

DATA AND DESCRIPTIONS

TO ACCOMPANY

QUARTER SHEET 45 S.W.

OF THE

M A P S

OF THE

GEOLOGICAL SURVEY OF IRELAND.



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TO ACCOMPANY QUARTER SHEET 45 S.W.,  
OF THE MAPS OF THE  
GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

1. *Form of the Ground.*

THE main mass of the Galty mountains lies in the N.E. corner of this map; a lower ridge of craggy eminences running from them, through its centre, to the Ballyhoura hills, called Seefin, and the Black Rocks, on the W. These, after curving round to the N., are connected by another lower ridge running N.E. with some hills, called the Bench mountains, immediately N.E. of the village of Kilfinnane. Half enclosed within this curved line of heights, and almost entirely overlooked by them, lies a rather abruptly undulating, hilly piece of ground about Ballyorgan, Ballylanders, and Anglesborough. In the N.W. corner of the map is a small piece of low ground to the N.W. of Kilfinnane. To the south of the ridge that runs between the Galty mountains and the Ballyhoura hills lies the valley of Mitchelstown, in the hollow, between that ridge and another lower range on the S., which forms the western termination of the Knockmealdown mountains.

Galtymore, the loftiest point of the Galty mountains, rises to a height of 3,015 feet above the sea, being the highest point in the south of Ireland between Lugnaquilla in the county Wicklow, and the Killarney mountains in the county Kerry.\* There are several eminences close to it, varying from 2,500 to 2,700 feet above the sea. From these heights the ground slopes very abruptly towards the north, descending to the level of 1,340 feet in the space of about half a mile, and to that of 450 feet in about two miles; while towards the south, the slope is much more gentle into the Mitchelstown valley, requiring a space of four miles to fall to the level of 450 feet.—(See fig. No. 1.) These mountains end also rather abruptly towards the west, the highest points of the ridge that connects them with the Ballyhoura hills varying from 800 or 900 to 1,300 feet in height, while Seefin mountain and the Black rock of Ballyhoura itself rises to a maximum height of only 1,700 feet. The eminences of this ridge decrease pretty regularly in height from the Galty mountains to the Daragh Glen, which cuts right

\*The heights are those given on the six-inch Maps of the Ordnance Survey; some of which are also stated on the one-inch Maps.

Fig. 1. Section from the Mitchelstown Valley over Galtymore to Glencoeabinnia.

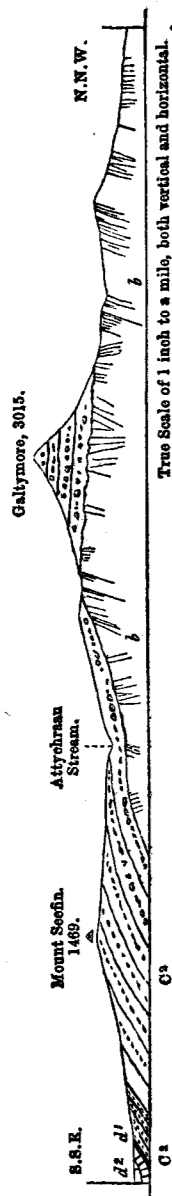
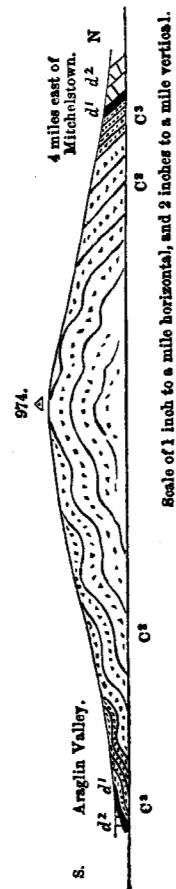


Fig. 2. Section across the western termination of the Knockmealdown Hills, from the Araglin Valley to that of Mitchelstown.



- d*<sup>2</sup> Lower Limestone.
- d*<sup>1</sup> Lower Limestone Shale.
- c*<sup>2</sup> Upper Old Red (or Yellow) Sandstone.
- c*<sup>1</sup> Old Red Sandstone.
- b* Lower Silurian Rocks.

through it; after which its summits again become more lofty, till we reach the Ballyhoura hills. The highest point of the Bench mountains is 1,439 feet.

The western termination of the Knockmealdown mountains in the S.E. corner of the map have three points exceeding 900, but none reaching an elevation of 1,000 feet.

The general elevation of the Mitchelstown valley is about 250 to 300 feet above the sea, with some eminences exceeding 400 feet. It is drained by the little river Funshion, which, rising near the summit of Galtymore, and hurrying past Mountain lodge, under the name of the Attychraan river, falls to a level of only 150 feet two and a-half miles S.E. of Rock mills, where it escapes from the district included in this map on its way to join the Blackwater below Fermoy.

Some high ground, which we may call the Castle Oliver hills, lying between Ballyorgan and Ballylanders, having eminences rising to a height of 1,078, 1,196, and 1,222 feet, is remarkable as sending off tributaries by Kilfinnane to the Shannon on the one side, and to the Funshion and Blackwater, through the Daragh Glen, on the other; while the adjacent ground near Anglesborough, the highest points of which are 897 and 1,144 feet, gives rise to the little river Aherlow, which is a tributary to the Suir. From the neighbourhood of Anglesborough the ground falls towards the vale of Aherlow, the highest points along the northern margin of the map in that direction, having an altitude of less than 600 feet.

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

As is almost invariably the case over a large part of the south of Ireland, the valleys and low lands are occupied by the limestone, which, in England, is commonly called the Mountain Limestone, while the loftiest heights consist of red sandstones and other red rocks known as Old Red sandstone. The Mitchelstown valley is all limestone, except some black Coal Measure shales near the small watershed which separates the tributaries of the Funshion from those of the river Tar, which lies in the next map to the eastward.

The low ground N.W. of Kilfinnane is similarly underlaid by limestone.

From underneath these limestone districts rise the beds of the Old Red sandstone up to the termination of the Knockmealdowns, on the one hand, and to the summits of Galtymore, the Ballyhoura and Bench mountains, and their connecting ridges, on the other.

In the termination of the Knockmealdown mountains the beds of Old Red sandstone, after rising from beneath the limestone on the north, curve over the axis of the range, and plunge down again on the south, beneath the limestones of the Araglin valley, in quarter sheet 51 N.W.—(See fig. 2.) In this range although many beds apparently terminate as they rise to the surface on each flank of it, yet nothing but lower beds of the same formation can be seen even

Fig. 3. Section across the Ballyhoura Hills, near the western side of the Map.

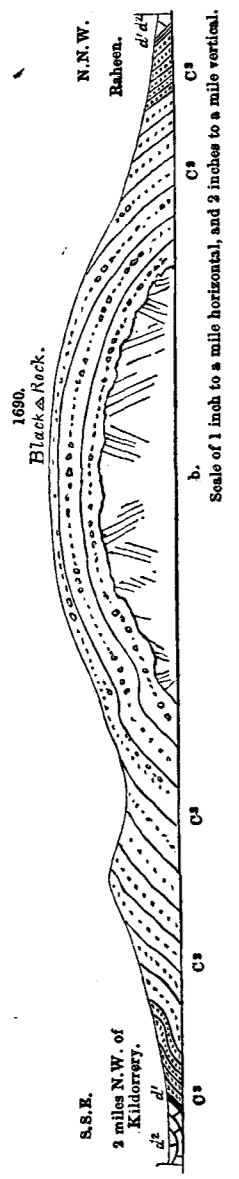
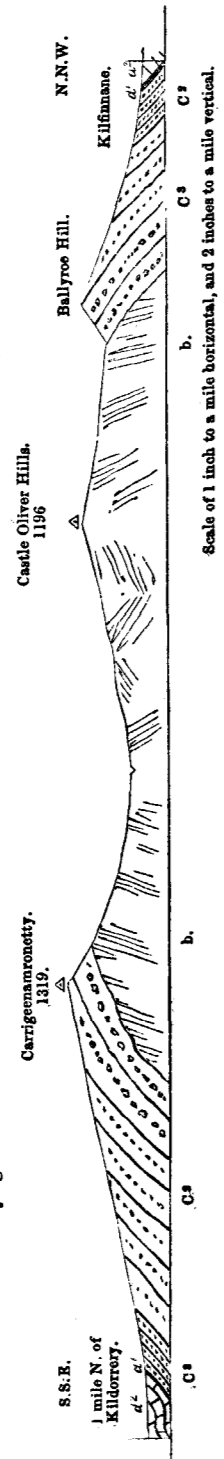


Fig. 4. Section across the Castle Oliver Hills, parallel to Section Fig. 3, but two miles further East.



- d<sup>2</sup> Lower Limestone.
- d<sup>1</sup> Lower Limestone Shale.
- c<sup>2</sup> Upper Old Red (or Yellow) Sandstone.
- c<sup>1</sup> Old Red Sandstone.
- b Lower Silurian Rocks.

on the crest of the ridge. A section across it would show the structure suggested in the section, figure 2, the beds forming an anticlinal curve over it, and being, at the same time, thrown into numerous minor flexures, the result of which is to prevent any very deeply-seated rocks from appearing at the surface.

If we drew a N. and S. section across the Black rocks of Ballyhoura, a similar general structure would be observable; but as the inclination of the beds on each side of the anticlinal arch is here more steady, and their rise continuous in each direction, lower beds make their appearance about the axis of this anticlinal than on that of the Knockmealdowns.—(See fig. 3.) So near, indeed, do we here arrive at the base of the Old Red sandstone, that a little east of Seefin and Black rock mountain the beds which formerly stretched over the crown of the arch have been entirely removed, and a valley formed along the axis of the anticlinal instead of a ridge. The ground slopes rapidly down to the east towards Ballyorgan, and on the slope of the hills, and in the neighbouring low ground, we pass below the base of the Old Red sandstone, and find underneath it an altogether different set of rocks, consisting of dark gray and green slates and grits lying at various angles, and inclining in different directions. These beds belong to the formation known as Lower Silurian. If we draw a section across the Castle Oliver hills from Carrigeenamrooney, on the south, to Ballyroe hill, on the north (see fig. 4.) we should still find the anticlinal position of the beds of the Old Red sandstone retained, so far as their dipping N. and S., respectively, is concerned, but the two ends, or abutments of the arch, are separated from each other by a vacant space of four miles, over which space the rocks that lie below the Old Red sandstone are exposed at the surface, uncovered except by loose detritus and vegetable soil.

*Denudation.*—Looking at this latter section, and observing the ends of the beds of Old Red sandstone, pointing, as it were, at each other, we could hardly help speculating on the possibility of their having once been connected over the intervening space; and this speculation would be turned into belief on comparing it with the section across the Ballyhoura hills, where the beds are still preserved, stretching across the arch. Armed with this belief, if we examine the steep northern slopes of the Galty mountains (see fig. 1.), and find every where the highly inclined, and often contorted, Lower Silurian rocks rising to a certain height, but capped above that level by beds of Old Red sandstone resting on the edges of the Lower Silurian, and stretching regularly and continuously across them, every where consisting of the same materials, disposed in the same order, and ending abruptly at the steep slopes, as if their former continuation had been torn away, we should then become impressed with the certainty that the Old Red sandstone was once continuous across all the intervening space which is now overlooked by its craggy terraces, and that all the Lower Silurian district of Ballyorgan, Anglesborough, and Ballylanders was once buried beneath a thick covering of Old Red sandstone. It might, perhaps, tend to strengthen this conviction if we visited two spots on the southern slopes of the Galty mountains, where the Lower Silurian rocks re-appear through obvious excavations

in this upper covering of Old Red sandstone. This is very perceptible in the Pigeon Rock glen, at the upper end of the Coolatiny stream, where the Lower Silurian rocks (as discovered by Mr. Wynne) may be seen in the bed of the brook, for about half a mile, covered on either hand by beds of Old Red sandstone that appear, one above another, on the sides of the glen, uniting above in consequence of the rise of ground, and below in consequence of their own dip becoming greater than that of the slope of the hill.

Fig. 5, page 13, will give an idea of this structure.

A similar set of arguments and chain of reasoning might be brought forward to show that the Old Red sandstone itself, even that on the top of Galtymore, was once covered by the Limestone, and that again by the Coal Measures; but this would require the description of a larger district than that included within the limits of this map.

*Unconformability.*—An attentive examination of the two sets of beds would disclose the fact, that not only had the Old Red sandstone and the underlying Lower Silurian suffered greatly from denudation since the deposition of the upper group, great spaces having been stripped of Old Red sandstone, and deep hollows worn in the Lower Silurian; but also, the further fact, that the Lower Silurian itself had suffered from a still greater amount of denudation before the deposition of the old Red Sandstone. There is a total want of conformity between the two groups of rocks, the basal beds of the Old Red sandstone stretching right across the upturned edges of the Lower Silurian beds, reposing now on one part, and now on another part of that series—sometimes on the edges of higher, sometimes on those of much lower beds. Now, it is clear that the lower beds of the Lower Silurian series could never have reached the old surface of the ground as it was before the deposition of the Old Red sandstone upon it, if all the upper beds had not been stripped off them, and great erosion and denudation taken place in order to form that surface.

That old surface formed the bottom of the sea in which the Old Red sandstone was deposited, having been gradually depressed so as to form, first a shallow sea that was filled with gravel and shingle (now conglomerate and breccia); then a deeper sea, with red sand and red mud (now red sandstone and shale), till a thickness of several thousand feet of those beds had been accumulated, to say nothing of its being probably covered by the Limestone and Coal Measures. It has since then been all elevated bodily, and with greater intensity, and to a higher elevation in some places than others (as in the Galty and Knockmealdown hills). To such an extent also has that upward thrust been carried in those places, that the rocks of the hills still retain a greater altitude above the sea in spite of such a vast mass of materials having been removed from above them, and notwithstanding that they were originally below the level of those now lying in the valleys.

J. BEETE JUKES.

### 3. Formations or Groups of Rocks entering into the structure of the District.

#### AQUEOUS ROCKS.

	Name.	Colour in Map.
	Alluvium, Bog. &c., Drift (Limestone gravel).	Pale Sepia. Engraved Lots.
Carboniferous.	d <sup>5</sup> Coal Measures.	Indian ink.
	d <sup>1</sup> Upper Limestone.	Prussian blue (dark.)
	a <sup>3</sup> Calp. or Middle Limestone.	Not distinguished in this sheet.
	d <sup>2</sup> Lower Limestone.	Prussian blue (light.)
	d <sup>1</sup> Lower Limestone Shale.	Prussian blue and Indian ink.
Old Red Sandstone.	c <sup>3</sup> Upper Old Red (or Yellow) Sandstone.	Indian red (dark.)
	c <sup>2</sup> Old Red Sandstone.	Indian red (light.)
	b Lower Silurian beds.	Purple.

#### IGNEOUS ROCKS.

None.

b. *The Lower Silurian Rocks*, as seen within this district, consist of hard quartzose grits, either gray or green coloured, interstratified with slates of green or purple colours, sometimes variegated, and often strongly and finely "cleaved." Some of these beds, however, are of dark olive and blackish sandy shales, rather than slates. No fossils have been found in these beds, and their Lower Silurian age is therefore assumed from their analogy with beds in neighbouring localities, which are believed to belong to that period, and are similarly related to the overlying Old Red sandstone.

c. *The Old Red Sandstone.*—This group is capable of a subdivision by a boundary, which is, however, very arbitrary and indefinite, into two sub-groups.

c<sup>2</sup> *The Old Red Sandstone* proper consists of thick beds of red conglomerate below, containing pebbles of quartz, red jasper, and gritstone, interstratified with, and covered by deep red and liver-coloured sandstone and beds of dark red shale, often cleaved into slate. The basal conglomerates are often brecciated, and are then probably composed of materials derived directly from the Lower Silurian beds on which they rest. They sometimes also are very soft, both in their base and in their included fragments, the softness being probably due to decomposition.

Thickness, from 3,000 to 4,000 feet.

c<sup>3</sup> *The Upper Old Red (or Yellow) sandstone* is represented by a few beds of coarse yellow sandstones and green shales, alternating with red beds.

Thickness, about 800 or 1,000 feet.

No fossils have ever been seen in any of the beds belonging to the Old Red sandstone in the district included in this map, except some small fragments of plants in the Upper Old Red of Templemolaga.

d. *The Carboniferous group may be subdivided into the following sub-groups.*

d<sup>1</sup>. *The Lower Limestone Shale* is seen in one or two places within the district, and consists, as elsewhere, of dark earthy shales, occasionally weathering white, interstratified above with flaggy limestone.

Their thickness does not exceed 150 feet.

A few fossils have been seen in it, principally Fenestella.

d<sup>2</sup>. *The Lower Limestone* consists below of dark-coloured limestone, of which the beds are very distinct. Higher up the colour becomes bluer, and then grayer and paler, while the joints increase in number till the stratification becomes less obvious, and is sometimes greatly obscured. Chert is locally abundant.

Thickness, several hundred feet at least, but not easily determinable with any accuracy.

Fossils rather scarce, except a great abundance of crinoidal fragments which are almost universal.

d<sup>3</sup>. *The Calp or Middle Limestone.*—The distinctive characteristics of this sub-group seem to have died away from Kilkenny towards the south and west, so that it is no longer recognisable in this district.

d<sup>4</sup>. *The Upper Limestone.*—Light gray, thick-bedded, compact limestone, not separable from the lower limestone by any definite boundary, owing to the absence of the Calp, or middle black subdivision of the limestone group.

d<sup>5</sup>. *Coal Measures.*—Black shales below, and olive or gray grits above.

A thickness of three or four hundred feet is all that is known of them.

No fossils known.

The *Drift* and *Superficial Deposits* will be noticed in the detailed descriptions.

J. B. J., G. V. D., and A. B. W.

#### DETAILED DESCRIPTIONS.

##### 4. Position and Lie of the Rocks.

The northern portion of the Map was surveyed by Mr. A. B. Wynne; the southern and central part by Mr. G. V. Du Noyer.

Beginning at the western side of the map, the following are the places where the rocks are visible on the surface:—

*The Lower Silurian Rocks.*—In the stream that forms the boundary between the townlands of Fanningstown and Toor, a little west of the road, three-quarters of a mile south of Ardpatrik, are seen fine purplish and gray grits, cleaved, and greatly jointed, lying apparently at a high angle and supposed to belong to the Lower Silurian group. In the stream, about 100 yards north-west of this are found the red grits and conglomerate of the Old Red sandstone; and again, in that to the northward of it, more of these red grits and conglomerate are visible, the latter rock being very soft, and apparently dipping to the west at a low angle. Southward of this, and higher up on the hill, are seen the cliffs called the Black rocks of Ballyhoura, formed of thick beds of Old Red sandstone, consisting of a somewhat brecciated conglomerate, containing fragments apparently of the silurian rocks and pebbles of quartz. Lower down in the stream that runs by the Green Wood are seen some of the Lower Silurian beds, consisting of fine hard gray and olive slates and grits, and beds of fine green sandstone, dipping S.W. at 45°. Near the top of Seefin mountain, which rises above the wood just mentioned, may be seen projecting crags and rough prominences of Lower Silurian, green, gritty slates, cleaved nearly vertically, the cleavage striking somewhat S. of E. and N. of W. In a stream, about 500 yards south-west of the summit of Seefin, green and greenish-olive grits and slates of the Lower Silurian rocks are found. About half a mile S.E. of this, there is a stream meeting a rather sharp bend in the road from Ardpatrik to Kildorrery, and exposing a section of Lower Silurian, consisting of gray, bluish, and olive grits below, and fine green and gray grits and slates above, dipping S.W. at 45°.

On the top of a hill in Castle Oliver or Clonodfoy demesne, on which is the building called Oliver's folly, are some cleaved gray siliceous grits and dark gray slate, apparently dipping a little east of north at 50°, and rudely cleaved, the cleavage striking nearly N.E. and S.W., and being nearly vertical. In the valley eastward of this hill, near Ballinlyna house, in the stream west of the road, are a quantity of green and greenish-gray shales, and greatly cleaved slate, the cleavage striking nearly east and west. About 300 yards north of this, along the course of the same stream, come in gray grits; and dark gray grits and slates, probably much contorted, are found along the stream, until it leaves the townland of Clovers, where the Lower Silurian and Old Red sandstone may be seen very nearly in junction; the lowest visible bed of the latter being a soft variegated conglomerate. North-east of this, at Ballyroe hill, are seen thick beds of hard red conglomerate, full of quartz pebbles, the dip being slight to the north. A knob of conglomerate S.E. of this, about 500 yards, is called Carricknagat, and dips north at 20°. In a south-easterly direction from here, and along the boundary of the townland of Ballinlyna, dark gray and greenish Lower Silurian grits are seen, wherever the drift becomes thin.

Along the road from Kilfinnane to Daragh, and at the north end of Thomastown wood, where the road suddenly bends, there occur beds of Old Red conglomerate and hard purple grit, dipping north-west at 35° and 40°. In the Thomastown stream, about 660 yards south-east of this, and near some houses where two streams join, occur some dark gray grits and slates. About half a mile south of that, along the old road, are seen some dark gray olive grits and shales; and further south still, where the old and new roads join, at

the top of this valley, a cutting exposes some contorted beds of cleaved green and greenish-gray slate and ashy-looking grit: the beds seeming to have a contorted dip to the west, and the cleavage striking nearly east and west. In the valley of the river Keale, the Lower Silurian rocks are seen, two fields north of the church of Ballyorgan; on the road between the townlands of Ballydonohoe and Ballyorgan, they consist of concretionary, black, and dark gray, shaly-looking slate, of which the bedding is not apparent. In the stream that runs from Richchair, near its junction with the Keale river, are seen dark olive slates and greenish-gray grits; the cleavage nearly vertical, striking south of east.

About three-quarters of a mile north-west of Richchair, and in the townland of Coolavehy, a few yards above the road, variegated Lower Silurian slates are seen, and about 200 yards west of this, a junction of the Lower Silurian and Old Red sandstone occurs, the Silurian being variegated, red, green, and gray, hard, slaty grits and slates, with green grits, and the Old Red sandstone containing splintery fragments of green slate, passing up into thick, lumpy, soft, red conglomerate, having over it more red grits. At various places along the hillside in this neighbourhood the hard Old Red conglomerate appears, full of quartz and grit pebbles, averaging about the size of an egg. Further down the valley in the Keale river, where the townlands of Keale and Kileruaig join, in a wood, are seen hard gray grits, greenish, ashy-looking grits, and cleaved gray and olive-gray grits and slates.

Near Daragh bridge, and by the road north of it, are seen dark gray grits and slates, undulating and dipping southwards at 50°. In the Ahaphuca river, north of Ahaphuca bridge, is seen a mass of undulating and contorted gray grit and gritty slates, the contortions often sharp and sometimes pushed over, so as to have an inclined axis; they are well seen along an unfinished line of road, the continuation of which leads to Ballylanders. At somewhat less than a mile north of Ahaphuca bridge, on this road, is a large slate quarry, in dark greenish-gray slate, dipping south-east at 50°. Half a mile north of this quarry are seen more contorted greenish and sometimes bluish-gray cleaved grits and slates. For half a mile north again, gray and greenish grits are occasionally seen, having various dips, sometimes south at 45°.

At Annaglug bridge, the Annalushnia river falls into the Ahaphuca; following up the latter, just above the bridge, pale green and greenish-gray gritty slates are seen for some distance; the dips being very obscure. At somewhat less than a mile up this stream from the bridge, are seen green and gray grits and slates, cleaved, dipping generally south at 30°, the cleavage strike being a little north of east, and sometimes east 30° north. Returning to the new road at Annaglug bridge, green and gray grits, cleaved, may be seen by the roadside. Half a mile further north, and at the west side of the river, are seen more green and gray grits and slates, much jointed and cleaved. Further north still, about a third of a mile, this road is crossed by another, and on the west side of the stream at that place, are seen some gray grits and slates, dipping south at 30°. Northwards still, along the road, near some trees, green gritty slates and fine olive slates occur; here the dip is seen in a small wood: it is N.W. at 30°, the cleavage dipping south-east at 70°. On a hill rising from this spot, in a nearly easterly direction, the tops of gray, fine, gritty slates and quartzose grits are found, probably contorted. About half a mile south of the Ballyfauskeen crossroads are some greenish-gray hard grits and gritty slates, which seem to be much contorted; and on the road from the above named cross to Ballymahony bridge, about half a mile from the bridge, are some nearly vertical gray and greenish-gray grits and slates, striking 35° north of east. Near an angle in the road, two or three fields north of the bridge, are greenish-gray grits, dipping N.W. at 55°.

There is no section seen above the Ballymahony bridge in the river Aher-

low; but on its western bank, where it suddenly bends southwards by the road from Ballylanders to Mitchelstown, there is a dip of 55° to the north, in dull greenish ferruginous grit. At about a mile south of this curve, the Owenballynaheeney stream falls into the Aherlow, and following it from this point in a westerly direction for about half a mile, we find greenish-gray grits dipping north at 45°, and some bright red shaly beds, just where a farm road forms two rectangular turns close to the stream. On the high ground from which this stream runs, not much rock is seen, what there is being generally at the bottom of ditches, and consisting of fine gray and green gritty slates and grits. About Anglesborough the rocks are greatly concealed by drift, but the Lower Silurian may be seen in the deeper water-courses that leave the Galtees. Upon the northern declivities of those mountains the Lower Silurian rocks rise to a height of sometimes 2,000 feet, and consist of gray, hard, flaggy grits and fine gray and dark-coloured slates, coming out from below the Old Red conglomerate. On the west side of Temple hill some beds of purple grit, belonging to the Lower Silurian series, are to be seen. Between the summits called Temple hill and Lorrakoppul, the Lower Silurian appears at the surface, even on the crest of the watershed of the Galty range, spreading for a short space down its southern slope, round the heads of two streams that run southward. Except the narrow part of the crest just mentioned, the Lower Silurian is here surrounded on all sides by loftier eminences and slopes of Old Red sandstone, the Silurian being chiefly gray grits and slates, more or less cleaved.

In the Pigeon rock glen, south-west of this, between Knockaterriff and Temple hill, the coating of Old Red sandstone has, for a short space, been entirely worn through, and the Lower Silurian is exposed in the stream, surrounded by some of the lowest beds of the Old Red sandstone on every side.

Fig. 5. Diagram to explain the structure of the Pigeon rock glen.



This is merely a diagram and not a view of the glen. The supposed section across the front of the sketch, shows the level beds of Old Red sandstone, with its conglomerates, resting on the upturned and contorted beds of Lower Silurian slate rocks exposed in the bottom of the glen.

The Lower Silurian rocks here consist of alternations of fine green and gray grits, and slates of pale gray, quartzose grit, fine green mudstone weathering brown, and some remarkable purple beds of both grit and slate, similar to those on the west face of Temple hill, and like the last of the Lower Silurian beds to be seen in descending the Carrigeen stream, three-quarters of a mile to the eastward. The cleavage is well shown here, striking E. 20° S., and dipping N. 20° E. at 85°. The dip of the beds is various; but at one point, where the cleavage was observed as above, the

beds dipped E. 20° N. at 60°. About half a mile S.S.E. of Galtymore mountain the Lower Silurian is again exposed at one small spot, in a similar manner to that of the Pigeon rock glen; it consists of fine purple slate, shale, and gray grit, cleaved, the cleavage dipping south at 60°. All the eminences in this neighbourhood, such as Galtymore, Galtybeg, Knockater-riff, and Temple hill, are capped with Old Red conglomerate, which is also the nearest visible rock to the Lower Silurian outliers just described.

The *Old Red sandstone*, beginning at the eastern side of the quarter-sheet, where it is most seen, is found to consist of coarse, massive, red sandstones and conglomerates. This may be very well seen in the fine cliffs that overhang Loughs Muskerry, Borheen, Diheen, and Curra, which were surveyed by Mr. O'Kelly. It is seen also in the west branch of a stream that runs out of this quarter-sheet down Glenagarra, where the rocks are found to consist of red grits and sandstones, nearly horizontal, with slightly undulating dips to the south-east. In the stream between the townlands of Coolagarranroe and Skeheenarankey, running down to Cahergal bridge, the rocks are also seen. Here, where the section begins in the brook, nearly a mile above the bridge, red and salmon-coloured grits are found, dipping south at 35°; from underneath these come more red sandstones, dipping S. at 30°, and then a thick conglomerate, containing scattered fragments of altered black and green slate, and of fine black syenitic rock, in addition to the usual pebbles. It dips here south at 25°. Beds of similar conglomerate continue to crop out for a quarter of a mile farther, as we go up the brook, nearly in the direction of the rise, the dip varying from 15° to 20°, and bands of red sandstone intervening between its beds. Then occur soft red grits and shaly beds, sometimes conglomeritic, the dip getting lower, until the last beds seen (in this rather broken section of a mile and a half) are nearly horizontal, consisting of red and brownish soft sandstones.

The next stream to the west is the Attychraan river, running by Mountain lodge, and exposing in a course of four miles from its source, nothing but red and purplish grits, sandstones, and conglomerates, the sandstones being sometimes obliquely laminated, conglomerates, however, are scarce in the lowest beds, which are seen near the top of the stream, and the rocks there, are upon the whole, almost horizontal, though gently undulating, not having anywhere, from Galtymore to Mountain lodge, a dip of more than 10°. The stream running from the Lower Silurian exposure previously mentioned as crossing the crest of the range, and through Monabrack wood into this river, exposes, soon after it leaves the Lower Silurian, some beds of coarse Old Red conglomerate, consisting of red pebbles in a green base, and after it enters the wood it runs for half a mile across a similar conglomerate. The dip of these conglomerates is very slight, and the fall of the ground nearly equal to it, so that probably the stream runs for the most part on the same beds. Farther south they are covered by red grits and flagstones, dipping S. at from 5° to 10°. In the river west of the gate lodge of Mountain lodge, some yellowish coarse sandstones appear, dipping S. at 50°. Between this and the next stream to the westward in the townland of Carrigeen, and on an eminence of 1,000 feet, is a mass of hard red conglomerate, containing quartz pebbles, and dipping south at 20°. In the Behanagh river, immediately to the west of it, just above a long narrow stripe of wood, are seen red grits and conglomerates, dipping south at 20° or 30°. From here upwards, till the Carrigeen and Coolatiny streams join to form this one, red grits are occasionally seen, dipping southwards at 25°. Following up the latter of these streams, we reach the foot of the Pigeon rock cliff, which, like the beds in the stream below it, is formed chiefly of conglomerate, having below in the river, angular and other fragments of gray and purple grit in a green base. Farther up in this series of beds, the base is red, and beds of red coarse sandstone and grit come in.

South and west of the stream just described is another, which flows by Kil-

behenny castle, into the Funshion. This also exposes a section in the Old Red sandstone, the lowest beds seen being red sandstones and conglomeritic grit, dipping S. at 20°. There is then a wide interval, and the next beds seen in the stream, are nearly a mile north of Kilbehenny castle, consisting of red sandstones, grits, and shales, with beds of conglomerate, dipping S. at 40°. They pass upwards, towards the castle, into fine red shaly beds, having a band of white sandstone, and some green shaly beds, with pale purple felspathic grits interstratified with them. The upper 500 feet of this section forms a portion of that which has been called Upper Old Red sandstone, but it is difficult to separate it from the beds below.

Westward of this, the stream at Geeragh exhibits similar rocks, the basal conglomerate being soft; and in the next glen, in the same direction, a new road runs through a wood to Anglesborough from Mitchelstown, the cuttings giving a good continuous section in the Old Red rocks for a mile; the dip is from 20° to 35° to the south, and the beds are red sandstones, flaggy red grits, red shales, and conglomerates. In some purplish and liver-coloured fine sandstone beds, among the lowest seen in this section, were observed markings resembling those which have been elsewhere described as fucoids and annelid tracks. The bulk of the conglomerates is in about the middle of this section, and among the highest beds seen are some pale, purple and yellow beds, which have been included in the Upper portion of the Old Red.

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The boundary of the counties Cork and Tipperary, skirts along the east flank of Ballyarthur hill. The summit of this eminence is formed of the lowest beds of the Old Red sandstone, which consist of thick conglomerates, containing pebbles of red and greenish-gray grit, with a few pebbles of quartz and jasper; some coarse-grained, red, sandy layers being arranged irregularly through these conglomerates. The dip of these beds is, to the S.S.E. from 25° to 30°; and as their edges crop out to the north, they form a precipitous escarpment in that direction, the base of which slopes gradually into the comparatively low and undulating ground occupied by the Lower Silurian rocks on which these conglomerates rest. Passing west along this escarpment of the Old Red sandstone, its junction with the subjacent Silurian rocks is clearly seen for the distance of nearly one mile and a-half; the basal beds being formed of the same conglomerate as those just described. At the eminence, marked 912 feet, a good section of these rocks is obtained. A still better section of the Old Red sandstone and its junction with the Lower Silurian may be seen on Toorreagh hill, 852 feet, nearly three-quarters of a mile further to the west. Between these two hills, is the depression on the ridge through which the roads to Labbamolaga pass. In this depression, the boundary of the Old Red sandstone is thrown a little distance to the southward, the deflection being probably aided by a small fault running North and South on either side of the hollow, the rocks being slightly upcast over the intermediate space.

The section of the Old Red on Toorreagh hill is as follows:—Basal beds, consisting of hard red sandstone, free from conglomerates, 450 feet; coarse and fine conglomerates, the same as at Ballyarthur hill, 550 feet, passing up into coarse red sandstones—in all, 1,000 feet. The junction of the Old Red continues in an unbroken wavy line to a short distance south of Ahaphuca bridge.

Excellent exposures of the basal beds of the Old Red sandstone are to be seen on the side of the mountain along the boundary of the counties Cork and Limerick. West of Ahaphuca they consist of coarse and fine conglomerates, containing well-rounded pebbles of quartz and red grits, with occasional lumps and small pebbles of jasper. Sandy layers are deposited through the conglomerates, and some admirable examples of oblique lamination may be



observed in both, the dip of these beds is, S. 10° to 15° E., at from 15° to 20°. The Lower Silurian rocks of this district are best seen over the comparatively low and undulating lands of Labbamolaga. To the east in the townland of Derrylahan, at the branch roads, these consist of gray and occasionally micaceous grits and slates; the latter cleaved, East 30° South, vertical—the dip of the rocks unfortunately is not clear at this locality; the change of the strike of the cleavage as here given, is remarkable, its general bearings being East 15° North, inclined Southwards at various angles, sometimes as low as 55°. An example of this latter may be observed at the quarry in the Lower Silurian slates, close to the boundary of the Old Red sandstone on the north of Toorreagh hill.

Good exposures of the Silurian rocks may be observed on the road in the flat, north of Toorreagh hill, and in the Tooraleagan river, from the west extremity of the townland of Labbamolaga middle, to Ahaphuca bridge, with one exception, at the commencement of this section on the north where the Silurian rocks are contorted, the dip and strike are remarkably persistent, being south at from 35° to 75°, cleaved east 15° north, with an inclination to the south.

Over the southern slopes of what may be called the Ballyarthur hills, previously described, the Old Red sandstone is but rarely seen coming to the surface. Some of its upper beds, however, may be observed in the stream forming the boundary between the counties Cork and Limerick, which runs past Ballyarthur hill on the east, and joins the river Funshion at Ballaghaderry bridge, and also in the small stream to the west of it. There the beds which would come next above the conglomerates are hard and soft red sandstones, with red shales and slates, dipping south at 30°, and these pass up into the Upper Old Red, or the rocks sometimes called Yellow Sandstone; of these but an imperfect section is exposed in the west boundary stream. They consist, first, of yellow coloured sandstones, thin quartzose and felspathic yellow grits, hard red sandy and splintery shale, red sandstones, the uppermost beds being quartzose and felspathic yellow coloured and flaggy sandstones. In this section, which occupies an extent of more than a quarter of a mile, but one undoubted dip can be seen; it is S.S.E. at 30°.

Above the beds last described is a band of soft, pale yellow, rotten, earthy shale, which most probably is a decomposed portion of the dark gray shales of the Lower Carboniferous limestone, and in that respect resembling the Lower Limestone Shales at Granny castle, county Waterford. The sections just noticed are so imperfect that even their approximate thickness cannot be determined. At the distance of a few hundred feet south of the shale just described, and nearly three-quarters of a mile north of Ballaghaderry bridge, the basal beds of the Lower Carboniferous Limestone appear, dipping S.S.E. at 50°. They consist of dark gray crystalline crinoidal limestone, with shaly beds, and nodules of black chert. The next locality where the Upper Old Red beds can be observed is in the small stream courses at either side of the townland of Graigue, parish of Templemolaga. In that in the west of the townland, the section is as follows, commencing with the lowest bed:—Flaggy brown felspathic sandstone, greenish gray gritty shale with fragments of plants, brown yellow flaggy sandstones, red marly shale, red flaggy sandstone, yellowish brown sandstone, red marl, flaggy red brown soft micaceous grits, thick beds of red marl, yellow quartzose and felspathic sandstones, thin layers of red, yellow, and green marl, passing upwards into soft felspathic and quartzose yellow coloured sandstone. The dip of all these beds is nearly due south, at angles from 20° to 35°; and as they occupy an extent of about 1,000 feet, we may estimate their total thickness at 500 feet.

North-west of Kildorrery, in the stream which runs through the centre of Quit-rent mountain, a good exposure of the Upper Old Red beds, as well as the upper portion of the Old Red proper, may be seen. After a considerable

thickness of the Old Red is passed over, consisting chiefly of red flaggy sandstones, a few beds of conglomeritic sandstone, which pass up into a fine quartzose conglomerate, occupy the upper portion of the section. Above these are red earthy and flaggy sandstones, over which again are hard felspathic yellow sandstones, which may be considered as the base of the upper subdivision of the Old Red. A thick deposit of red flaggy sandstone rests on the beds last described, these pass up into brownish red, flaggy and slaty light brown and red sandstones, with red shales, over which are brown and yellow sandstones and flaggy grits; the remainder of the section is occupied by red and brown shales, light brown and yellow quartzose flaggy sandstones. The dip of all the beds, from the very lowest observed to the highest, is southwards, at from 25° to 40°, and the thickness of the observed portions of the upper rocks may be estimated at 700 feet. Detached sections of the rocks just described occur in the stream courses to the west, especially in the upper portion of the Ballintlea river above Ballintlea bridge.

From the foregoing observations, the thickness of the Upper Old Red sandstone which skirts the southern slopes of the Galty mountains and the Ballyhoura hills may be estimated at from 700 to 800 feet.

GEORGE V. DU NOYER.

On the hill called Carrigheny may be seen beds of red sandstone and conglomerate; the conglomerates containing pebbles of red jasper and white quartz, over which are beds of coarse-grained grits; they dip south at 20°.

Rather more than a mile farther west is the hill called Carrigeenamronetty, where beds of thick red conglomerate, with large pebbles, dip south at 10° or 15°. A mile still further west is the junction of the Old Red sandstone and Lower Silurian previously described, as to be seen to the north-west of Richchair. Between this point and the Black rocks of Ballyhoura, three miles to the northward, several exposures of the lower beds of the Old Red sandstone are to be seen on the slopes of the hills. Some beds, higher up in the formation, are also to be seen near the western borders of the map, in the valley of Glenanair, consisting of red felspathic sandstones and grits, with some beds of conglomerate, dipping south-west at 20°. West of this stream is another rivulet, in a wooded glen, in which some beds of Old-Red sandstone are to be seen, consisting of brownish red grit and soft sandstone, dipping south at about 40°; these pass under beds referred to the Upper Old Red sandstone, consisting of alternations of red grits, with red shales, and some brown, green, and yellow beds of similar character, dipping to the south at angles varying from 30° to 40°.

Returning now to Ardpatrik, at the western end of the Lower Silurian district of this sheet, and continuing the description of the Old Red sandstone to the northward, red conglomerate is to be seen about 600 yards S.S.E. of the ruins on Ardpatrik hill, the beds dipping north at 35°, while on the western side of the hill, beds of soft red fine-grained ferruginous sandstone dipping north from 45° up to 90° may be seen in a stream. Few exposures of rock are then to be seen till we reach the neighbourhood of Ballyroe and Ballinalyna, where they have been already described.

The Lower Limestone is seen on this map in the low land, south of the Galtees, in the townland of Kilglass, in two quarries, one on the road to Anglesborough, where it is pale gray, without visible bedding, and the other about half a mile to the N.E. of it, near a wooded glen, where it is dark gray, compact, with crystalline beds, and dips south at 40°. About half a mile eastward of this, near Geeragh house, is a large quarry, in dark, gray sub-crystalline, and compact limestone, full of fossils, dipping south at 35°. About the same distance eastward again, similar limestone is seen in another quarry, dipping south at 45°. At Kilbehenny, some gray, compact lime-

stone may be seen, dipping south at 55°; and in two quarries, about half a mile S.E. of this, in the townland of Ballynamona, the same sort of limestone, but somewhat cherty, occurs, dipping south at 50°.

At short distances to the W., N.W., and S. of Skeheenrankeypool, blue thick-bedded, having the surfaces of the bedding rough, compact limestone is seen in several quarries; that to the south dipping south at 35°, the others, 45° and 55° in the same direction. In the most westerly of these quarries, the limestone is cavernous.

*Coal Measures.*—On the long rising ground, south of these last mentioned quarries, the coal measures shales are sometimes seen *in situ*, but best at a new east and west road that runs on the top of the rise. There are seen olive grits and shales in the ditches beside the road, apparently much contorted. In the townland of Knockacommane, near a ford that crosses the Funshion, are some old trial pits for culm, and an adit. In the black carbonaceous shaly debris, at the pit's mouth, traces of fossils are to be found. The beds inside the adit are olive gritty shales, contorted.

*Drift.*—The drift on this sheet, so far as seen by me, is almost entirely local, all that covering the Lower Silurian being generally fine, yellow, ferruginous clay, with small fragments of the Lower Silurian rocks in great quantity. Near Carrigeen crossroads, south-west of Kilfinnane, is a large limestone gravel pit, close to the boundary between the Lower Silurian and Old Red. In the limestone and old red mixed drift, at the north-west corner of the sheet, are many pebbles of syenitic and trap rocks. The Old Red sandstone is always covered thinly on the eminences, and more thickly below, with its own debris, of a bright red colour.

A. B. WYNE.

*Southern portion of the Map, commencing with the Western termination of the Knockmealdown Mountains.*

In the descriptions of Quarter Sheet 45 S.E., an account is given of the structure of the Knockmealdown mountains, showing them to consist of one great anticlinal, with smaller undulations upon it, the beds of which dip north and south into the valleys at either side of the range. The same structure is continued into the district included in the present quarter sheet, but the elevation of the hills, and the inclination of the beds gradually diminish towards the west.

*Old Red sandstone.*—In the small stream at the extreme eastern limits of the map, which has its rise east of the summit of Knockavadeen hill, 882 feet in elevation, and flows to the north into the flats of Ballyporeen, a small imperfect section of the Old Red sandstone, and its upper Yellow sandstone beds, is obtained.

When first observed at the head of the stream, the dip of the dark red sandstone and shales is but 5° to the north. They soon flatten, roll at the same low angle the opposite way, flatten again, and in this manner spread over a distance of half a mile, till, at the angle of the stream, west of the branch-road, leading west of the summit of Lyrefune hill (Sheet 45 S.E.), they dip steadily northwards at 10°, increasing to 30°. This dip and inclination they now maintain for the distance of about 1,000 yards north of the branch-road, where the Yellow sandstone beds set in; here the angle of dip is 40°, flattening to 30°. These beds are quite similar in lithological character to those described in the adjoining sheet to the east, and consist of yellow grits and sandstone, brown earthy sandstones, coarse yellow felspathic grit with numerous beds of dark red shale occurring throughout. On the south side of the ridge, in the county Cork, better sections through the Old Red sandstone are obtained than in the north; one of the best occurring in the stream between the townlands of Lyre East and West, which has its rise on the south

watershed of the mountain, south-west of the summit of Lyrefune hill. The first rocks, or those lowest in the section, appear on the county boundary (Tipperary and Cork); they consist of dark red sandstones and slate, in places nearly horizontal, and rolling at various angles up to 35°. This irregularity in the mode of occurrence in the Old Red sandstone beds continues southwards for the distance of half a mile; the dip then becomes somewhat more steady from 15° to 25° southwards, for the distance of about 300 yards, when they again flatten to 5°; and as we descend the stream the rocks again roll to the north and south, as they approach the Upper Old Red beds of the Araglin valley. The length of the exposed section just described is something more than a mile in a direct line from the county boundary on the north, and at this point the Upper Old Red appears. The exact spot where these beds commence cannot be determined, as the transition from the dull purple or dark red grits and slates of the Old Red proper to the light yellow sandstones and shales is very gradual, yellow and green beds frequently occurring in a mass of dark red rock. However, at the southern termination of the plantation, along the east of the stream, certain beds, which may be regarded as typical of the Upper Old Red, are observed; they consist of hard yellow grits and sandstone, with red and gray slate, green and gray slates and flags, having throughout the mass dark purple slate beds here and there. The general dip of all these rocks is south from 10° to 70°, and they are observed in a continuous section for the distance of about 700 yards. Passing westerly from this stream, rocks similar to those last described are observed near the termination of the stream, between the townlands of Lyre and Billeragh East, and the section, here, supplies the upper portion of that last noticed, for the true Upper Old Red beds are observed to pass gradually upwards into yellow and purplish rotten shale (cleaved), containing small *Orthides* and *Orthoceras*, above which are soft blue and gray slaty shales, decomposing into a dark clay, in which *Fenestella* and other fossils are found. These shales become converted into a black clay, and occur immediately below the limestones of the Araglin valley, and are to be regarded therefore as the true Lower Limestone shales of the south of Ireland.

About one mile to the west of the locality just described, and in the stream which runs south from the old barracks into the Araglin river, a broken section of the Old Red sandstone is also obtained. Here, as in the river-courses lately alluded to, the rocks are observed only at intervals, and are never continuous in their dips for any great distance, hence no very instructive sections are obtained. In a sharp turn of the river, north of the village of Ballard, where the rocks roll southward at low angles, there are some beds of coarse whitish or yellowish sandstone, which contain numerous grains of feldspar. These beds pass up into the yellow or upper part of the Old Red, and form portions of the underlying rocks of the western extremity of the limestone of the Araglin valley. The various shallow stream-courses which run over the southern slopes of the portion of the Knockmealdowns now under review, all exhibit short and detached sections through the Old Red sandstone and its upper subdivision; and over that portion of the district where these rocks curve round to the west and north, before they plunge under the great mass of the limestones of Rockmills and Mitchelstown, they appear at the surface only in detached and widely-apart localities, barely sufficient to enable their geological boundary to be traced with comparative accuracy.

At the hill of Caherdrinny, 695 feet in elevation, a few beds of coarse-grained, hard and flaggy red sandstones appear. Beds on the same geological horizon, but finely conglomeritic, occur on the northern extremity of Gortnahown wood, at the elevation of 855 feet. Adjoining these to the west the lower portion of the Upper Old Red may be rolled in by the curves in their beds, which admits the limestone of Ballindangan in a bay-shaped

outline into these lower rocks. The band of Upper Old Red sandstone, which skirts the Old Red beds, lying south of Ballindangan, consists of hard brownish yellow sandstones, greenish brown flaggy grits; thin irregularly-bedded quartzose, yellow sandstones and gritty shales, with dark red sandstones and shales frequently occurring through them. Short sections of these rocks are to be seen in several places. Firstly, on the east bank of the river Funshion, where it runs south from Ballykenly bridge to Airhill; here a thick mass of hard red earthy sandstone appears dipping nearly due north at  $60^{\circ}$ . It is quite slaty from cleavage, which strikes E.  $10^{\circ}$  N., inclined  $65^{\circ}$  to the south. Secondly, on the west bank of the river, below the last locality, where dark purplish red shales are slaty from a cleavage, which strikes E.  $10^{\circ}$  N., inclined  $40^{\circ}$  to the southwards, the dip of the beds, (determined merely by some thin quartzose yellow sandstones occurring about 200 feet north of where they are last seen), being S.  $10^{\circ}$ , W. at  $25^{\circ}$ . Thirdly, in the small plantation, close to, and east of, Ballylegan castle, on the south bank of the Funshion; here the flaggy yellow sandstones dip S.  $10^{\circ}$  E., at from  $25^{\circ}$  to  $30^{\circ}$ ; but in a short distance they curve over to the north, and dip from  $55^{\circ}$  to  $60^{\circ}$ , being overlaid by thin gritty brown shales, having dark gray shale on the top. Close to this locality, but on the north bank of the river, the same yellow sandstone beds, last observed, appear again, but dipping S.  $15^{\circ}$  W. from  $30^{\circ}$  to  $40^{\circ}$ . Northward of these beds, and absolutely abutting against them by means of a fault which strikes nearly east and west, are the lower beds of the Carboniferous Limestone, at first apparently vertical, but gradually lowering to an angle of  $70^{\circ}$  in a distance of 700 feet north of the fault. From this point easterly, for the distance of nearly four miles, following the outline of the upper portion of the Upper Old Red, till the rising ground, north-east of Ballindangan, is reached, there is not a single spot along the flanks of the higher ground where the Upper Old Red rock comes to the surface, its geological boundary being determined chiefly by the form of the ground, and the mode of occurrence of the Lower Limestone, which occupies the adjoining county to the west.

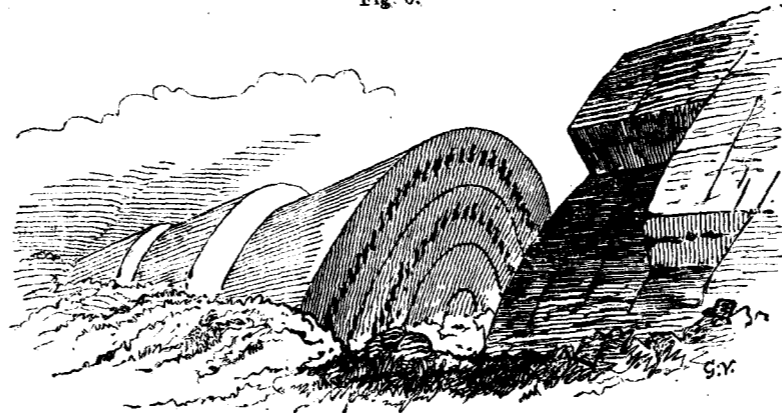
The rising ground to the north-east of Ballindangan, in the townland of Flemingstown, is formed by beds of Yellow Sandstone, which, on the southern side of the hill, dip south at  $40^{\circ}$ , curve round by the west, and on the northern side dip north-west at apparently low angles, having bands of dark red and light brown shale through them; the dip of the beds here being determined by that of the gray lower limestone adjoining. This nose, as it were, of the Upper Old Red sandstone here terminates the northern portion of the western extremity of the Knockmealdown range. From this point, the Upper Old Red beds appear to strike easterly in a regular waved band along the flanks of the mountains south of Mitchelstown, as far as the eastern limit of the map at Ballywilliam house; and, strange to say, in the entire distance which it is evident these rocks must extend, viz., from Flemingstown on the west to the stream west of Ballywilliam house, nearly eight and a-half miles, there is not a single spot where the Upper Old Red comes to the surface *in situ*: its geological outline, therefore, either along its upper or lower limits, is entirely drawn as an inference, and not from observation.

*The Limestone.*—If we now commence the examination of the limestones at the eastern extremity of the map near Ballywilliam house, we find it rarely exposed at the surface. To the north of Ballywilliam house, some quarries show hard, very light gray, compact, thick-bedded limestone, traversed by regular joints which strike north and south, crossed by others east and west; but the dip of the beds is not apparent. Proceeding north for nearly a mile, the long low ridge of coal measure shale is reached, which has been described by Mr. Wynne; close to the south boundary of which, in the townland of Cooladerry, is a quarry of hard light gray limestone. No limestone is to be seen west of the quarry last noticed for the distance of fully three miles, till we

reach the townland of Carrigane, on the eastern side of which is a quarry which exposes gray and finely crystalline limestone, dipping S.S.E. at  $40^{\circ}$ . In the strike of these beds, on the bank of the Funshion river, are some thin gray limestones, with chert layers, dipping south at  $60^{\circ}$ . Proceeding down the Funshion river, gray, and dark gray, hard and finely crystalline limestone, which when freshly broken, is very fetid, is observed at either side of Kilbenny bridge, dipping south at  $40^{\circ}$ . Lower down the river, in the townland of Coolyregan, the limestones are well seen at several places, but changed in lithological character, becoming light gray and magnesian, weathering sandy, and white; the dip of the beds not apparent. Occasionally, large *Orthoceras* with *Fenestella* and other fossils are found in this rock. There are only three or four other places along the Funshion where the limestone appears, till the river enters the demesne of Mitchelstown castle. Here, in Donnelly's fields, it is light gray, compact with black chert, the beds dipping south  $10^{\circ}$ , east at  $75^{\circ}$ . Lower down the river, the limestone is similar in dip and composition, and the chert occurs in numerous layers and nodules, but is white in colour.

In Carriganroche wood the limestone is very light gray, and flaky, without any apparent dip; but in a quarry close to and south-east of the wood, thick and thin bedded light gray limestone, with numerous layers of white chert, dips north  $10^{\circ}$ , west at  $80^{\circ}$ . At the crossroads outside the demesne, at its south-west corner, light gray, compact, finely crystalline limestone is seen, the lowest exposed beds being full of black chert.

Fig. 6.



Diagrammatic Sketch. Cleavage in Limestone, re-arranging chert nodules. On road, S.W. corner of Mitchelstown Castle Demesne.

In the quarry to the east of the road, the beds on the north are vertical, and striking east  $10^{\circ}$  north; they rapidly and very regularly curve round to the east and E.S.E., with a dip of  $30^{\circ}$  to  $40^{\circ}$ , and are all cleaved in the direction of about east  $20^{\circ}$  north: the planes of cleavage inclined  $70^{\circ}$  to the northward. It is remarkable that in the cherty beds the nodules of the flint have been lengthened in lines parallel to the direction of the cleavage.

There are many quarries in the limestone around Mitchelstown; that most used for building purposes being in Mulberry-lane, the rock is a hard, compact, very light gray limestone, flaky looking. The dip is nowhere certain in this quarry, though it may be suggested by the lamination of the rock, which is inclined to S.  $10^{\circ}$ , E. at  $35^{\circ}$ . The joints are very well developed and numerous, striking north and south vertical. On the main road, a short way north-east of this quarry, are others, where the light gray compact limestone has occasional thin crystalline layers through it, as also

layers of chert. In the centre of the quarry are some hard, black, flaggy beds, and below them light gray compact limestone. The dip here is well seen, being north  $15^{\circ}$  west, at  $75^{\circ}$  to  $85^{\circ}$ .

If we now follow the course of the Funshion after it leaves Mitchelstown castle demesne, it runs very nearly on the strike of the limestone beds, so that though they often appear along its banks, they afford but little information as to the general structure of this rock in the mass. At Killoe house the limestone is light gray, flaggy, and finely crystalline, dipping southwards at  $60^{\circ}$ , and close by, northwards at  $80^{\circ}$ . This synclinal makes the same beds vertical at the distance of nearly one mile further to the west, and then they disappear near Marshalstown bridge. On the road, three-quarters of a mile north of this bridge, a large quarry has been opened, exposing light gray compact, and gray finely crystalline, limestone, the beds of which varying from 5 to 20 feet in thickness, the dip in one place being south at  $45^{\circ}$ . All these beds are jointed north and south, the joint surfaces being inclined  $60^{\circ}$  to the west.

By following the road which leads south from Marshalstown bridge to Newgrove house, the limestone may be observed in many quarries and knolls, but for the most part, so irregular is the direction of the dip of its beds, that no continuous progressive section can be obtained. Near the cross-roads north of Ballydeloughy, a few beds of dark gray, crystalline, crinoidal limestone, containing chert, and resting on massive bedded and finely crystalline light gray limestone can be traced for the distance of more than half a mile to the westward, having a dip north  $10^{\circ}$  west, to north  $30^{\circ}$  west at  $75^{\circ}$ . Close to Newgrove house, the lower limestones rest against the Upper Old Red sandstone, by a fault before described, which conceals the lowest beds of the limestone; the section being gray crystalline beds passing up into dark gray, earthy, and shaly beds, with thin, lumpy, crystalline layers, full of fossils, vertical at first, but lowering to  $80^{\circ}$  to the north, over these, are hard, dark gray, crystalline, and compact, thin-bedded limestones, with chert, followed by dark, bluish gray, thick beds, and terminated by gray crystalline beds, dipping north at  $70^{\circ}$ . To the east of this locality, north of the ford at Nutgrove, and adjoining the Upper Old Red, the following section is seen:—lowest beds, dark gray, thin-bedded, with shales, passing up into thick-bedded, crinoidal, crystalline, and cherty limestone, all dipping north-west at from  $40^{\circ}$  to  $50^{\circ}$ . The sections just described afford the only evidence we possess, in this portion of the district, of the presence of a thin band of lower limestone shale between the limestone and the Upper Old Red.

The limestone in the neighbourhood of Kildorrery, especially to the north and east, and along the banks of the river Funshion, southwards to Rockmills, appears in many places. Its general character is light gray, compact, often finely crystalline and crinoidal, and containing abundance of chert; the dips are steady either to the southwards or the northwards, giving a general strike parallel to the main limestone valley of Mitchelstown and Shanballymore; but the amount of inclination of the beds very variable, in one locality, about a mile and a-half west of Rockmills, in the townland of Carrigleagh—the general direction which the limestone has, of an east and west strike is altered, in a thick set of beds which are exposed for a distance of half a mile in a low rough escarpment having a north and south direction. On the north of it, the beds are dark gray and compact, with abundance of chert, the dip being north-west at  $60^{\circ}$ ; these pass downwards into light gray, finely crystalline, massive beds, which are jointed in the direction of north  $10^{\circ}$  west, having, as they pass to the south, a dip of  $50^{\circ}$  to the west; they then curve round to the southwards, and allow the upper beds which were first described to come again into view, with a dip to the W.S.W. of  $45^{\circ}$ .

Adjoining the village of Rockmills, the light gray, finely compact, or else crystalline limestone frequently loses its bedding, and becomes amorphous,

though exposed in cliffs of seventy or eighty feet in height; and it is here associated with dark gray, compact, and earthy limestones, containing abundance of black chert, which dip south from  $25^{\circ}$  to  $70^{\circ}$ .

Further description of the limestones which occupy the district to the westward of Kildorrery and Shanballymore is scarcely needed, as they are the same beds as those just described followed in their natural line of strike; they may be seen in many quarries and small eminences scattered over the country, the dip of the beds being to the northwards or the southwards at angles varying from  $30^{\circ}$  to  $80^{\circ}$ , jointed in lines running either north and south or  $15^{\circ}$  to the west of north. There is but one locality along the entire line of boundary between the Carboniferous Limestone and the Upper Old Red of the northern portion of the map, where the Lower Limestone shales are visible, and even that imperfectly, viz., in the stream which forms the boundary of the counties Cork and Tipperary, and which runs southward from the east side of Ballyarthur hill.

*Drift.*—The limestone drift extends over the greater portion of this valley, and is deposited against the northern and north-western flanks of the Knockmealdown range up to an elevation of from 300 to 400 feet, then following, with tolerable regularity, the outline of the Upper Old Red sandstone. It is remarkable that this drift deposit does not appear to reach to a corresponding height along the southern flanks of the Galtees or Ballyhoura hills, being here covered by a thick accumulation of more recent detritus derived from the local Old Red sandstone. The northern limit of the drift, as thus defined, extends far over the limestones of the Mitchelstown and Shanballymore valley, in one place approaching near to Kildorrery.

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