flats of the Blackwater. At the former locality the beds, which consist of flaggy olive gray grits, dip synclinally at 60° to the S.S.E. and N.N.W. Lower down the glen, at the distance of about 280 yards, the beds dip to the S.S.E. at 40°, and from this point southerly the observed dips are all to the southward, from 40° to 65°; the rock, however, is very imperfectly seen, and at wide intervals; the harder beds only being those which come to the surface. On the roadside at the termination of the old canal, and in the lands of Westwood Cottage, some dark gray earthy and splintery shale, with sandy layers, appear dipping to the S.S.E. at 75°. Along the road between this place and Mallow the ends of the beds of gray shales and olive gray grits

frequently appear. The sections afforded in the Coal Measures by the cuttings of the Great Southern and Western Railway north of Mallow are instructive, but as they are far apart, they do not afford sufficient data to enable us to estimate the local thickness of the deposit. The first cutting on the S. is at the Mallow Station; it exposes thin olive gray grits and gray earthy shales, all dipping to the S.E., at from 65° to 80°; and as it has been already shown that the limestones are probably not more than 500 feet to the east of this, the observed dips in the Coal Measures are evidence in favour of the existence of the fault between them and the limestones, which has been marked on the map. The next cutting appears to the S. of the Union Workhouse, and is about 600 yards in length. It shows for the most part hard, gray, splintery shale, often cleaved, and sometimes exhibiting a concretionary structure, with thin bands of olive gray grit occurring at tolerably regular intervals and from ninety to 100 feet apart. The general dip is to the S.S.E., at from 40° to 65°, for the distance of about 230 yards, when the beds are bent into an S-shaped fold (an anticlinal and synclinal), for the distance of ninety feet, when the section is continued northwards to the end of the cutting. The beds immediately below the contortion are hard splintery shale, which pass down into gray and dark gray concretionary shale. Below this there are two beds of olive gray grit, enclosing a light brown or rusty calcareous grit, or impure earthy limestone, about two feet thick, containing eucrinite rings. I have no doubt that if an unweathered portion of this bed could be exposed, it would be found to be light gray in colour, and not easily distinguishable from an ordinary earthy, compact, impure limestone. The beds below this are hard dark gray splintery shale, with a few thin grit layers, and the lowest beds seen are highly concretionary, decomposing into large spheroidal bales. The dip of

Fig. 6.



Black shale of Coal Measures weathering into Spheroids, northern end of railway cutting at Mallow.

all the beds below the contortion is to the S.S.E. also, but the angle of inclination is only 20°. Owing to the occurrence of a few faults at the southern end of the section, it would be hazardous to venture a conjecture as to the total thickness of the shales and grits exposed in this cutting; setting the faulted portion aside, however, and leaving out the contortion, we have a thickness of about 750 feet of rock presented to us.

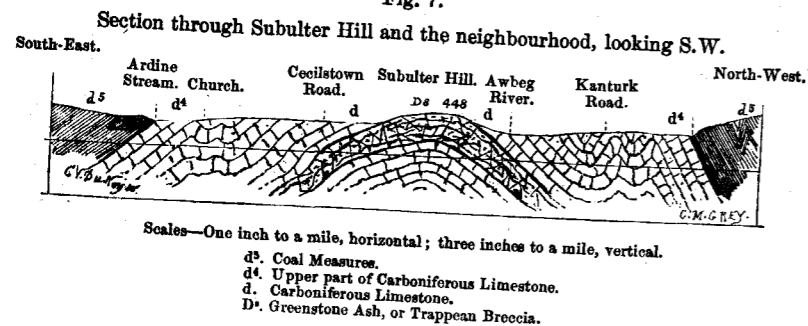
The next cutting N. of this is much more extensive and deeper, and therefore more interesting than the former. The bands of grit are here much more numerous, and thicker than before. Generally speaking, the dips are to the southward, but there are many contortions, which obscure the section, and prevent us from gaining an insight into its true stratigraphical arrangement. Several thin beds of pindy, or coal mud, resting on dark gray fire-clay, appear here and there throughout this cutting, and one of them formerly yielded culm in some sinkings in the high grounds near the S.E. corner of the townland of Pencil Hill, nearly a mile E. of the railway cutting. In that portion of the railway cutting which passes through the N.W. corner of the townland of Cloghluca South there is a band of obliquely laminated olive gray grit, which measures fully ninety feet in thickness. The dark gray shales are frequently concretionary, resembling those illustrated in Fig. 6. In this cutting it is probable we have a total thickness of 1,600 feet of Coal Measures presented to us.

Over that portion of the Coal Measures which extends N.E. from the railway the rocks are very imperfectly exposed in detached localities, but an interesting junction between them and the limestone is noted by Mr. Wynne, in the stream-cutting dividing the townlands of Curraghakerry and Caherduggan North.

The Coal Measures are here exposed for the distance of about 600 yards; they consist of black shales, with some olive gray grits; and as the dip is invariably to the S.E. at from 35° to 60°, we may assume their thickness to be 630 feet. To the east of this, in the stream which runs through the townland of Ballydineen, dark olive gray shales and gray grits appear in four places, dipping to the southwards at rather high angles. On the southern boundary of this portion of the Coal Measures the rocks are rarely seen, though the escarpment formed by them is well defined. Dark gray splintery shale and olive gray grits can be observed in the townland of Cooldurrageha, to the N.E. of Mount Nagle, but the direction of the beds is not apparent. To the S.W. of this, in the stream-cutting forming the boundary of the townlands of Ballyvinitier Upper and Ballyvinitier Middle, S. of the race-course at Dromroe Commons, the dark gray shales and thin olive gray grits come to the surface, but they present no fact of any interest. The same beds appear, under the same circumstances, as we approach Mallow, in the lands of Ballyvinitier Lower and Spa Glen.

Igneous Rocks.—The Trappean Ash of Subulter.—The beds of this rock, which appear interstratified with the limestones to the E. of Kanturk, rise from beneath the limestone which surrounds them on all sides. The beds are well exposed on the south side of Subulter Hill, as well as along its western and north-western slope. The uppermost layers are dark greenish gray, hard, and feldspathic, with small crystals like glassy feldspar, through the mass of the rock. The beds forming the lower part of the deposit

Fig. 7.



which is visible weather into numerous small hollows, which in fresh fractures appear to be filled with carbonate of lime; indeed the rock is throughout highly calcareous. Some of the lower beds are decidedly conglomeritic, the pebbles being formed of scoriaceous greenstone. On the N.W. flank of the hill these beds dip to the N.W. at 50°, and pass beneath the limestone exposed to the S. of Rockfield. In the grounds of Subulter House the ash is flaky and conglomeritic, its dip is here stated to be to the northward at 30°. The last locality where this ash breccia is to be seen is on the S. bank of the Awbeg river, at the W. corner of the townland of Ballyrusheen, and at the distance of 500 yards above Marybrook bridge. The rock is here highly conglomeritic. The total observed length of the Subulter conglomeritic trap ash is stated by Mr. Willson at one mile and 600 yards from N.E. to S.W., by about 750 yards from N.W. to S.E. On the horizon of this deposit, as suggested by the examination of the limestones which appear to the eastward of it, and at the distance of more than a mile from its northern end, we find a dyke-like mass of compact porphyritic trap, three to four feet in width appearing beneath some pale blue compact limestones, in a quarry at the S.E. end of the townland of Ballymacpierce, the dip of the beds being to the N.N.E. at 65°. To the E.S.E. of this, at the distance of about three quarters of a mile, and in the N.E. corner of the townland of Kilgilky North, another and very similar looking porphyritic trap dyke is again presented to us, in a quarry of hard compact gray limestone, the dip of which is also to the N.N.E. at 75°. Mr. Willson, who first observed these dykes, thus describes that at the latter locality: "Dyke of porphyritic trap four to six feet wide. Angular pieces of the limestone are embedded in this trap on the walls of the dyke. Sometimes these fragments are rounded, and they give the trap the appearance of a conglomerate. The limestone in contact with the trap does not appear to be much altered, it merely becomes more dense and compact. At the west end of the quarry the trap is observed to die out between beds of shaly limestone, and to become shaly and earthy itself, so as to be easily mistaken for an earthy shale." It is just possible that these two supposed dykes are portions of the same bed of ash as that of Subulter.

Trappean Ash of Carrigleenamore.—In the Old Red sandstone to the S.S.W. of Mallow, a trap ash conglomerate appears, forming the little hill of Carrigleenamore. Though it is merely a small boss of about 300 yards in length from N.E. to S.W. by 200 yards in width, the nature and quality of the rock is well seen. It consists of thick beds of bright grayish green and very compact feldspathic ash, containing well rounded pebbles of greenish gray fine-grained grits, compact greenstone, scoriaceous trap, with rarely a pebble of fine crystalline dark gray limestone, all intimately incorporated in the ashy matrix; one layer of bright green slaty ash contains cubical crystals of iron pyrites. On the weathered surface these pebbles stand out in relief, some of the included fragments measuring from eight to twelve inches across; some are angular, with the angles rounded. The base of this conglomerate is in some places cleaved in planes striking N. 70° E., inclined 20° to the S.W. at 75°, and in general it is cemented by a calcareous paste. Though this deposit is probably interstratified with the Old Red sandstone, the two rocks are not anywhere to be seen nearer to each other than 300 yards on the S.W. side of the knoll, and there the dip of the sandstones is not apparent. At the distance of half a mile to the W. of this, on the boundary of the townlands of Knockdrislagh and Carrigleenamore, a few beds of hard light greenish gray grits and purple slates, dipping to the S.S.E. at 15°, were observed; it is, however, impossible to say what relation these beds bear to the ash conglomerates on the E.

5. Drift.

The northern portion of the district is covered with a thin deposit of local

drift, which has, however, been subsequently removed from the higher parts of such elevations as Kilmacleanine Hill, Pencil Hill, and Subulter Hill. Resting on this drift are rounded boulders of syenitic granite in the eastern part of Mallow Castle demesne.* In a field to the S.W. of the Mallow Workhouse, at the distance of 400 feet from the yard wall of the workhouse there is a large angular boulder of light gray cherty thin-bedded limestone, containing thin gray shale layers, characteristic of certain beds exposed in a quarry in the deer park of Mallow Castle. The distance between this boulder and the place where the same rock is now to be observed *in situ* is fully one mile and three-quarters to the S.E. From the foregoing fact it is evident that shore ice was formed and floated about the base of the Old Red sandstone hills S. of Mallow, during the glacial period, and aided in the formation of the present distribution of boulders and other blocks. The drift over the southern portion of the map is also derived from the local rock, and, strange to say, is now seen to rest on the flanks of the mountains, up to elevations of over 1,000 feet in some places. At the head of the Cummeen stream, and at the sharp turn on the mountain road there, to the N.E. of the summit of Best Hill, it reaches an elevation of 1,100 feet. Doubtless this deposit once covered the very highest summits of the mountains, and it is owing to subsequent forces of denudation acting on the land, as it slowly rose from out the sea, that we owe the fact of the summits of the hills being now bared of it. The general altitude at which this drift now ceases is from 850 to 950 feet, and a contour line, therefore, drawn round the summits at or between these heights, will give a tolerably accurate outline for it. In some places the drift terminates at the height of 650 feet, as may be seen in the northern flanks of Laharan Mountain.

The various streams which cover the S.E. portion of the district have worn for themselves channels in the local drift to the depth of 100 feet in some places before the solid rock was reached.

6. Mineral Waters.

The Spa at Mallow and the adjoining Thermal Springs.—Dr. Smith, in his "History of County Cork," first published in 1749, states that the medicinal value of the Mallow spa was discovered "some years since" by Dr. Rogers of Cork, *i.e.*, some years before 1749.

Dr. Knox, in his "Irish Watering Places," gives the following analysis of the water, on the authority of Sir Robert Kane:—

Sp. gr. 1000·958. 10·000 grains evaporated, left a pale fawn coloured residuum, weighing 2·01 grains, consisting of—

Muriatic acid,	0·17
Sulphuric acid,	0·18
Lime,	0·77
Soda,	0·29
Carbonic acid,	0·60
	2·01

According to Dr. Daubeny, the gas evolved from the spring is composed of—

Nitrogen,	93·5
Oxygen,	6·5
	100·0

and he states that this is the largest quantity of nitrogen to be found in any mineral water in Great Britain.

I am indebted to Sir Denham Norreys, of Mallow Castle, for the following

* These are probably derived from the granite N. of Galway Bay. Blocks of it are scattered over the counties of Clare, Limerick, and Tipperary, and the northern part of Cork.—J. B. J.

information regarding the temperature of the spa well and the other adjoining thermal springs, derived from his observations made during a series of years.

The Spa.—The temperature of the spa varies according to the period of the year. In the winter and spring it is 67°, but it reaches the maximum of 71½° in the month of November, gradually increasing its temperature during the previous months of September and October. The variation of temperature is supposed to be induced by the amount of rain which falls on the spot.

Lady's Well.—Temperature varies from 67° to 72¼°, or ½°, that is, 1° higher than that of the spa, its variations in temperature, like the Spa, being dependent on the season of the year and the amount of rain. The spring on the west bank of the Glen river, and distant from Lady's Well about 320 feet to the N.W. has a temperature of 53½°. The spring to the south of the spa, near the old court-house, was 54°, but on the present spa being utilized, it rose to 60°.

The spring which supplies the pump formerly used at the old salt works on the west side of the Glen, opposite the Spa House, is stated to have a temperature of 56°, but in a fissure of the limestone, within ten feet of it, the temperature of the water is 66° to 68°. On the west bank of the canal, in the flats at the foot of the limestone cliffs, various small springs gush up, the average temperature of which is 60°. The temperature of the spring under the old castle in Mallow is 52¾°.

The spa water lathers freely with soap, is very soft, and well calculated for making extracts.

G. V. D.

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