Memoirs of the Geological Survey.

# EXPLANATIONS

TO ACCOMPANY

SHEETS 194, 201, 202 OF THE MAPS

OF THE

# GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING A PORTION OF THE

## COUNTY OF CORK.

*Published by Order of the Lords Commissioners of Her Majesty's Treasury.*

DUBLIN:

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE.

PUBLISHED BY

ALEXANDER THOM, 87 & 88, ABBEY-STREET;

HODGES, SMITH, & CO., 104, GRAFTON-STREET.

LONDON:

LONGMAN, GREEN, LONGMAN, AND ROBERTS.

1862.

THE

# GEOLOGICAL SURVEY OF THE UNITED KINGDOM

IS CONDUCTED UNDER THE POWERS OF THE

8TH & 9TH VICT., CHAP. 63.—31ST JULY, 1845.

---


DIRECTOR-GENERAL OF THE GEOLOGICAL SURVEY OF THE UNITED KINGDOM:

SIR RODERICK IMPEY MURCHISON,

D.C.L., F.R.S., G.C.ST.S., &C., &C.

*Geological Survey Office and Museum of Practical Geology, Jermyn-street, London.*


---

## IRISH BRANCH.


*Office in the Museum of Irish Industry, 51, Stephen's-green, Dublin.*

LOCAL DIRECTOR:

J. BEETE JUKES, M.A., F.R.S., &C.

SENIOR GEOLOGISTS:

G. V. DU NOYER, M.R.I.A.; W. H. BAILY, F.G.S.; G. H. KINAHAN, ESQ.; F. J. FOOT, M.A.

ASSISTANT GEOLOGISTS:

J. O'KELLY, M.A.; A. B. WYNNE, F.G.S.; J. KELLY, ESQ.

COLLECTORS OF FOSSILS, &C.:

MR. C. GALVAN; MR. A. M'HENRY.


---

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.

---


AGENTS FOR THE SALE OF THE MAPS AND PUBLICATIONS:

Messrs. LONGMAN, GREEN, & Co., London;

Messrs. HODGES, SMITH, & Co., Grafton-street, Dublin;

ALEXANDER THOM, Printer and Publisher, Abbey-street, Dublin.

# EXPLANATIONS

TO

ACCOMPANY SHEETS 194, 201, 202 OF THE MAPS

OF THE

# GEOLOGICAL SURVEY OF IRELAND.

---

## General Description.

The district now to be described is part of the county of Cork, the chief towns in it being Bandon and Clonakilty, with the lesser places called Ballyneen, Enniskeen, and Inishannon, in the northern part, and Ballinascarty, Timoleague, Courtmacsherry, Kilbrittain, and Ballinspittle, in the southern part. It includes the coast line from Galley Head to the Old Head of Kinsale.

### 1. *Form of the Ground.*

This ground is part of a country characterized by many parallel ridges and valleys running from a little south of west to a little north of east, the ridges having their sides often cut by small but deep lateral valleys, and being sometimes completely traversed and interrupted by such valleys.

The only ridge, indeed, which extends unbroken through this district is the one north of Bandon, the crest of which forms the watershed between the basin of the Bride river and that of the Bandon river. This seems to have a mean elevation of about 600 feet above the sea, its highest point being 719 feet about three miles S. of Crookstown. The loftiest point in the district is one of 905, near the N.W. corner of Sheet 194, on a part of the watershed between the basin of the Bride river and that of the upper part of the Lee.

The ridge to the S.W. of Bandon has one point of 670 feet about a mile W. by S. of Kilmessan lodge. South of this no ground reaches to 600 feet, the next highest point being one of 580, about two and a-half miles N. of Timoleague.

The district includes parts of the three following principal valleys.

The first is the valley of the Bride river, which rises but a little out of the limits of the district, and passes Crookstown and Ryecourt on the way to its junction with the Lee (*see Explanation of Sheets* 185 *and* 186).

The Bandon river, which rises on the southern flanks of Shehy Mountain, breaks its way through the hills into a longitudinal valley that stretches from Dunmanus Bay to Carrigaline and the southern part of Cork Harbour. The river runs along this valley from Dunmanway (in Sheet 193) nearly to Inishannon, a little below Bandon, where, after receiving a considerable tributary called the Brinny river, it is deflected to the S.E., and cuts in a deep winding course through

much higher ground than it would have had to traverse had it continued along the valley to Carrigaline, a course followed by the little river Owenboy, which falls into the valley three miles N.E. of Inishannon. The height of the water of the Bandon river at Ballyneen is 120 feet, and it becomes tidal at Inishannon, a distance of thirteen miles, ultimately finding its way by a farther tortuous course of about ten miles into a corner of Kinsale Harbour.

The small river Argideen drains the third and smallest valley of the three, falling at Timoleague into a shallow muddy arm of Courtmacsherry Bay.

Two small transverse valleys—that of Ballinspittle and that of Kilbrittain—bring brooks into Courtmacsherry Bay.

Similar transverse valleys, at right angles to the general bearing of the ridges, may be noticed in that of the brook entering Dirk Bay, in the Clonakilty estuary, in the flat entering Dunworley Bay, in the mouth of Kinsale Harbour, and in the little deep blind cove that runs for a mile into the high land just to the west of that mouth.

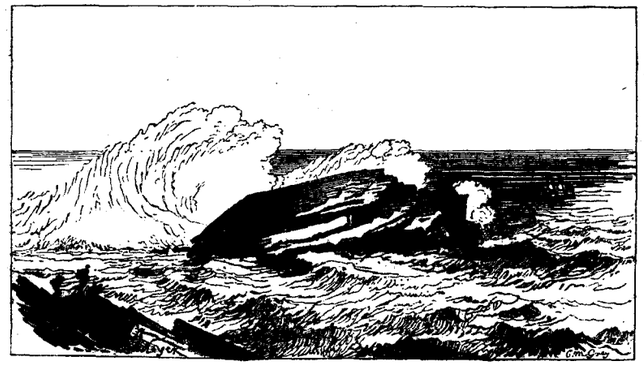
It is indeed but a further extension of the same feature which produces the indentations of Clonakilty Bay and Courtmacsherry Bay, separating the once-continuous ridge that stretched across these bays into the promontories of Galley Head, the Seven Heads, and the Old Head of Kinsale.

The extremity of the Old Head of Kinsale, which rises to 139 feet above the sea, is begun to be cut off from the land by a subterranean sea passage, through which the light can be seen from each of the two indentations of the land, which are hence called Holeopen Bays.

Galley Head is in like manner nearly cut off from the mainland, and formed into an island; and this is, doubtless, one of the ways in which the rocky islets, with vertical cliffs, like those of the neighbouring coasts, have been formed.

The Sovereign islands, off the mouth of Oyster Haven, afford examples of these, of one of which the following figure is a sketch, taken by Mr. Du Noyer during a gale of wind. J. B. J.

Fig. 1.





## 2. *Geological Formations or Groups of Rocks entering into the Structure of the District.*

### Aqueous Rocks.

| | Name. | Colour on Map. |
|---|---|---|
| | Bog, Alluvium, &c., | *Pale sepia.* |
| *Carboniferous.* | d². Carboniferous Limestone, | *Prussian blue (pale).* |
| | d¹. Carboniferous Slate, | *Prussian blue and Indian ink.* |
| | Coomhola Grits, in Carboniferous Slate, | *Ditto, with yellow dots.* |
| *Old Red Sandstone.* | c³. Upper Old Red Sandstone, "Yellow Sandstone," | *Indian red (dark).* |
| | c². Old Red Sandstone, | *Indian red (pale).* |

### Igneous Rocks.

| | | |
|---|---|---|
| D.P. | Greenstone, | *Dark crimson.* |

c¹. *Old Red Sandstone.*—These rocks, especially over the northern portion of the district, are bright liver-coloured or purple sandstones and slates, with greenish gray grits and pale greenish shales and slates, the maximum thickness of all being fully 4,000 feet, but the base of the deposit not reached.

c². *Upper Old Red or Yellow Sandstone.*—The upper 500 to 700 feet of the Old Red sandstone proper exhibits a greater amount of pale yellow quartzose and flaggy sandstone, with occasional gray grits in its upper parts, and light-brown and yellow shales, than in any other portion of the deposit; it has, therefore, been recognised as a distinct group. Some of the shaly beds contain impressions of plants.

d¹. *The Carboniferous Slate.*—This series of beds consist of dark gray, sometimes black, slates, with thin gray or greenish grits and flags, often interstratified with the slate beds. The slates are sometimes worth working as rough roofing slate, especially where the dip of the cleavage is in the opposite direction to that of the beds.

The maximum thickness is not less than 6,000 feet.—G. V. D.

*Coomhola Grits.*—In the parts where the Carboniferous slate attains to a great thickness, it generally has in its lower portion many thick beds of strong grit, similar grits occurring in the Upper Old Red sandstone below it. When this is the case, it is often difficult to decide on the boundary between the Old Red sandstone and the Carboniferous slate. The only good mark of distinction is the colour of the slates, which are interstratified with the grits.

The lowest bed of dark gray or black slate may be taken as indicating the base of the Carboniferous slate; and the highest group of red slates as indicating the top of the Old Red sandstone.

Marine fossils occur only in the beds which have dark gray and black slates, while plants may be found near the junction in both sets.

The grits interstratified with the gray or black slates are now called Coomhola grits, from the name of a place near Glengariff, where they are well exhibited.

A thickness of at least 900 feet of these grits may be seen in some sections in the southern part of this district.

There is a peculiar set of fossils in the Coomhola grits, of which *Avicula Damnoniensis, Cucullæa Hardingii,* and *trapezuim, Dolabra securiformis, Modiola Macadami,* and *Curtonotus elegans,* are the most frequent. They are however, mingled with such species as *Rhynchonella pleurodon, Spirifera cuspidata,* and *disjuncta* (or *Verneuillii*), and many other Carboniferous species, which are also found here and there throughout the Carboniferous slate.*

In the Crookstown valley the Old Red sandstone is succeeded by beds of black or gray shale or slate, which do not attain a greater aggregate thickness than 60 or 100 feet, before they are conformably covered by solid beds of Carboniferous limestone. These little beds of shale might be called the Lower Limestone shale, but they are precisely the same in lithological and palæontological character as the upper part of the Carboniferous slate.

The Crookstown valley, in which this thin band of shale is all that lies between the Carboniferous limestone and the Old Red sandstone, is now separated by a ridge of Old Red sandstone, about four miles wide, from the Bandon valley, in which the Carboniferous slate lies. How thick it may be just S. of that ridge is not ascertainable, but it is certainly several hundred feet, and it reaches certainly over 6,000 feet in the Old Head of Kinsale, at a distance of eighteen miles S. of Crookstown.

This thickening of the beds between the Old Red sandstone and Carboniferous limestone, as we proceed southwards from a certain line, is readily to be accounted for, on the supposition of a depression having commenced towards the south, after the deposition of the Old Red sandstone, and continued for a long time, until it gradually affected the rocks more and more towards the north. In the early part of the depression sand was occasionally deposited, forming the Coomhola grits; but as it proceeded and extended towards the north, mud or argillaceous matter prevailed, until the greater part of the materials of the Carboniferous slate were accumulated. The depression then became general, and the Lower Limestone shale was deposited over all the S. of Ireland; and, subsequently, the depression became still more general, and the sea therefore wider, and the land more remote, and limestone only was formed.

The thickening of the Carboniferous slate from 60 to 6,000 feet in the space of eighteen miles, would all be subtended by an angle of less than 5°; since a plane sloping regularly under water at an angle of 5°, from the water's edge to a distance of eighteen miles, would there attain a depth of more than 8,000 feet.—J. B. J.

*The Carboniferous Limestone.*—This rock occupies but a few square miles of the district at its northern margin under the low land lying to the E. of Crookstown as far as Aherla, where it appears in numerous small bosses rising from beneath the alluvial deposits of the valley.

* A little west of the R. C. Chapel of Ballyheedy, in the townland of Skehanagh, and at one or two other localities near it, the late James Flanagan formerly collected some fossils, which included fragments of fish remains, which were considered by Sir P. de M. G. Egerton, who kindly inspected them for us, to belong to the genus *Cœlacanthus*. There were also impressions of large *Posidonomya*, and of plant stems, some of which were dichotomous, and like the *Filicites dichotoma* of Haughton. These fossils occur in some peculiar soft gray shale, very earthy, and not like the usual character of the Carboniferous slates.—J. B. J.



The rock is light gray in colour, finely crystalline, and for the most part massive-bedded or sometimes even amorphous.

In some of the lower beds on the north side of the valley the Fenestella is a common fossil, but those which are most abundant are Encrinite fragments.

The Limestone is everywhere cut up by well-developed joints, which have a bearing of about 10° to 15° W. of N. and E. of S., crossed by others at nearly right angles. Black chert is rarely met with in these Limestones.

In the Cashelmore quarry, to the W. of Ryecourt, small bunches of copper have been from time to time discovered occurring in an interstratified layer, as I was given to understand.

From the steadiness and regularity of the dip observed in the Old Red sandstone rocks along the boundaries of this Limestone, it would appear probable that the Limestone must attain a considerable depth in the centre of the trough or synclinal, possibly 1,500 feet; but this is uncertain, as there may be concealed curves in it.

D. *Greenstone.*—In a small glen to the S. of Mishells House, and at the distance of about one mile and a-half N. of Bandon, in the midst of the Carboniferous slates, there is a mass of hard green crystalline Greenstone, the base hornblendic and the crystals pale yellowish feldspar. The rock is imperfectly seen *in situ*, but large sub-angular boulders of it are scattered up and down the glen, which has an E. and W. direction for the distance of about one mile and a quarter, with a width of over a quarter of a mile. G. V. D.

---

### 3. *Relations between the Form of the Ground and its Geological Structure, and general account of the latter.*

The two high ridges, parts of which stretch across the northern portion of the district, are formed of the Old Red sandstone.

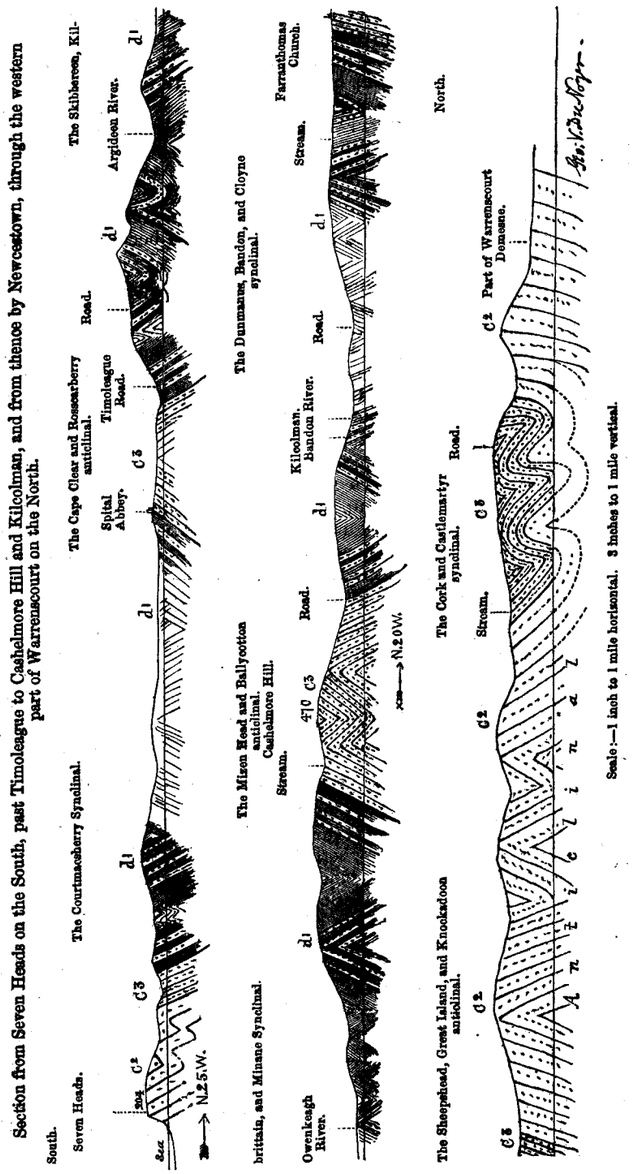
These two include between them the synclinal trough in which the Crookstown limestone lies, which, as is usual with the Carboniferous limestone in the S. of Ireland, makes some of the lowest ground in the country.

Coming S. into the valley of Bandon, and traversing the country between it and the sea, we no longer find the high ground formed of one geological formation, and the low of another; but the ridges are formed of the harder grits, whether they belong to the Carboniferous slate or the Old Red sandstone, and the valleys and low ground of the softer parts of those formations.

The direction of the ridges and valleys, however, is the result of the long rolling undulations into which the beds have been thrown beneath the surface, over axes which range about E.N.E. and W.S.W. These undulations throw the rocks into long anticlinal ridges and synclinal troughs in the way shown in the section in fig. 2. which has been drawn by Mr. Du Noyer, across the district at right angles to the strike of the axes. The denudation which has removed so vast a mass of rock, in order to cut down to the present undulating surface, always left the harder rocks a little more prominent than the softer ones, and thus finally produced the existing longitudinal hills and valleys of the district.

Fig. 2.

Section from Seven Heads on the South, past Timoleague to Cashelmore Hill and Kilcolman, and from thence by Newcastown, through the western part of Warrenscourt on the North.






The folds of the rocks are excessively numerous; but six principal anticlinal lines may be distinguished along the western side of the district, by the rise of the Old Red sandstone to the present surface of the ground.

1. The most southern anticlinal curve is the one of which we have the northern flank running through the Old Head of Kinsale, the Seven Heads, and Galley Head, the remainder of the curve being now under water. North of this the trough of the Courtmacsherry synclinal brings in the Carboniferous slate.

2. This synclinal is complicated by a minor anticlinal curve, the axis of which rises towards the west, and brings out the Old Red sandstone into the second anticlinal, that of Kilkerran, which has the northern branch of the Courtmacsherry synclinal on the north of it.—(*See Engraved Sections on six-inch scale, sheet* 4.)

3. The third anticlinal, that of Cape Clear and Rosscarberry, rises to the north of this; but its axis sinks towards the east, and the Old Red sandstone disappears accordingly, though the anticlinal curve is perceptible in the Coomhola grits S. of Kilbrittain, and in the Carboniferous slate to the eastward.

4. North of the Rosscarberry anticlinal, the Carboniferous slate is brought in by the Skibbereen, Kilbrittain, and Minane synclinal, from beneath which there rises towards the north the *fourth* anticlinal, that of the Mizen Head, Ballydehob, Dulieve, and Ballycotton. The axis of this fourth anticlinal sinks towards the east in our district, so that the Old Red sandstone disappears to the eastward of Bandon Mountain and Kilhessen, though the anticlinal form is indicated by the occurrence of the Coomhola grits on each side of its strike towards Shippool, and the axis rises again still further east, so that the Old Red sandstone reappears in Dulieve (sheet 195), and stretches thence to Ballycotton Island.

5. To the northward of this comes in the great synclinal trough that stretches from Dunmanus Bay, by Bandon, Carrigaline, and Cloyne, to Ballycotton Bay; and then again to the north, rises the fifth anticlinal ridge, that which runs continuously from Sheepshead between Dunmanus and Bantry Bays, to Knockadoon Head and Cable Island between Ballycotton and Youghal Bays.

North of this we have another large synclinal trough running from Bantry Bay, by Cork and Middleton, to Youghal Bay. The ground over this synclinal is sometimes lofty, as in Shehy Mountain, beneath which the rocks dip on either hand inwards, and the upper rock is Carboniferous slate towards the west; while towards the east it is Carboniferous limestone where the slate is thin or altogether absent, and nothing but the Lower Limestone shale in its place.

6. The sixth anticlinal rises to the north of this, and may be distinctly traced all the way from Glengariff to the town of Youghal. This, however, is but the commencement of the rise of a series of great undulations, which complicate the larger anticlinal curve which lies between the valleys of the Lee and the Blackwater, and which we have included under the term of the Great Mangerton Anticlinal. It stretches from Dursey Island and Valentia on the west, to the headlands of Waterford, called Ardmore Head, Mine Head, and Helvick Head, on the east, and includes numerous small synclinal troughs.

NOTE.

In speaking of the form of the ground described in some of the Explanations of Sheets in the S. of Ireland, I have had occasion to call attention to the very singular courses pursued by some of the rivers. A river suddenly deviates from the broad and flat longitudinal valley in which it has been running for many miles, and, notwithstanding that that valley is continued, with no apparent sensible alteration in form, directly out to the sea, the river turns at right angles to it, down a ravine that cuts through broad ridges rising, perhaps, to a height of some hundred feet above the level of the valley.

The most conspicuous instance of this remarkable phenomenon is that of the river Blackwater, which runs down a well-marked limestone valley between lofty continuous ridges all the way from the borders of Kerry into county Waterford, that valley being continued straight out to the sea in Dungarvan Harbour. At Cappoquin, however, a transverse valley commences at right angles to the longitudinal one, and cuts through the lofty ridges on the south, leading out the Blackwater into Youghal instead of Dungarvan Bay. There are several analogous instances in the county of Cork, and the turning of the Bandon at Inishannon, and its lateral escape into Kinsale Harbour, instead of what would seem its more natural continuation into that of Cork, is one of them.

This apparent anomaly in the courses of the rivers had long been a puzzle to me; and it was only in studying the maps for the purposes of this Explanation that I hit upon the clue which will, I believe, ultimately lead us to the solution of the problem.

The little river Brinny rises in the centre of the ridge that forms the watershed of the Bandon on the north, and runs southwards down the slopes of that ridge, cutting deeply down into the rocks. From this glen it issues on to the broad valley that runs along the foot of the ridge, receiving there the waters of the Ballymahane and Sale brooks. It then cuts through a smaller ridge by another deep valley to the point where it joins the Bandon, there running also in an equally deep valley. The course of the Bandon river below the junction is much more nearly in the line of the Brinny than it is in the line of its own course above the junction, and the Brinny seems to receive it as it does other brooks from the west, none flowing into it from the east except some small ones much lower down.

It would seem then as if the Brinny ran along some old line by which the waters of the west were carried into Kinsale Harbour, although the principal ridges and valleys of the country run direct for Cork Harbour. In this case, the Bandon becomes a tributary of the Brinny, or the longer and larger river a tributary of the less, which seems at first an absurdity. The essential point, however, is the age of the respective valleys. It appears, in this case, that the lateral valley proceeding directly from the watershed had been worn down across the parallel longitudinal ridges before the completion of the longitudinal valleys, so that, on the last elevation of the land above the sea, when the River Bandon commenced to run along the foot of the northern ridge, it found a valley already complete for it, by which its waters were carried through the ridges on the south out to the sea in that direction, instead of following the longitudinal valley to the sea by way of Carrigaline.

On subsequently examining other sheets of the map, I found the existence of a strong lateral valley, or the junction of two lateral valleys, an invariable accompaniment of these sudden changes in the course of the large rivers. In the case of the River Lee and Cork Harbour, the deep valley of Glanmire points directly to the opening between Blackrock and the Little Island, and leads to that of Passage West between Monkstown and the Great Island, while the



Passage at the east end of the Great Island is similarly related to the brook called Owennacurra, which comes down by Middleton.

In the case of the Blackwater, the Glenshelane river comes down about a mile E. of Cappoquin, through a deep ravine from the mountains on the north, while at Lismore, three miles west of Cappoquin, there issues, in a similar manner, the still larger brook called the Owenshad river. It is between the mouths of these two glens, and at a point where they would naturally meet if continued to the south, that the ravine of Dromana commences, through which the Blackwater escapes across these southern ridges into Youghal Harbour.

I cannot doubt, therefore, that the transverse valleys which cut completely across the lesser ridges have in some way been caused by the erosion of the lateral brooks that spring from the watershed of the greater or dominant ridge.

If we refer to the Andes, the fact of the rivers springing from one Cordillera cutting through another one, parallel to it, is always taken as proof that the former is the older of the two, and that the elevation of the second did not proceed faster than the rivers could cut down channels for themselves through it. Can we, however, suppose it possible that the disturbance which has thrown the S.W. of Ireland into so many parallel undulations has acted since the production of the present surface of the ground, and that that elevation lifted first one ridge and then another without any subsequent denudation. Such a supposition is utterly disproved by the way in which the subterranean curves in the beds are related to the undulations of the surface, which shows at once that the form of the surface has been produced by denudation across the edges of the already highly-inclined beds.

Space does not allow of the question being fully discussed here, but I believe the true explanation will be sought in referring the production of the river valleys to some older surface far above the present surface of the ground, on which certain features having been impressed, subsequent action continued to grave deeper and deeper some of the more locally-marked of those features, while other more general ones were greatly altered, if not in some instances wholly changed. J. B. J.

---

## Detailed Descriptions.

The district was surveyed by Mr. W. L. Willson, now of the Geological Survey of India, Mr. A. Wyley, since Superintendent of the Geological Survey of the Cape of Good Hope, and Mr. G. V. Du Noyer, who has drawn up the following detailed description from his own notes, and those of Messrs. Willson and Wyley.—J. B. J.

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

*The Crookstown and Waterfall District.*—The Carboniferous limestone which occupies the flats of the River Bride, to the east of Crookstown, is well exposed, and extensively quarried for burning and building. The largest quarries are those of Castlemore, to the W. of Ryecourt. Here the rock is light gray and finely crystalline, dipping to the S.S.E. at from 60° to 65°. Fenestella has been found in the lower layers. In the upper beds some small bunches of copper have been met with. To the E. of this, in the townland of Coolmucky, several quarries have been opened in the limestone, which is here unbedded but finely laminated, and traversed by well-marked joints, having a compass bearing of from 10° to 15° N. of W. and E. of S. At the distance of one mile further to the E., the limestone is again extensively quarried, to the townland S. of Aherlabeg and Rathard. Here the rock is also finely

crystalline and unbedded, but probably dips N. as it lies on the southern side of the synclinal. In the former townland some of the limestone takes a good polish as a marble. Close to the cut of the map, in the townlands of Aberlamore and Kilcree, there are a few small quarries opened in the limestone through the drift, the rocks being principally the same as that last described.

The Lower Limestone shale is represented in this neighbourhood by a few layers of dark gray, earthy slate, and a few gray grits, which appear on the road-cutting in the townland of Knockaneroe, at the distance of 700 yards due E. of the village of Crookstown, and again by some bluish gray slates and grits, with a few yellowish and brown grits and shales, which are exposed on the road side in the southern end of the townland of Aherlabeg, and distant three miles to the eastward of Crookstown. On the northern side of the synclinal there is not a trace of these beds, and the narrow band of them represented on the map, is inserted from evidence derived far to the eastward of the district, as well as from that just adduced. It is quite possible that this portion of the Carboniferous rocks may really be here present, but concealed by the alluvial deposits of the valley, for no rock is seen in the place which these shales ought to occupy.

The Yellow sandstone and Old Red beds which rise from beneath the limestone, are best seen in the small cutting made by the stream which divides the townlands of Inchirahill and Farranes, just above the Macroon Road, and at the stream and road-cutting where the ground rises close to and north of Farranes cross-roads. In the former place the Yellow sandstone is made up of beds of purple slate, with greenish, yellow, and brownish sandstone, and greenish, sandy, as well as earthy slates, all dipping to the S.S.E. at from 65° to 80°; at the latter locality the beds exposed are all supposed to belong to the Old Red sandstone proper, and are all purple sandstones and slates, their dip being similar in direction to the former, but varying in amount from 40° to 75°. All these beds are pervaded by a cleavage, the dip of which is about 10° to 20° W. of N., at from 65° to 75°. The exposed thickness of rock here must be about 1,290 feet.

On the southern side of the synclinal, south of Hickstown, and in the stream-cutting dividing the townlands of Cloghduff and Kilbonane, we have a section through the Old Red and Yellow sandstones similar to that last noticed, the dip of the beds being to the northwards at 80°.

To the east of this, at the distance of two miles and a quarter, we find a good section through 3,000 feet, or thereabouts, of the Old Red sandstone exposed by the road-cutting along the bank of the River Bride, S. of Crookstown. The upper portion of this section exposes some green beds in purple slates, but the remainder is made up entirely of purple grits and massive beds of purple slate, the dip of all being almost due north at from 70° to 80°, the cleavage planes dipping about S. 10° to 20° E., at from 50° to 70°. The rocky ground to the S.W. of Crookstown House, exposes some greenish and purple slates and grits, with occasional greenish gray beds, all dipping to the E.S.E. at about 80°, thus forming the continuation in an easterly direction, of the Farranes beds previously noticed. To the N.W. of this, around Lissardagh House, the rocky ground exposes short sections in the Old Red sandstone, which are mostly a repetition of brownish purple sandstone and slates, with here and there a bed of light yellowish gray grit, and a green slate. All these beds have a steady dip to the S.S.E. from 40° to 75°, and the cleavage, which more or less pervades them dips to the opposite point, at from 80° to 85°.

In the glen to the S. of the little village of Kilmurry, the Yellow sandstone beds, which are a continuation westerly of those near Crookstown, appear here and there along the different road-cuttings and the banks of the River Bride, where it forms the northern boundary of the townland of Poularick. These beds agree in every respect with those previously described as belonging to this group.



The high ground to the S. of Greenville, and in the townland of Cleavagh, to the S.E. of it, is made up of beds similar to those last described. They are nowhere well exposed, merely appearing in scattered localities over the district. On the southern side of this synclinal, and at the N.W. angle of the townland of Knocknareirk, along the roadside, there are some beds of Yellow sandstone, shale and purple slate, but they are all much contorted, and are, therefore, repeated over and over again.

The exposures of the Old Red sandstone, along the southern side of the Crookstown part of the Cork and Castlemartyr synclinal, are confined to isolated bosses of rock, and such superficial sections as are afforded by lanes and road-cuttings. Of the former the most important is that seen along the low ridges known as Green Hill and Ballynalaght, which extends westerly from Raheen House, for the distance of a mile and a half, where we find green and purplish sandstones and slate beds, with occasional light green sandstones and sandy slaty beds. The average dip is to the N.N.W., at 60° as a maximum angle.

At the distance of two miles to the east of Raheen, and in the townland of Mossgrove, the Old Red sandstone appears in numerous bosses over the comparatively high ground of this locality. The beds consist of purple sandstones and slates, cleaved in the direction of E. 30° N., either vertically or with the cleavage dipping S. 30° E. at 70° to 80°. On the southern side of this rise of ground, the beds dip to the S.S.E. at from 45° to 60°, being on the southern side of the great anticlinal of Old Red which here stretches across the district in an E.N.E. and W.S.W. direction, and is, indeed, continuous across Ireland, from the Sheepshead promontory on the W., to Knockadoon Head, between Ballycotton and Youghal bays, on the east.

Along the southern side of the Crookstown Valley, S. of Aherla, and in the stream-cutting forming the boundary between the townlands of Rathard and Aherlamore, a short superficial section is exposed in the Upper Old Red and the Old Red sandstone proper, the former, for the most part, being made up of thin yellow sandstones, shales, and slates, with brownish beds and purple slates, and the latter almost entirely of purple grits and slates, the line of boundary between the two groups of rock being quite arbitrary.

For the most part those beds are vertical, but in one place they appear to dip to the S. at 75°. As they are on the southern side of the great limestone synclinal they ought to dip to the opposite point, but this discrepancy may be due to a local turning over of beds which are either vertical or inclined to the northwards at high angles.

At the distance of one mile to the east of this, in the small stream-cutting which is close to Kilcrea House, we find red slates and grits, with a few layers of reddish sandstone, exposed for the distance of 1,500 feet, the beds being possibly all vertical.

The district to the S. of this comprised in Sheet $\frac{6}{4}$ of the six-inch map, is, for the most part, covered with local drift, the red sandstone appearing only here and there at three localities, viz., along the stream dividing the townlands of Moneen and Rear Oar, and this latter townland from those of Knockaneleigh and Knockaphreaghane, and lastly, on the road to the east of this, below Ballymountain House, where it passes through the townland of Raheen.

The beds exposed at Kilcrea House, if followed in their natural line of strike easterly, are again seen in the stream-cutting dividing the townlands of Knockaneamealgulla and Ballygroman Lower, and still further to the east in the stream bounding this latter townland and that of Killumney. In both of those places the beds of Old Red and Yellow sandstone are quite

the same in appearance as before, and the general dip is to the northwards, at from 75° to 80°.

As we pass still further to the E., into the N.E. angle of the district, where it is traversed by a portion of the Cork and Bandon Railway, we find a tolerably comprehensive section through the upper part of the Old Red sandstone proper in the stream course to the west of the townland of Ballyshoneen; the beds for the most part consist of red and green slates and shales, which dip to the northwards at from 40° to 70°, for the distance of less than half a mile, when they are suddenly bent over to the southwards, and then are rolled from N. to S. in repeated folds, as they are followed southwards to near Corbally House.

The section through the Old Red sandstone, afforded by the cuttings of the railway, and on the banks of the stream to the west of it, expose only the ordinary red and purple sandstones, shales, and slates, so frequently observed elsewhere over this district, and the dips are never steady to one point of the compass for any great distance after passing the uppermost 1,000 or 1,500 feet of the deposit. The anticlinal, therefore, is mainly formed of crumpled beds, which, however, again become steady in their dip as they approach its southern boundary, when the band of Yellow sandstone again makes its appearance.

In the railway-cutting S. of Abbey View, and in the townlands of Ballyleigh and Killea, a short section is exposed in a portion of the Old Red and the Yellow sandstone; the former consist of soft red earthy shales and slates, covered by thick-bedded red sandstone, and the latter of yellow sandstone, and green and red slates and shales. The beds are rolling, but as a mass dipping to the southwards at low angles, and in this manner passing beneath the Carboniferous slate of the Inishannon district.

If we proceed westerly along the Old Red sandstone, from the railway-cutting S. of Abbey View, we find that the different stream courses which traverse the southern slopes of the Old Red sandstone anticlinal afford sections through those beds and the Upper Old Red, which are more or less instructive. If we take these in order from east to west, we find that in the stream to the W. of Ballinphellic House there are cleaved red slates, with green bands, in the upper part of the section which we suppose to represent the Yellow sandstone, the dip of all being to the southwards at 60°, and the dip of the cleavage being to the N.N.W. at from 65° to 75°. To the W. of this, at the distance of something over a mile, in the stream course to the W. of Fortwilliam, we have cleaved red slates, with occasional beds of thick red sandstone, representing the Old Red sandstone, and a large mixture of greenish and yellowish beds of both grits and slates to form the Upper Old Red. The dip of all is to the southward, at from 55° to 75°.

*The Ballyneen and Callatrim District.*—The rocky ground which lies to the north of the village of Ballyneen, and between it and Castletown, exposes Old Red sandstone beds, which dip northwards near the latter place at high angles, but southwards at 75° to 85°, as we proceed towards the south. The beds, for the most part, consist of purple slates and smooth earthy dark purple shales, with occasional purple and dark red sandstones; all the softer beds are cut up by cleavage, the planes of which dip to the northwards at 80°.

As we pass southwards, towards Ballyneen and Enniskeen, we find the upper part of the Old Red sandstone to become interstratified with hard, greenish gray, and yellowish grits, slates, and some shales, having purple beds through them, and then eventually pass up to the great Carboniferous slate series which lies to the southwards.

The Carboniferous slate occupies by far the greater part of the district, lying to the S. of the Old Red sandstone ridge which extends across northern portions of the map, and the beds are here and there well exposed in bosses,



and in the cuttings made by roads, lanes, and small streams. This is especially the case directly to the north of Ballyneen and Enniskeen, where the gray and greenish gray flags and grits and gray slates very frequently appear.

Ripples or current marks may be observed on some of those flags, and fossils have been found in those grit beds which appear in the lane opposite to the parochial school-house of Enniskeen, in beds on the same geological horizon as those to the west, in which fossils have also been found.

In the townland of Teadies Upper, and at the distance of about 200 yards N.E. of the school-house, thick beds of smooth dark gray slate have been quarried for roofing purposes. At the distance of three miles to the east of Enniskeen we find the Coomhola grits and Carboniferous slates tolerably well exposed along the line of country extending from Murragh church on the north, to Mawbeg House on the south, the locality where the grits appear being indicated on the map by rows of yellow dots.

Along the glen of the Ballymahane river, and the lower part of that of the Sall river, both of which have been excavated along the strike of the beds for the distance of five miles, we find frequent exposures of the Carboniferous slate in shallow road-cuttings, but no continuous or instructive section. Where they are last seen here is along the road, from the first turn S. of Gurteen Cottage northwards to near the Roman Catholic chapel of Farranhavane, where we find a repetition of dark gray, bluish, and greenish gray slates, with occasional grit bands. At the distance of half a mile E. of the southern end of the section, and on the roadside, near Callatrim Retreat, we find some Coomhola grits, dipping to the N.N.W. at 45°, and these same beds, or those immediately above them, are found to contain fossils. G. V. D.

*Greenstone of Mishells.*—North of Cullatrim there is a little valley in which Mishells House stands. This valley is full of blocks of a greenstone, consisting of distinct crystals of light-coloured feldspar, thickly scattered through a dark green hornblendic crystalline mixture, the two materials being in about equal proportions. Some blocks, just by a cottage on the roadside due S. of Mishells House, are very large and very close together, as if they were *in situ*, while the bottom and sides of the valley are strewed with blocks of it, that are evidently not *in situ*, but may not have travelled very far. The rounded form of a boulder is no test of the distance it has travelled, for crags of greenstone weather into round blocks without travelling at all.

There is no other site from which these blocks could have been derived than this little valley, but there is nothing to tell us how the greenstone is related to the surrounding rocks.* J. B. J.

*Innishannon and Ballinhassig District.*—At the distance of three miles to the N.E. of this, in the northern end of the townland of Brinny, the Coomhola grits make their appearance on the E. side of the road, with a dip to the S.S.E. of 65°, and those beds, which consist of thick greenish gray grits and bands of dark gray slate, appear again at the distance of about a mile in the ancient rath called "Cashel Fort." Cucullæa were found in the upper portion of these grits. The section afforded by the Cork and Bandon Railway, where it passes along the E. side of the Bandon river, opposite to Woodlands, and further to the northwards from the river up to Rockfort House, is one of the most instructive in the district. At its southern end

* Dr. Allman, and his brother, Mr. Richard Allman, called my attention to this greenstone, and took me to the Mishells valley before the district was surveyed. Dr. Allman had been led to it by observing the quantity of greenstone boulders scattered over the country about Bandon.—J. B. J.

we find a thick mass of dark gray and greenish gray slate, cleaved vertically, the dip of the beds not being apparent. Beneath these are thick gray and brown sandstones and gray slates, dipping to the S.S.E. at from 30° to 70°. Lower down the river, and opposite to Woodlands, we have thick greenish gray Coomhola grits and gray slates, bent anticlinally at angles varying from 15° to 30°, and presenting a thickness of about 250 feet.

Beyond this, on the opposite bank of the river, we have contorted beds of greenish gray grits and slates, and further to the north we have what appear to be the same beds, but as we approach Rockfort House, we get into the dark bluish gray slates and thin gray grits, characteristic of the main mass and upper part of the deposit. The beds here dip to the N. at from 50° to 70°, and thus appear to be above those previously noticed.

On the southern slope of the high ground W. of Cross Barry, in stream and road-cuttings, we have the greenish gray and gray slates and ripple-marked grits tolerably well exposed, the general dip of the beds being to the southwards, at from 20° to 55°; and in a quarry on the lands of Annaghmore House, we find dark bluish gray calcareous shales and slates, very fossiliferous, crinoid fragments being, however, the chief fossil.

On the southern bank of the Bandon River, opposite to Inishannon, as well as inland, we find dark gray and bluish gray slates, and thin grits, all dipping to the N.N.W. at from 45° to 70°. Opposite to Frankfort House, there are pale gray and bluish gray argillaceous slates, with bands of brown rotten shale, which Mr. Willson remarks are fossiliferous looking; the cleavage in these beds is E. 10° to 20° N. vertical.

In the railway-cutting at the Halfway House, and in the little glen to the N. of it, gray slates and grit bands are well exposed, the dip of the beds being to the southward at from 45° to 65°. Fossils have been found here in the beds exposed by the stream-cutting above the little waterfall at Ballinhassig. To the S. of this, on the by-road skirting the western side of the townland of Ballyheedy, thin gray and bluish gray soft shales, with alternations of thin greenish gray grits are observed. Many of these beds are fossiliferous. To the S. of this, and close to the R. C. chapel of Ballyheedy, we find soft dark bluish gray slates, slightly carbonaceous, and containing fossils.* At the distance of one mile and a-half to the S.S.W. of this, on the bank of the stream forming the eastern boundary of the townland of Killaminoge, some Coomhola grits and greenish gray slates appear, bent anticlinally at 45°, the axis of the curve pointing to the N.E. These grits contain fossils, especially those which are of a dark brown colour. At the distance of about one mile and a quarter S.E. of this, at the N.E. angle of the townland of Shanavally, some Coomhola grits, and dark gray and greenish gray slates again appear, dipping to the northwards at 60°. The exact locality of these beds is indicated on the map by yellow dots.

In the stream-cutting bounding the townland of Carhoo South on the W., and in the townland of Ballyreganbeg, to the south of it, we have a tolerably good exposure in the Carboniferous slate beds. At the northern end of the section we find hard gray slates, with occasional nodular layers dipping to the northwards at 55°, and cleaved in planes, which also dip to the northwards at 80°. Below this are smooth gray slates, with nodular layers dipping apparently N. 10° W., and S. 10° E., the cleavage being E. 15° N., with a dip of 70° to the northwards. The section terminates with gray slates and nodular layers, dipping to the northwards at 35°. The rocks are thus seen for the linear distance of one mile, and if we allow the beds an average dip of 30°, and deduct for contortions, I think we may infer that a

* This is the locality in which the fragments of fish (Cœlacanthus) were found, together with Posidonomya. J. B. J.



thickness of about 1,900 feet of rock is here exposed. South of this, in the N.W. angle of the townland of Melfontstown, fossils have been discovered in the dark gray slates; and again to the W.S.W. in some similar beds on the road side, close to and N. of Dunderrow, which are in the same line of strike though distant from them one mile and a-half.

*Bandon and Bandon Mountain District.*—In the vicinity of Bandon there are many large quarries opened in the Carboniferous slates, and some rocks appear also in several small stream courses. Of the latter we have a good example in the extreme western end of the townland of Coolfadda, W. of Bandon. Here we find dark bluish gray nodular slates, with occasional bands of hard grit, all dipping to the S. at from 50° to 60°, and exposed for the distance of about 560 yards, thus presenting a thickness of about 1,290 feet. In the streets and lanes of the upper part of the town of Bandon, the Carboniferous slates just show at the surface, apparently dipping S. at 70°.

To the E. of Bandon, at the distance of over one mile, and along the eastern side of the townland of Moanarone, all the observed beds dip to the northwards at 75°; hence it appears that the town of Bandon, and that portion of the valley of the Bandon River occupied by Castle Bernard demesne, and some miles of country in the same line of strikes to the eastward, lies in a synclinal curve of the Carboniferous slates. At the southern end of the Moanarone section we find some beds of coarse yellow and greenish gray micaceous sandstones, with occasional thin beds of dark gray shales. Fossils have been found on these grits which belong to the Coomhola grit group. Their exact position is indicated by yellow dots on the map. Directly in the strike of these beds, and at the distance of one mile to the W.S.W., two quarries have been opened in similar grits at either side of the road passing between the townlands of Knockanreagh and Clancoolmore; doubtless they are the same beds, and they contain the same fossils.

As we pass S.W. from Bandon, by Oldchapel village to Butler's cross-roads, we find purplish gray slates exposed at this last locality; and as similar beds are seen in this line of strike westerly, and as they pass downwards into decided purple beds, we have classed them as belonging to the Yellow sandstone or Upper Old Red group. The best exposure of these rocks is to be seen along the road which leads to the S.W. from Hare Hill, over the high ground N.W. of Brandon mountain school-house; the beds are only superficially exposed, but they clearly consist of alternations of pale purple and gray slate and grit bands, with occasional greenish gray slates, all cleaved in the direction of E. 10° to 15° N., the planes of cleavage dipping to N. 10° to 15° W. These beds must occur in the form of an anticlinal, as we soon find the Coomhola grits and Carboniferous slates again appearing on the southern side of Brandon mountain school-house, while as they are also found towards the east in the strike of the red beds, it is clear that the axis of the anticlinal must decline towards the east, and the upper beds arch over it.

If we follow these pale purple and grayish beds in their strike to the W.S.W., past Cashelmore House to Serges Cottage and Kill House, and thence out of the district by Knocks cross-roads, we find the same kind of rocks as those just described, occurring in detached bosses, and appearing in road and lane cuttings. They are best seen at Serges Cottage, and to the E. of it, in the townland of Garranelahan, where pale green sandy slates are of frequent occurrence in the pale purplish gray beds. From this locality, for the distance of three miles and a-half to the W.S.W., these Upper Old Red beds are but imperfectly seen; but at Knocks cross-roads, and southwards to Springfield cross-roads, we find greenish gray slates, with some pale purple beds exposed in road-cuttings. From Springfield cross-roads easterly for the distance of over two miles, the Carboniferous slates are constantly exposed in lane and road cuttings.

*The Banks of the Bandon River below Inishannon.*—Along the banks of the Bandon River, from Cliffort southwards, throughout its course in the district, the Carboniferous slates are more or less well exposed, chiefly in low cliffs, or between the level of high and low water. At the sharp bend in the river at Poulnalong Castle, and below it at Rock Castle, and then again further south, by Ship-pool Wood and the angle of the townland of Laherne, we find dark gray, sandy and argillaceous slates, with thin greenish gray grits and flags, all interstratified and rolling to the northwards and southwards alternately, at various angles, from 20° to 50°. In the S.E. angle of the townland just named, fossils were discovered in thick green and greenish gray grits and slates.

On the opposite bank of the river, in the townland of Kilmacsimo, some Coomhola grits make their appearance bent anticlinally to the W. and S. at dips of 60°; their position is indicated on the map by yellow dots. To the S. of this, at either side of the river, low cliffs expose an unbroken section through dark gray slates and thin gray grits for the distance of about half a-mile; and as the beds all dip to the southwards, for the most part at angles of 60°, we may infer that the thickness of rock there exposed is about 2,200 feet.

The cliffs at Short Castle, on the W. bank of the river, and in the townland of Knocknagappul, are formed of dark bluish gray glossy slates, which are here and there full of bullet-like concretions, which often contain a nucleus of iron pyrites, or carbonate of lime. The dip of these beds is not given in the six-inch map, but the cleavage which pervades them is said to have a dip of S. at 75°; it is possible that they may be over those previously noticed.

Between Peafield and the narrow creek leading to the little village of Ballinadee, and in the lands of Oak Hill, rather extensive slate quarries have been opened in beds which, lithologically, are the same as those at Short Castle. Here the dip is very distinctly to the north, at 80°, flattening to 65°; and the strike of the cleavage is parallel to the bedding, but dipping to the south at 85°. Some of the hard nodules in the slates contain an admixture of galena in the pyritic nucleus. These nodules, when repeatedly struck with the hammer, become quite warm. The uppermost beds of this section are those appearing along the shore under the lawn of Oak Hill; they consist of thin irregular gray grit bands, with slate partings, dipping to the northwards at 65°, and flattening to 40°.

On the opposite shore of the river from Holy Hill House southwards as far as the creek leading to Holy Hill, a distance of over three-quarters of a mile, we find a repetition of hard gray slates and thin sandstones, with dark gray earthy slates and nodular layers, rolling to the north and south at the northern end of the section, but having a somewhat steady dip of from 40° to 80° to the northwards; as we follow the beds southwards, the cleavage for the most part dipping southwards, at from 65° to 80°. At the southern end of the section the cleavage dips northwards at 70°, in beds which dip N. 15° W. at 30°.

From Kilgobbin Castle southwards to the bank of the river, the shore exposes dark gray slates, with numerous nodular layers, rolling to the N. and S. at various angles up to 65°. The low cliff bounding the lands of Roughwood, consists of dark gray slates, with thin nodular layers, dipping at low angles to the S.E. at the west end of the section, to the E., in the middle, and to the N.E. at the E. end. All these beds are cut up by a cleavage striking E. 10° N., with a dip of 75° to N. 10° W.

Along the opposite shore of the river, below Woodview, and at Ballywilliam, the gray slates with nodular layers, are rolled about to every point except the west, the prevailing dip, however, being to the S.E.; and in the



opposite shore, in the townlands of Currahoo and Knocknabinny, the same character of rock, with a dip to the N. or S. is everywhere seen. Along the river edge, by the townland of Kilmacloona, and that of the adjoining townland of Ringfinnan, to the east of it, we find the gray slates and nodular layers all dipping steadily to the N. at angles up to 60°; the cleavage dipping N. 10° W. at 75° to 85°. The shores of Whitecastle creek, which branches in a N.W. direction from this portion of the river, expose gray slates, with nodular layers, dipping to the N. or S. at angles up to 70°, in some places being vertical, and all cleaved in the direction of E. 10° to 15° N.; the planes of the cleavage inclined either to the N. or S., at angles sometimes as low as 55° to the S. in beds dipping S. at 35°.

*The Clonakilty, Timoleague, and Kilbrittain District.*—In the neighbourhood of Ballinascarty, three and a-half miles N. by E. of Clonakilty, the Carboniferous slates are frequently to be observed at the surface in bosses of rock and road cuttings; as also in all the district through which the Argideen River flows. At no single locality can any thing like a continuous section through these beds be observed for a thickness of more than a few hundred feet, and the dips, which are few and scattered, afford no clue to the stratigraphical arrangement or thickness of the rocks.

A constant repetition of gray and greenish gray slates, with occasional flaggy grits, may be observed over this area, and that to the S., as far as the boundary of the Upper Old Red sandstone, which strikes E.N.E. from the south of Curragh Lough past the southern suburb of Clonakilty to the shore of Courtmacsherry creek, between Timoleague and Mahon Abbey. Some Coomhola grits make their appearance on the road side at the distance of half a-mile E. of Clonakilty; and also close to Timoleague on both sides of it, and on the point of land opposite to Timoleague church, as indicated on the map by yellow dots.

At the distance of three miles to the N.W. of Timoleague, we find a tolerably clear section in the Carboniferous slate along the eastern bank of the small stream which falls into the Owenkeagh River, at Skeaf Bridge. At the southern end of the section, at the stepping stones, and at the distance of a few fields above the bridge, there are some thick-bedded gray and dull brown micaceous grits, nearly vertical, or dipping to the N. at 80°; and these are overlaid by bluish gray slates, and between them is a quartzose bed containing copper. To the N. of this, for the distance of half a-mile, the dark grayish blue slate and thin grits, with greenish bands, all appear to dip to the N. at from 65° to 70°; thus possibly presenting a thickness of about 2,000 feet. From this point northwards, however, the same rocks dip southwards, at from 60° to 65°, showing the existence of a large synclinal.

For a distance of three miles to the eastward of Skeaf Bridge, along the road past Skeaf House, to the E. boundary of the townland of Kilshinahan, some massive brown grits, which are often micaceous, and found to contain fossils, were observed. These are marked on the map by yellow dots, being considered to be Coomhola grits.

The section exposed along the east side of Kilbrittain creek is one of the most comprehensive in the district. For the distance of nearly a mile from Bateman Bridge to the shore at the Salt Works near Cassino House, dark gray glossy slates, with occasional nodular and gritty layers, are very frequently exposed; and all the observed dips are to the northwards, at from 55° to 60°. Just north of the Salt Works, there are a few beds of massive micaceous gray grits, which most probably are the topmost beds of the Coomhola grits, that are so markedly developed along the shore to the S., and under Coolmain House.

At the distance of 100 yards S. of the Salt Works, we again find some dark gray slates and thin gray grits, dipping as before to the northwards.

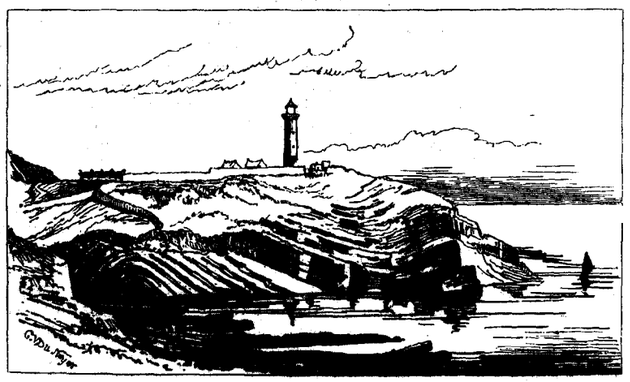
If we assume that the section just alluded to is unbroken—and I see no reason to suppose otherwise—and if we allow 50° as the average dip, we have a thickness of dark gray slate of fully 3,900 feet. Between the Salt Works and that point on the shore W. of Coolmain House, where the Coomhola grits commence, a distance of nearly half a-mile, we do not find any rock exposed. We may, however, protract to this space a short section of grits and sandstones, with slate and slate partings, which appears at the distance of three quarters of a mile to the eastward, and at the N.W. corner of the townland of Carrigcannon, the beds of which also dip to the northwards, at an average of 55°, and represent a thickness of 850 feet of rock.

The Coomhola grits along the shore W. of Coolmain House, all dip to the southwards, and hence appear to form the southern side of a large anticlinal. The thickness of these beds, as seen along the shore, has been estimated at 900 feet, an amount which agrees most remarkably with that of the Carrigcannon section, and which I think very probably represents the total thickness of the Coomhola grits in the district. Directly to the W. of Larahan, there is a narrow band of gray grits, with brown and yellow sandstones, which occupies the same geological horizon as the grit beds described as appearing to the N. of and close to the Salt Works, and supposed to represent the upper beds of the Coomhola grits. Over this lie some dark bluish gray glossy slates, all dipping S. as far as the point, at angles of 60° to 70°, and precisely like those which have been just mentioned as dipping to the north between the Salt Works and Bateman's Bridge.

The shore which extends from Coolmain Point easterly to the embouchure of the Ballinspittle Valley, close to Laherne, and from thence to Curlaun Point and Bullens Bay, is clearly made of the same beds. They are well seen along the shore, and their dip is steady to the southwards, at from 60° to 75°.

*The Old Head of Kinsale.*—On the shore due east of the little village of Ballymackean, at the northern extremity of the Old Head of Kinsale, we find some dark gray rotten beds, which weather brown, and which are, in fact, impure limestone. These I regard as the very uppermost beds of the Carboniferous slates, if not the commencement of the true Carboniferous limestone, or the beds elsewhere spoken of as the Lower Limestone shale. To the south of these the dark-gray slates, containing thin grits and nodular bands, are well-exposed in the cliff sections at both sides of the Old Head, though

FIG. 3.



Old Head of Kinsale, looking E.S.E.



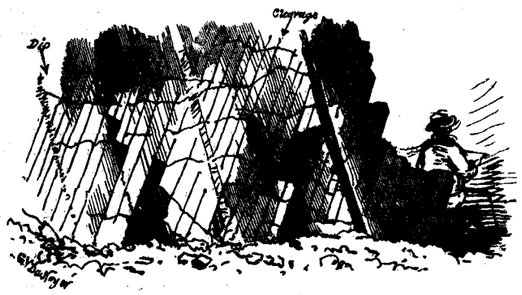
they are much contorted, as far to the southward as Coosnaclasha on the east side, and the northern shore of Ringalurisky Point on the west. From this southwards, past the two Holeopen Bays, up to a point opposite to Bream Rock on the one side, and the corresponding point on the other side of the Old Head, the dip is steady to the northward at an average of 60°.

FIG. 4.

Bent cleavage in dark gray slates N. of Coosnaclasha, E. side of Old Head of Kinsale.

The distance thus indicated, as being occupied by beds which dip steadily to the northwards, is fully one mile and three quarters; and if we allow an average dip of 50° to compensate for any concealed faults, and for two local contortions of not much account in the calculation, we have a stratigraphical thickness of rock of fully 6,000 feet, to which must be added at least 500 feet for the Coomhola grits, which form the extremity of the headland.

FIG. 5.




Cleavage assuming the character of jointing in shaly beds, on the shore of Bullen's Bay, Old Head of Kinsale. Beds dip N., cleavage dips S.

At Dunmacpatrick, where the Old Head narrows to such a remarkable degree, we find a series of yellow sandstones and grits, with dark gray and other black shales and slates between them, all dipping to the northward at 75° to 85°. These beds pass down into light gray flags and slates, having below them the thick hard grits of the Coomhola series. (*See fig.* 3.)

Encrinite remains and a few other fossils are of common occurrence in the

sandstones of this locality. As a general rule, the cleavage dips south in beds inclined to the north, and *vice versa* in the gray slates of the Old Head.

*Ground S. of Clonakilty.*—The anticlinal of Old Red sandstone which extends in an E.N.E. and W.S.W. direction to the S. of Clonakilty, is traversed by a N. and S. fault, near the west margin of the map. The downthrow is to the W., and it may amount to several hundreds of feet of vertical displacement.* The general character of the Old Red sandstone here is quite the same as in the district to the north; the Upper Old Red consisting of pale purple slates and greenish-yellow shales and sandstone, with an occasional gray bed, while in the lower portion of the deposit, the purple colour predominates, and the gray grits, slates, and sandstones die out. Both groups are well seen along the W. shore of the creek to the S.E. of Springmount, and around the old church of Kilkeranmore.

The Old Red and Yellow sandstone beds are to be well seen along the shore to the W. of Arundel mills, and to the N. of them along the bank of the stream, and along the road leading to the Roman Catholic chapel in the townland of Darrary. These rocks all dip to the southwards, being on the S. side of the long anticlinal, and the angle of the dip varying from 60° to 80°. As they are exposed for the distance of 1,500 feet their thickness must be about 1,350 feet, if we allow 65° as the average angle of dip. As we pass easterly from Arundel mills, we lose the Lower Old Red beds at the edge of Cruary bog, and the Yellow sandstones are brought in, in consequence of the axis of the anticlinal dipping to the eastward. These beds are not well exposed, the best section through them occurring along the farm wall passing through the townland of Ballincourcey, where we find purplish-gray sandy slates and greenish gray sandy shales. As we pass from this point to the eastward, we get into the ordinary gray slates and gritty layers of the Carboniferous slates.

*The Seven Heads Promontory.*—Along the shore from Land Point at the entrance to Courtmacsherry creek, southwards to Meelmane, at Broadstrand bay, we have bed after bed of blue and gray slates and gritty layers, dipping to the southwards at an average angle of 60°, for the distance of three quarters of a mile, and thus representing a thickness of about 3,350 feet. We then come to some thick gray grits and gray sandy slates, which undulate to both N. and S. at 65°. The former beds are clearly those which form the shore between Coolmain Point and Laharane, before described, and the grits may be the equivalents of those observed at Ballymackean. The shore of Broadstrand Bay is devoid of any rock; but at its southern side the section is resumed at Lisla or Quarry Point, by the ordinary dark gray slates which are now seen to dip to the northwards, which dip they retain for the distance of nearly one mile, or as far as to the point S. of the cliffs of Coolim.

To the S. of this point the beds are rather contorted; but, after a short distance, they turn round "*en masse*," and form an anticlinal, the southern side of which extends for the distance of half a mile, or beyond the coast-guard station of Seven Heads Bay. It is, therefore, evident that on this portion of the coast rocks we have again presented to us those beds first described as lying directly to the south of Land Point.

From the Coast-guard station just mentioned, the dip of the beds is again to the northwards, at angles from 75° to 80°, as far S. as a little nook called Cooltraw, where we again reach the Yellow sandstone from underneath, which the Old Red sandstone rises. These beds are well seen in the cliffs which form the eastern side of the Seven Heads. The Old Red sandstone

* This fault is well seen on going along the road that leads from Clonakilty to Kilkeran Lough, just about the junction of Sheets 200 and 201, before reaching the R.C. Chapel and Milltown Place. The beds on one side of the road do not correspond with those of the other. The downthrow, however, here is to the eastward.—J. B. J.



here is the same in general character with that observed in the neighbourhood of Clonakilty. The general dip of the Old Red sandstones along the sea face of the Seven Head is to the northwards at angles of from 45° to 70°, and the predominant rock is red or liver coloured shales.* G. V. D.

*Clonakilly Bay.*—The Old Red sandstone is excellently seen along the W. side of the Seven Heads, having a general dip to the N. at high angles from Bird Island to Coosboy. The Carboniferous slate is equally well shown on the west side of Dunworly Bay, at the new cut made for draining the bog to the northward, and the Coomhola grits rise steadily out from beneath it all round the headland into Lion's Cove. They contain an abundance of the characteristic fossils which may also be found in Seven Heads Bay, and in the intermediate district. Dunworly Bay, indeed, is the part of the coast which is quite most worthy of a geologist's visit, being much before either the old Head or Galley Head in interest and beauty.—J. B. J.

The coast from Dunworly Bay to Ring Head, east of the Clonakilty estuary, presents the ordinary dark bluish-gray glossy slates and shales, with thin grits and sandstones of the Carboniferous slates, the beds dipping to the southwards.

The coast on the western side of Clonakilty Bay, from Muckross Head on the N., to Duneen Point on the south, is formed of the Carboniferous slate beds, which are very much contorted. To the north of Duneen Bay some thin gray siliceous slates and gritty bands are stained with the green carbonate of copper; and just N. of Duneen Point there are old workings for lead and copper, in glossy bluish-gray slates. Fossils have been found in thin greenish-gray grits at this locality. The cliffs forming the coast at Dunnycove Bay are all of dark gray slates and thin grits, which, in the aggregate, dip to the northwards at from 65° to 80°, and are often vertical. As these beds are followed to the S., we find they pass down into greenish-gray grits, with yellowish-gray and green slaty beds, which are marked on the map as Coomhola grits. At Dunnycove Point the purple slates and green grits of the Upper Old Red sandstone rise from beneath these beds, and the uppermost beds of the Old Red sandstone proper, rise still further to the south, forming the coast line from Ringlia Point to Dunowen Head. These beds differ in nothing from those which form Seven Heads, of which they are, doubtless, the extension.

*The Gally Head.*—Dirk Bay, which lies to the W. of Dunowen Head, exposes the Old Red and Yellow sandstones along its western side, the beds at Dunowen Head forming the eastern, while the innermost portion of the bay penetrates into the massive gray slates, and thin gray grits and flags of the Carboniferous slate. The dip of all the beds along the coast line of Dirk Bay is to the northwards, at from 65° to 80°.

Gally Head is geologically the same as Dunowen Head, being formed, in fact, out of the same beds in their projection to the S.W. On the E. side of the head at Castlecove, there is a well-marked N. and S. fault, which, by a downthrow to the W., brings the upturned edges of the Carboniferous slates and Yellow sandstone abutting against those of the Yellow sandstone and Old Red sandstone respectively.

As all the beds dip steadily to the N.N.W. at 65°; and as the superficial displacement caused by the fault is about 1,200 feet, it would follow that the amount of vertical throw must be fully 2,568 feet.† G. V. D.

* The N. and S. fault, which is represented on the map as passing through the headland of "Seven Heads," is, by no means, distinctly proved. The fault which is shown to the W. of this, at the head of Dunworly Bay, is much more probable, as the rocks on either side of the Bay, where it is only a quarter of a mile across, are totally different.—G. V. D.

† With beds at such high angles, and subject to so much change of inclination, or even contortion, these calculations are very uncertain.—J. B. J.

Dundeady Island, the name given to the extreme point of Galley Head, is composed, according to Mr. Willson's notes, of purple and green slates, dipping to the N. at 75°. These are supposed to belong to the lower part of the Old Red sandstone. Above them lie a series of green and gray grits and flags, interstratified with purple and green slates, which are considered to be the Upper Old Red or Yellow sandstone.

These beds are well shown in the cliffs along the western side of Galley Head, dipping north, at angles that decrease gradually from 75° to 65°, as we proceed north. As we ascend in the series, the purple slate gradually disappear, and gray slates only are to be found between the grits, and the gray slates gradually become more numerous, until, about three-fourths of a mile north of the exteme point of the Head, they are in great mass, often soft and earthy, and interstratified with thin grit bands only.

The dip hereabouts is still steady to the north, but sometimes at as low an angle as 50°.

About Doonane Castle the beds begin to undulate, but still dip on the whole to the north as far as the last headland, when they undulate rapidly, dipping both S. and W., but again recover their northern dip as far as the sandy beach where they are no longer visible. These most northern beds of the promontory consist largely of grits and flags, like some of those a mile to the southward; and half a mile further north, on the shores of Kilkerane Lake, purple slates are met with, belonging certainly to the Old Red sandstone.

These facts induced Mr. Willson and myself, when examining the ground in the year 1858, to believe that the Carboniferous slates of Galley Head lay in an inverted synclinal, both sides of it dipping to the north, but the beds on the north side being the same as those on the south, and rising up in an inverted position.

It is clear from the rapid convolutions in the beds, and the dislocation before spoken of as occurring north of Kilkerane, and east of Castle Freke demesne, that the beds are greatly disturbed hereabouts. J. B. J.

The beds which form the anticlinal in the Old Red and Yellow sandstone which extends in a N.E. direction from Kilkerane lake, on the western margin of the district, near Dirk Bay, to within three-quarters of a mile of the coast at Duneen Bay, are tolerably well seen in the district around Greenfield House. They consist of purple and greenish-gray slates, in no way different from beds in the same horizon which form the Old Red sandstone anticlinal to the S. of Clonakilty.

*Mouths of Kinsale and Oyster Haven Harbours in Sheet* 202.—The sections through the Carboniferous slates, presented by the coast line at the entrance to Kinsale Harbour and Oyster Haven, afford no further insight into the character or structure of the deposit than those described in the Innishannon district, along the bank of the tidal portion of the Bandon River. In no instance along this coast line can we find any very continuous sections, if we except that presented to us at the E. side of Kinsale Harbour, from Lower Cove to Hangman's Point, southwards, and that on the west side of the harbour opposite to the former, from Small Point, N. of Sandycove Island, to Courtaparteen Rocks, S. of the old church. The first section exposes gray slates with nodular layers, all dipping to the northwards at from 20° to 50°, and representing a thickness of about 1,600 feet of rock. The second shows beds similar to the former, but the upper portion of the section contains more grits than it, and represents a total thickness of about 1,800 feet of rock.

With regard to the cleavage observable in the rocks to the E. and W. side of Kinsale Harbour, it is noteworthy that it frequently dips to N. 10° W., at from 65° to 85°, in beds which are inclined to the same, or nearly the same point of the compass, but at much lower angles, viz., from 10° up to 40°.



The coast section at the entrance to Oyster Haven, exposes the same beds as those last described; but they are much more contorted, and the general dip of the cleavage which pervades them is to the S. 10° E., from 70° to 80°. G. V. D.

*5. Drift.*

The Drift has not been marked on the maps of this district, partly because it does not occur anywhere in sufficient quantity to obscure the determination of the rocks below, or produce any marked feature in the country itself, and partly because not being formed of limestone gravel, or containing beds of marl, it has little or no agricultural value in itself.

Local accumulations of sand and gravel, derived from the waste of the adjacent rocks, occur sometimes in considerable mass, especially in the valleys of the district. Far-travelled boulders, also, are by no means absent either from the valleys or the summits of the hills. Over much of the country, even about Clonakilty, scattered boulders of grit, like Glengariff grits, occur, sometimes in great abundance and of large size. These could only have been derived from hills considerably beyond the limits of the district on the north or west.

Boulders of Mishells greenstone, as much as three or four feet in diameter, occur plentifully over the country to the south of Mishells valley, even on the summits of the hills. These far-travelled boulders were of course here, as in other cases, carried by icebergs or icefloes, when the ground was beneath the level of the sea, during the Pleistocene period.

No fossils, either marine or freshwater, have been as yet collected from any Drift deposits in the district.

*Submerged Bog.*—On the western side of Courtmacsherry Bay, as on so many parts of the south coast of Ireland, a submerged bog is found at dead low water of spring tides, and is then cut for turf by the neighbouring farmers. How much farther it may extend below the sea is, of course, not known.

There is a large bog at the back of Dunworley Bay, the surface of which is but little above the level of high water mark, respecting which Mr. J. Good, of Dublin, informs me that a rod was put down in it for a depth of more than fifty feet without reaching the bottom.

These, and other similar facts to be found round all the coasts of Ireland, seem to point to a recent depression of the whole island. J. B. J.

DUBLIN: Printed by ALEXANDER THOM, 87 & 88, Abbey-street,
For Her Majesty's Stationery Office.