Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 46 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

BY

RICHARD J. CRUISE, M.R.I.A.

WITH

PALÆONTOLOGICAL NOTES BY W. H. BAILY, F.G.S., (Acting Palæontologist).

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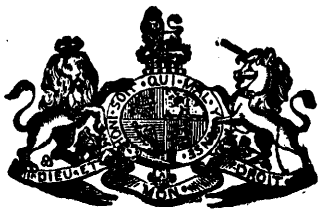

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CONTENTS.

PREFACE.

THE District included in Sheet 46 was geologically surveyed by Mr. Cruise, the author of this Memoir, during the years 1878–79, with the exception of small portions along the northern borders by Messrs. Nolan and Kilroe. It forms a part of the branch of Carboniferous rocks which stretches from the great tract of similar strata forming the central plain of Ireland in the direction of Lough Neagh, and presents a complete succession of the Lower Carboniferous series from the basal conglomerates to the Millstone Grit of Slieve Beagh. This outlier of the Millstone Grit is a new feature on the geological map of Ireland, as the grits and shales forming that mountain were regarded by Sir R. Griffith as beds of the Middle Limestone or "Calp" Division. The enormous amount of denudation which the Carboniferous strata underwent prior to the Triassic Epoch is illustrated by the position of the New Red Sandstone along the eastern margin of the map, where it is found resting on the basal beds of the former system—nearly the whole of the Carboniferous strata, amounting to 6,000 or 8,000 feet—having been removed before the New Red Sandstone was deposited.

EDWARD HULL,
Director.

20th April, 1886.

THE

GEOLOGICAL SURVEY OF THE UNITED KINGDOM

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

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

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

Condensed memoirs on particular districts will also eventually appear.

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

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EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 46 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND.

CHAPTER I.

PHYSICAL GEOGRAPHY AND GEOLOGY.

The area included in Sheet 46, and described in this Memoir, lies between the parallels 54° 17′ 20″ and 54° 27′ 50″, N. latitude and 6° 47′ 30″ and 7° 14′ 10″ W. longitude.

The northern part of the sheet lies in the County of Tyrone, while the southern is included in the Counties of Monaghan, Fermanagh and Armagh.

The principal towns are Aughnacloy, Caledon, Augher, and Clogher, with a small portion of Ballygawley, all in the County Tyrone. Emyvale and Glasslough, with the villages of Tedavnet and Glannon, in Monaghan, and the small but pretty village of Tynan, in Armagh.

The western margin of the sheet is occupied by comparatively high ground; Slieve Beagh, in the southern corner, attaining an elevation of 1,255 feet over Ordnance datum.

From Slieve Beagh the ground falls gradually in a northerly direction towards Clogher, which is situated in a well-marked valley extending from Fivemiletown in Sheet 45 to Ballygawley. This valley is bounded on the N. by a rather steep escarpment, the ground rising at an angle of 22°, from behind Cecil, 2½ miles N. of Clogher, to Knockmanny, 779 feet.

From Slieve Beagh the ground also slopes to the E. and S.E. towards Emyvale and Glasslough, the average heights being from 200 to 300 feet over Ordnance datum.

About ten square miles of ground, along the southern and western flanks of Slieve Beagh, are included in the Erne drainage. The waters of the remaining part of the district find their way by a series of small catchment basins into the Blackwater, the main river that drains the district and one of the tributaries of Lough Neagh. It enters the sheet on its western margin, three miles N.W. of Clogher, at a height of 450 feet over Ordnance datum. It then flows in a general E.S.E. direction to Augher, passing a little N. of Clogher, where it receives the waters of the Fury river, which drains the northern flanks of Slieve Beagh. At Augher the river is 200 feet over Ordnance datum, thus showing a fall of 250 feet in about five miles, or fifty feet to the mile.

From Augher the river still continues to flow in an irregular E.S.E direction, passing a little S. of Aughnacloy to the "Decoy," two miles south of Caledon. In its course, about two miles E.N.E. of Glasslough, it receives a very considerable addition to its volume, being here joined by the "Mountain Water," a stream or river draining the eastern slopes of Slieve Beagh. At the "Decoy" the course of the river is sharply deflected to the North, and it meanders for a distance of eight miles in a N.N.E. direction, finally leaving the district at Battleford bridge, at an elevation of 115 feet over Ordnance datum. The height of the river at Augher, as already mentioned, is 200 feet, thus giving an average fall of four feet per mile, the total length being about twenty-one miles. It will be thus seen that from Augher to Battleford bridge, the river is a comparatively sluggish stream, which partly accounts for the formation of the numerous and extensive alluvial flats along its course.

Some of the other tributary catchment basins in the N.W., where they discharge their waters into the Blackwater river, may be specially referred to, particularly a stream flowing S.E. through a transverse opening in the northern ridge bounding the Clogher valley, and entering the low ground between Kilfaddy and Cecil.

Though at present comparatively insignificant, the stream draining this area, not over two square miles in extent, occupies a deep valley a mile and a half in length. At the upper extremity of this valley the ground rises on either side to a height of 300 feet over the bed of the stream. Taking into account the depth and length of this valley and the acclivity of its sides, its origin is apparently due to a much larger stream than that which now flows through it.

The high ground bounding the valley, E. and S. of Augher, is broken through by a wide opening forming an outlet for the streams collected along part of the eastern and northern slopes of Slieve Beagh. These flow into the Blackwater at Favor Royal, which also receives at this point the Ballygawley waters.

Lakes and Tarns.—The district is remarkable for the number of small lakes which are scattered over its whole surface, not only in the low-lying grounds, but in some of the higher elevations, particularly to the east of Slieve Beagh among the hills of Millstone Grit. Some of the streams have their sources in these natural pools of water, such as Lough Braddan, Lough Naheery, and Lough Glenbower. Emy Lough to the east of Emyvale, is nearly a mile long from N. to S.; others lie on the margins of bogs and alluvial flats, over which it is to be presumed that their waters originally extended. By far the larger number of these lakes are situated in places covered by glacial deposits, such as boulder clay and gravel, which are distributed thickly over the plains, and to a less extent on the high lands. There can be little doubt that many of these lakes in such positions have been formed by the irregular accumulation of Drift deposits, the hollows in which have afterwards been filled by surface waters. Others, however, occupying the higher elevations, such as those on the

plateau of Slieve Beagh, probably owe their origin to the erosive action of the great ice sheet, presently to be referred to, which at one time certainly overspread even the highest elevations in this district; and this view is confirmed by the fact that some of the rocks on this table-land exhibit ice-worn surfaces.

The position and relations to each other of the rocks of the district are well illustrated by two sections (see frontispiece), one from S. to N., and the other from W. to E.

The present outline of the ground is almost entirely due to denudation. A small cap of Millstone Grit at Slieve Beagh remains as the only representative of this subdivision of the Carboniferous Period. Coal-measures may be supposed to have been originally deposited over this formation.

The main line of fault running through the Clogher valley doubtless exercised some influence on its formation, in addition to the natural weathering of the Carboniferous strata lying between the Millstone Grit of Slieve Beagh and the Lower Old Red Rocks of Knockmanny.

There is no positive evidence to fix the geological epoch when this vast denudation took place, but judging from analogy, and from the fact of the New Red Sandstone along the eastern margin of the district being deposited unconformably on the Lower Carboniferous Limestone it was to a very large extent before that of the Trias.

There is no doubt but that subsequent denudation also modified the outward configuration of the ground during the long interval between the Triassic and the Pleistocene or Glacial epochs, when the hollows and inequalities in the ground were partially filled by these deposits.

In consequence of the almost universal covering of the rocks with this latter formation, and the weathering of the exposed rock-faces, glacial striæ were not observed. The rock, however, in many places bears evidences of ice-planing, particularly at "Shane Barnagh's Stables" on Slieve Beagh, where well-marked "Roches Moutonnèes" were observed.

Writings of previous authors on the Geology of the district.—Little has hitherto been written by observers on the geological structure of this district; the principal references being those by Sir Richard Griffith, in his papers on the subdivision of the Carboniferous Rocks of Ireland,* and by John Kelly on the same subject, in which he correctly describes the Millstone Grit of Slieve Beagh,† Sir R. Griffith relegating it incorrectly to the "Calp" division.‡

General Portlock, in his Report on Londonderry, &c.,§ has also described some of the rocks and trap dykes in the Northern part of the sheet.

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* Jour. Geo. Soc., Dub., vol. vii., p. 267. † *Ib.*, p. 276, *et seq.* ‡ *Ib.*, p. 274.
§ p. 495 (1843.)

CHAPTER II.

Rock Formations and Divisions.

Aqueous Rocks.

Recent and Post-Pliocene.

	Colour and Sign on Map.
Alluvium, Bog, and other superficial covering,	*Burnt umber.*
Drift, or Post-Pliocene, ...	*Engraved dots.*

Triassic.

New Red Sandstone (Bunter), . . .	f^3, *Light red.*

Carboniferous.

Millstone Grit, ...	d^4, *Light lampblack.*
Yoredale Shale, ...	d^3, *Light indigo.*
„ Sandstone, ...	d^3, *Gamboge dotted crimson.*
Upper Limestone, ...	$d^{2/''}$, *Deep Prussian blue.*
Calp Sandstone, ...	$d^{2/'}$, *Indigo dotted yellow.*
„ Limestone and Shale, . . .	$d^{2/'}$, *Indigo.*
Lower Limestone, ...	$d^{2/}$, *Prussian blue, light.*
„ Carboniferous Shale, . . .	d^1, *Prussian blue and Indian ink.*
„ „ Sandstone, . . .	d^1, *Do., dotted yellow.*

Old Red Sandstone.

Upper Old Red Sandstone, ...	c^1, *Indian Red.*
Lower Old Red Sandstone ("Dingle Beds"), .	b^6, *Indian red and purple*

Lower Silurian.

Caradoc, or Bala, Beds, ...	b^2, *Pale purple.*

Igneous Rocks.

Felstone, ...	*F, Vermillion.*
Dolerite, Basalt, ...	*B, Burnt crimson lake.*

Lower Silurian.

b^2. *Caradoc or Bala Beds.*—The small area occupied by these rocks in the extreme S.E. of the district is entirely covered with Boulder Clay Drift. They are however seen in the sheet to the South (No. 58) quite close to the boundary, where they consist of hard gray and greenish grits;—the dip being obscure.

Old Red Sandstone.

b[6]. *Lower Old Red Sandstone or "Dingle Beds."*—These beds occupy a triangular patch in the extreme N.W. of the sheet. They consist almost entirely of purple and chocolate-coloured conglomerates, containing pebbles of greenish brown and purplish grits, mingled with those of brown and slate-coloured felstone. A few sandstone beds occur through them, but they do not attain a degree of prominence in this area corresponding to that which they hold in the Fintona district, Sheet No. 33. Good sections are exposed in the valleys and glens N. of Kilfaddy, the general dip ranging from 15 to 30 N.W. The section in Lumford's glen is described in General Portlock's "Report on the Geology of Londonderry, &c."*

c[1]. *Upper Old Red Sandstone.*—These beds occupy two small tracts in the N. of the district, in both cases being brought up against more recent beds by lines of fault. One and a half miles S.E. of Augher, they are exposed in several sections where they consist of red pebbly sandstone; in some cases they may be described as a conglomerate.

The other patch occupied by this formation is quite close to the northern limits of the sheet, three miles N. of Aughnacloy, where the southern boundary is a line of fault. The beds here are conglomerates made up of pebbles of green and gray micaceous, grit and felstone dipping distinctly against the Lower Carboniferous Limestone. There is some doubt whether these beds may not belong to the lower division of the formaton.

Carboniferous.

d[1]. *Lower Carboniferous Sandstone and Shale.*—This division occupies an irregular tract in the N.W. As the beds vary much in character, it is necessary to decribe them a little in detail. Taking the most northern exposures where they leave the sheet N. of Aughnacloy, quite close to the Upper Old Red Sandstone boundary, pebbly grits with pebbles of green grit and white quartzite are seen dipping northwards at from 10° to 20°. To the S.W. of this in the same strike similar beds are freely exposed in sections in the "Ballygawley Waters." Further W. in the Blackwater river, N. of Gallagh wood, breccia with pebbly and argillaceous beds undulate at low angles. The breccia consists of pebbles embedded in a white calcareous material; and in the pebbly and argillaceous sandstones occur loosely compacted fragments, made up of Old Red Sandstone *dèbris* of large size and angular, indicating a not far distant source. S.W. of Gallagh wood, and S. of the line of fault, loose sandy conglomerate, containing rounded pebbles of quartzite, quartz, and chloritic grits with interbedded gray and reddish sandstone, pass apparently down through a series of shales, often concealed by Drift into fissile and pebbly sandstone showing false bedding, the pebbles consisting

* "In Lumford's glen near Kilfaddy the Old Red Sandstones appear as a bold mass not readily distinguishable as to dip and direction; and traces of igneous action are here also discoverable in a nodular clay-like trap, associated with the grits."—General Portlock's Report, p. 495 (1843).

of grit, quartzite, and felstone. These beds closely resemble the series of red sandstones and conglomerates flanking the mountain N. of Aghintin, described in the Memoir to Sheet 45, p. 12, forming the base of the Carboniferous formation. Farther north near the line of fault, in a well-marked glen, Derryclay, a series of sandstones and conglomerates, seem to attain a thickness of 400 feet. The conglomerates contain pebbles of a pinkish brown micaceous grit, these pebbles being sometimes four inches in diameter, together with others of quartzite and white quartz. Resting on these beds is a series of soft sandy, purple and mottled shales, with patches of purple and pebbly sandstone. N.E. of Cecil the escarpment is flanked by deep red breccia, mottled shale, and red flaggy friable and calcareous sandstone, containing fragments of white quartz and green grit. These beds are cut out by a fault between Cecil and Kilfaddy, at which place they re-appear and spread out westwards into the important basement series of the Carboniferous formation N. and N.W. of Aghintin before mentioned.*

All the beds above referred to are now relegated to the Carboniferous period, being representatives of the Lower Calciferous Series of Scotland. This is the view also taken by General Portlock in his "Report on the Geology of Londonderry."

South of the fault, near the northern margin of the map, at Clenally and Bloomhill, beds of light gray and yellow grit, massive and flaggy, appear to pass under an unknown thickness of dark gray calcareous shale and earthy limestone weathering shaly, which comes to the surface at several points.

One mile E. of Clogher a good section is laid open by the Fury river, in fine-grained yellow grits. Similar beds are also met with interstratified with shales in the Blackwater river, S.W. of Kilfaddy. Massive grits have been quarried S.E. of this, and at Fardross highly arenaceous beds seem to immediately underlie the Lower Limestone.

$d^{3'}$, *Lower Limestone.*—A considerable tract of ground is occupied by these beds particularly in the eastern part. They are also represented by several irregular tracts in the N. and W. of the sheet, brought in generally along lines of fault. There are but few exposures over the entire eastern area owing to the almost universal covering of Boulder Clay. The limestones are however well seen in the neighbourhood of Glasslough, and in the railway cuttings to the south of that town. The beds consist of evenly bedded gray and blue limestone, in places coarsely crystalline.

At the village of Glannon, west of Glasslough, extensive quarries are opened on the highest beds of this division. The limestone is generally of a dark blue colour, close in texture, and even-bedded, the beds ranging from twelve inches to two feet in thickness, with some shaly beds and shale partings. Large blocks and flags are raised here, suitable for gate piers, building stones, and tomb-stones, the rock being capable of a high degree of polish.

In the neighbourhood of Caledon and Tynan, beds similar to those at Glasslough occur in isolated patches and hillocks.

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* See Explanation of Geological Survey Sheet 45, p. 12.

West of Clogher, angular fragments apparently almost *in situ*, of bluish gray highly fossiliferous limestone are met with at various points, from which the boundary has been drawn, in continuation of these beds from the sheet to the west (Sheet 45). No satisfactory opening on the rock was observed.

In the Clogher Demesne is to be seen a small section of comparatively pure gray limestone containing *Encrinites*, with a little interbedded blue shale. In the Fury river near Belastera bridge, beds of fine blue limestone are thrown down against the wedge-shaped area of Lower Carboniferous shale formed by the two branches of the great E.N.E. fault.

One mile N. of Favor Royal thin bedded dark gray limestones, in parts weathering shaly, with grey arenaceous beds, dip southward at angles ranging from 55° to nearly vertical. These beds, near their junction with the Yoredale Sandstones, are broken, crushed, and contorted, showing in many places slickensides, all suggestive of faulting in the immediate vicinity.

Near the northern margin of the map, S. of Clenally and in the Ballygawley waters, dark gray flaggy limestones are exposed in several sections.

Further exposures of similar beds occur N. of Aughnacloy, at the fault boundary of the Old Red Sandstone and in several other localities; their position and dip will be best seen on reference to the map.

d^{2}''. *Middle Limestone or "Calp."*—This member is divisible into two parts, the upper consisting almost wholly of massive sandstone, weathering yellow generally; the lower of dark gray and blue thin-bedded shaly limestone, or calcareous shale, often fossiliferous. The former attains its greatest development north-eastward, where it spreads out over the whole area, to the exclusion of the latter, and extends downwards to the Lower Limestone boundary east of Relaghy wood.

These sandstones are exposed in several places, particularly in the neighbourhood of Aughnacloy, where they are extensively quarried quite close to the town. Where observed they were all of a similar character, and require no further detailed description.

From Relaghy wood the lower shaly beds extend in a broad semicircular band in a westerly direction, sweeping along the rising ground to the southern limits of the sheet. They are but seldom seen, being concealed beneath a thick mantle of Drift. Where observed, however, such as at Figanny bridge, three miles N.E. of Emyvale, at the corn-mill one and a half miles W. of the bridge, and in a few other localities, they consist principally of dark bluish thin-bedded limestone with shale partings. In some cases these beds are suitable for building stone, and are extensively quarried, particularly by the roadside three miles S.E. of Aughnacloy, where the beds run from one and a half to two feet in thickness.

d^{2}'''. *Upper Limestone.*—This subdivision of the Carboniferous series covers a considerable tract in the centre of the Sheet. There are also a few patches, one W. of Slieve Beagh, the others

occurring along the great fault which passes to the N. of Aughnacloy. In these patches the beds are more freely exposed than in the district of their greater development to the South, being in the latter case, nearly concealed by Drift.

This member of the series varies considerably in character, but generally consists of dark blue crinoidal limestone with occasional beds of shale and sandstone. It will now be described in detail.

In the neighbourhood of Aughnacloy dark gray and blue limestones, generally fossiliferous, are freely exposed. At several points beds of sandstone are interstratified with the limestones, as at Plaister, N. E. of Aughnacloy, at Killycarnon, near Favor Royal, and S. of Fardross.

In general the patches accompanying the great fault on its south side, consist of flaggy dark gray limestone weathering shaly. Exceptionally pure limestone, however, occurs at several points. East of Tymore lough a faulted section on the roadside shows dark bluish gray limestone, containing corals, accompanied with bands of shale. Fine blue limestone is also to be seen at Slatmore, near the western margin of the map, the beds being almost vertical, in proximity to the fault.

The limestones now described pass under the yellow grit and sandstone of the Yoredale division at Clogher, S.E. of Fardross, and at other places, which determines their position in the Carboniferous series. The throw of the fault, which here cuts out two entire members of the series, may also be determined; for the yellow grits are the continuation eastward of those which, in the maps to the west and south-west, are shown to be of Yoredale age.

d[3] *Yoredale Beds.*—These beds are divisible into two sets, namely sandstones and shales, the sandstones underlying the shales. They occur in the west of the district; and, as in the case of the Upper Limestone, the best and most numerous sections are laid open close to and along lines of fault. The beds however, are well seen in a section extending over two miles in length in the Fury river, where the rocks are thrown into a series of syclinal and anticlinal folds and are much broken and contorted. They consist of a series of reddish and yellowish grits, in parts calcareous, thin flaggy and shaly beds being of frequent occurrence in this section.

East of the Fury river and half a mile N. of Lough More massive-bedded, coarse quartzose grit, in some cases slightly conglomeritic, is well seen in a cliff section extending northwards for about half a mile. At the top of the cliff the rock at one point closely resembles a gigantic seat, and is known as "Saint Patrick's Chair."

Sandstones are again seen N. of this, along the line of fault, in its course eastward towards Aughnacloy, as far as Garvey wood, where a quarry has been opened on yellow massive pebbly sandstone. The beds are thrown down against Lower Limestone on the north, and overlie Upper Limestone on the south, the latter beds being seen dipping towards the former in the north corner of the County of Monaghan adjoining Favor Royal.

In some places bands of shale, containing thin-bedded or flaggy gray micaceous sandstone, alternate with the massive grits; and white quartz pebbles occur in the latter, often in such abundance and of such a size as to constitute it a conglomerate. This is to be observed at "Cross Glen," one mile south of Fardross, where the following exceptional varieties are also to be found; pebbles of quartz and quartzite cemented by a bluish grey calcareous material, and the perhaps still more exceptional variety, consisting of similar pebbles mingled with (concretionary ?) lumps of gray limestone, all embedded in coarse brown sand. False bedding may be frequently noted in the grits, which are also freely exposed in the numerous streams flowing from Sleive Beagh to the N.E. and S. In those sections the rock is mostly fine-grained, weathering yellowish, and dipping in all cases under the overlying shales at low angles.

The Yoredale Shales are exclusively confined to the flanks of Slieve Beagh, where they form an irregular oval band round the mountain. They consist entirely of dark brown and black fissile shales, which are well seen in the numerous streams flowing from the Millstone Grit table-land. Close to the western margin of the map they are for a short distance brought down directly against the Upper Limestone by a magnetic N. and S. fault. This fault appears to gradually die out in a northerly direction.

d^4. *Millstone Grit.*—These beds form the table-land of Slieve Beagh. They consist of coarse-grained quartzose grit, in some cases slightly conglomeritic. They are well shown at "Shane Barnagh's Stables," and in numerous patches and ice-worn bosses, where they appear through a thin coating of bog, which largely covers the ground. The beds are nearly flat and form a broken escarpment along the line of junction with the underlying shales.

Triassic.

f^3. *New Red Sandstone.*—The New Red Sandstone lying along the Blackwater is the southerly extension of a considerable tract which overlies various members of the Carboniferous group, in the direction of Dungannon, Coal Island and Stewartstown.* Few exposures of these beds are to be seen in the district, the area occupied by them along the eastern margin of the map being nearly entirely covered with drift and alluvial deposits. The beds consist of fine red striped sandstone of different shades. They are exposed in a section in the banks of the Blackwater, about one and a half miles N. of Caledon, and again, in a cliff, one mile S. of Eglish near the northern margin of the map. In the latter case dried specimens become coated with minute crystals of chloride of sodium.

Igneous Rocks.

Felstone.—General Portlock refers to a clay-like "nodular" trap in Lumford's glen near Kilfaddy, which was not discovered by us.

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* See Sheets 35 and 47.

† Report on Londonderry, &c., p. 495 (1843).

A narrow dyke of light greenish compact porphyritic felstone penetrates Lower Carboniferous grits near Culnaha bridge, S.W. of Cleanally at the north margin of the map.

Another small dark green felstone dyke, with felspar crystals porphyritically developed, was observed a little S.W. of Knockmanny, terminating westwards in the valley against the line of fault.

Dolerite.—A large dyke of highly crystalline dark gray dolerite enters the sheet on the N.W. Westwards it is traceable towards Irvinestown,* and eastwards across the Cecil and Kilfaddy fault, almost to Clogher, by large heaps of angular blocks which occur evidently almost *in situ* at intervals in a direct line.

Another dyke is to be seen in the Fury river east of Clogher, penetrating Lower Carboniferous Shale. This may be connected with the former dyke, but the connexion is not indicated on the map for want of evidence.

A dyke of compact basalt occurs near Knockmanny, entering the sheet on the N., and extending for over a mile in a S.S.E. traversing the "Dingle beds" to the summit of the hill.

Another small compact basalt dyke, four feet wide, was observed in the extreme N.E. of the sheet.

Recent and Post-Pliocene (Drift).

These deposits thickly overspread the entire district, with the exception of the table-land of Slieve Beagh and the high ground of Knockmanny, and consist of Lower Boulder Clay, sometimes overlain by stratified sands and gravels.

Lower Boulder Clay.—The Drift over the district belongs almost entirely to this division. It consists of yellowish and bluish clays with numerous boulders and sub-angular fragments of the rocks of the district imbedded in it. In the low-lying ground it is generally arranged in a series of drumlins or small ridges ranging in a general N. and S. direction.

Along the northern slopes of Slieve Beagh numerous blocks of quartzose grit, sometimes striated, are scattered over the surface. In the eastern part of the district, the Drift is principally derived from the disintegration of the New Red Sandstone, and is more or less sandy and of a red colour. North of Caledon, boulders of reddish and gray grit, basalt, and limestone were noted in numerous sections along the banks of the Blackwater river.

Middle Sand and Gravel.—The beds supposed to be referable to this division are but very sparingly represented; south of Tedavnet, however, they are about twenty feet thick. A few yards south of the Sheet margin they are seen resting on the Lower Boulder Clay, and capped by the Upper Boulder Clay, which, however, does not extend into this district. In this locality the sand is extensively used for building purposes.

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* See Expl. Mem. Geo. Survey, p. 45.

The only other locality where gravel occurs is in the neighbourhood of Dungillick House, N.W. of Emyvale, forming a series of irregular mounds; stratification not being here visible.

Travertine.—North of Favor Royal, at the fault boundary, between the Yoredale Sandstone and Upper Limestone, a bed of considerable thickness of porous travertine extends over a surface of about 100 yards in diameter. The bed is now fragmentary, streams having cut their way through it in various directions. It is either on the line of fault or near it. Its formation is probably due to waters flowing from the fault highly charged with calcic carbonate which was deposited on exposure to the atmosphere.

Bog, Alluvium, &c.—From Augher numerous and extensive alluvial flats spread out along almost the entire course of the Blackwater river. They occur in greatest breath at the "Decoy," east of Glasslough, and S. of Caledon, where they cover several square miles of ground. In many cases these alluvial flats are covered with bog, such as at Emyvale; and to the S.E. of Glasslough, irregular patches of bog, in some cases attaining a thickness of several feet, cover the high ground and slopes in the S.W. of the district, but not to such an extent as to warrant their insertion on the map. A few small patches of bog occur also N. of Augher.

CHAPTER III.

Palæontological Notes, Sheet 46.

Localities from which Fossils were collected.

No. of Locality.	Quarter Sheet of 6-inch Map.	County and Townland.	Situation, Geological Formation, and Sheet of 1-inch Map.
		County of Tyrone.	Carboniferous Limestone, Sandstones, and Shale.
1	58/4	Boundary of Townlands, Townagh and Aghnaglogh.	Rocks in stream a little south-west of Waring Bank, about two miles north-west of Clogher; dark gray calcareous shale.
2	59/3	Mullaghtinny, . .	Close to Fury River, about two miles south-east of Clogher; dark gray shale.
3	59/4	Lismore, . . .	Quarry on road to Lismore Bridge, close to Lismore Wood, 2½ miles west of Aughnacloy; dark gray earthy shale.
4	60/1	Cavankilgreen, .	Quarry close to road from Aughnacloy to Milltown, 2½ miles north-west of Aughnacloy; dark gray limestone and shale.
5	60/3	Dernabane, . .	Quarry on by-road, one mile east of Lissenderry House, and one mile east of Aughnacloy; dark gray limestone and shale.
6	60/3	Do., . .	Old quarry on road to Milltown, close to R. C. Chapel, one mile north-west of Aughnacloy; gray limestone and shale.

LOCALITIES from which FOSSILS were collected—*continued.*

No. of Locality.	Quarter Sheet of 6-inch Map.	County and Townland.	Situation, Geological Formation, and Sheet of 1-inch Map.
		Co. of TYRONE—*con.*	
7	60/3	Boundary of Townlands of Dernabane and Glack.	Rocks in stream about one mile north of Aughnacloy; dark gray limestone and shale,
8	60/4	Glendavagh, . .	In stream and at quarry, half a mile south-west of White Lake, two miles east of Aughnacloy; dark gray limestone and shale.
9	60/4	Edenageera, . .	Rocks on road from Caledon to Aughnacloy, one and a half miles east of Aughnacloy; "Rotten Rock," dark gray shale.
10	61/1	Roan, . . .	Rocks on Oon Water, near Pluck Bridge, a little north-west of Eglish; ochrey sandstone arenaceous limestone shale.
		County of MONAGHAN.	
11	1/1 & 3	Tayanagh, . .	Quarry near Mullyodan R. C. Chapel, two miles south-west of Aughnacloy; dark gray limestone and shale.
12	6/4	Skinnagin, . .	Quarry on road a little north of Drumcaw, Lough, three miles south of Emyvale; dark gray compact limestone.
13	7/1 & 2	Desert, . . .	Quarries near Glannan Corn Mill, close to Mountain Water River, one mile north-west of Glasslough; dark gray compact limestone and shale.
		County of ARMAGH.	
14	11/3	Enagh, . . .	Old quarry on road to Ballynameta Bridge half a mile south-east of Tynan; light gray limestone.

LIST of the FOSSILS collected from the LOCALITIES mentioned in the preceding TABLE.

The numbers opposite each species refer to the places at which they were collected, and the mark × where placed before them is intended to denote their comparative abundance.

CARBONIFEROUS LIMESTONE, SANDSTONE, AND SHALE.

PLANTÆ.

	Localities.
Plants, longitudinally striated about an inch and a quarter in diameter, on some of which small Annelidan shells, Serpula (Spirorbis) omphalodes are impressed, . . .	1.
Plant fragments, ...	1, 10.
Plants branching—? Algæ, . .	5, 11, 13.

ACTINOZOA—*Zoantharia.*

Chætetes tumidus, ...	4, 8, 11.
Cyathophyllum ceratites, . . .	11.
„ regium, . . .	3.
Favosites parasitica (on Zaphrentis cylindrica, ...	6.

ACTINOZOA—*Zoantharia—continued.*

	Localities.
Lithodendron affinis,	3, ××4, ××5 6, ×××11, ×12, ×××14.
„ junceum,	4, 5, 11, ××14.
„ striatum,	4.
Michelinea favosa,	9.
Zaphrentis cylindrica,	××4, 6, ××11.
„ sp. indet,	8.

ECHINODERMATA—*Crinoidea.*

Actinocrinus lævis (stems and joints),	×10.
Poteriocrinus crassus,	4,
Crinoid fragments,	3, 4, ××5, ××6, 7, ××8, ×××10, 11, ×14.

ANNELIDA.

*Serpula omphalodes (Goldfuss),	1.

CRUSTACEA—*Ostracoda.*

Leperditia Okeni,	××××1, 8,

Phyllopoda.

Dithyrocaris testudineus,	××1.

Trilobita.

Phillipsia Derbiensis,	6, ××11.

POLYZOA.

Fenestella antiqua,	3, 4, 5, 7, 8.
„ crassa,	5, 8.
„ membranacea,	4, 11.
„ tenuifila,	8.
„ quadridecimalis,	8.
Polypora verrucosa,	4.
„ papillata,	11.

BRACHIOPODA.

Athyris ambigua,	10.
„ planosulcata,	5, 7, 8, 11, 14.
Chonetes Hardrensis,	5, ×7, 8.
„ papilionacea,	11.
Orthis resupinata,	7, 8, 14.
„ aculeatus,	8.
„ giganteus,	××3, ××4, 5, 6, 8, ××11, 14.
„ hemisphæricus,	5.
„ punctatus,	4, 11.
„ semireticulatus,	3, 4, 5, 6, 7, 8, 11.
Rhynchonella pleurodon,	8
Spirifera bisulcata,	10, 11.
„ laminosa,	10.
„ striata,	8, 12, 13.
Spiriferina cristata,	4, 7.
Streptorhynchus crenistria,	8, 9, 11, 12.
Strophomena analoga,	8.
Terebratula hastata,	11, 14.

MOLLUSCA—*Lamellibranchiata.*

Aviculopecten Sowerbyi,	14.
Edmondea, sp. indet,	5.
Modiola Macadami,	××××1, 2.

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* I consider *Spirorbis minutus* (Portlock, Report on Londonderry, &c., p. 363, pl. xii., fig. 35), to be identical with this species.

	Localities.
Gasteropoda.	
Macrocheilus, sp. indet, . . .	11.
Phanerotinus cristatus, . . .	12.
Heteropoda.	
Porcellia Puzosianus, . . .	11.
Cephalopoda.	
Orthoceras, sp. indet, . . .	1.
VERTEBRATA—*Pisces.*	
Palæoniscus ? Fish scale, . . .	7.

REMARKS ON THE FOSSILS.

No fossils were observed in the Rocks described as Yoredale Sand stones.

The most important locality for fossils is that of No. 1 in the list, where dark calcareous shales of the Carboniferous formation occur in a stream near Waring Bank, in the Townland of Aghnaglogh, about two miles north-west of Clogher. In these shales is found the rare Phyllopod Crustacean, *Dithyrocaris testudineus*, described and figured in Colonel Portlock's Geological Report of Londonderry, Tyrone, &c., p. 314, pl. xii., occurring also, according to the same authority in "Derry shales, Ballynascreen" (Portlock's Report, p. 564,) and in Scotland (op. cit., pp. 564–5).

In this valuable work, the Author describes these shales on the Blackwater as "nearly horizontal, and the Modiola layers (*Modiola Macadami*), are associated with a layer the laminæ of which are thickly covered with *Dithyrocaris* (*Colei*)," *testudineus* (Report, p. 570).

In some of the associated shales at this place, I observed, in addition to the before-mentioned fossils, great numbers of the small carapace shells of Crustacea belonging to the order Ostracoda, covering the surfaces of some of the laminæ; these have also been described by Port lock in his Report, p. 316, under the names of *Cypris Scoto-Burdigalensis*, pl. xxiv., figs. 13 *a–e*, and *C. subrecta*, ibid., fig. 13 *b*; both being considered identical, are now referred to *Leperditia Okeni*, a species very common in the Carboniferous formations of Britain, Europe, and Nova Scotia.

WM. HELLIER BAILY.

December 27th, 1883.

CHAPTER IV.

FAULTS.

The great break referred to by Professor Hull* enters this sheet on its western margin, and extends in an E.N.E direction, by Favor Royal and Carnteel, across the entire Sheet. Its presence is established at several points by satisfactory evidence. For example, limestone beds proved to be "Upper," by passing directly under

* Physical Geology and Geography of Ireland, p. 191 (1878).

Yoredale Grit, are brought down against Lower Carboniferous Shale and Sandstone at Fardross, two miles S. of Clogher. Here also a series of limestone beds in the river where its course coincides with that of the fault has been subjected to enormous twisting and crushing forces, resulting in the formation of a mass of fault rock about two yards in width. Another striking point of evidence is observable in the Fury river, where the bedding is nearly vertical.

This main fault sends off branches to the north and receives dislocations on its south side of various degrees of magnitude and direction of throw. One of the former is seen crossing the Fury river, a short distance north of the main break, with a downthrow to the north, running north-eastward towards Ballygawley (Sheet 34). The fault running almost parallel to the latter with downthrow to the S.E., and leaving the sheet E. of Ballygawley, forms another of those branches.

The precise point of divergence of this fault is inferential, as no direct evidence is obtainable. Evidence for the small S.E. fault meeting the main break, E. of Fymore Lough, is found on the road side near Kilcarnon House, and further S. where massive pale grits of the Yoredale series are brought down against Upper Limestone. Another dislocation with opposite throw, meets the main break south of Fardross, bringing Yoredale beds against beds of Limestone on the N.E.

North of the Clogher valley, the Knockmanny escarpment ("Dingle beds") overlooks the Lower Carboniferous ground stretching away from its base, along which, therefore, a fault may be inferred, bringing beds stratigraphically higher, as well as geologically newer, to a lower actual level than those forming the escarpment.

This inference is further strengthened by the disappearance of the Lower Carboniferous beds between Cecil and Kilfaddy, which are well shown to the N.E. and S.W. of these places respectively.

Another small fault occurs S. of Slieve Beagh, entering at the western margin of the sheet, and running in a direction parallel to the main break, bringing Yoredale Sandstone down against Upper Limestone and Yoredale Shale. This break dies out in an easterly direction.

The only other dislocation to be referred to occurs on the west of Slieve Beagh, ranging in a direction S. 15° E., and terminating against the former, but with a greater throw as it brings the Yoredale Shale down against the Limestone.

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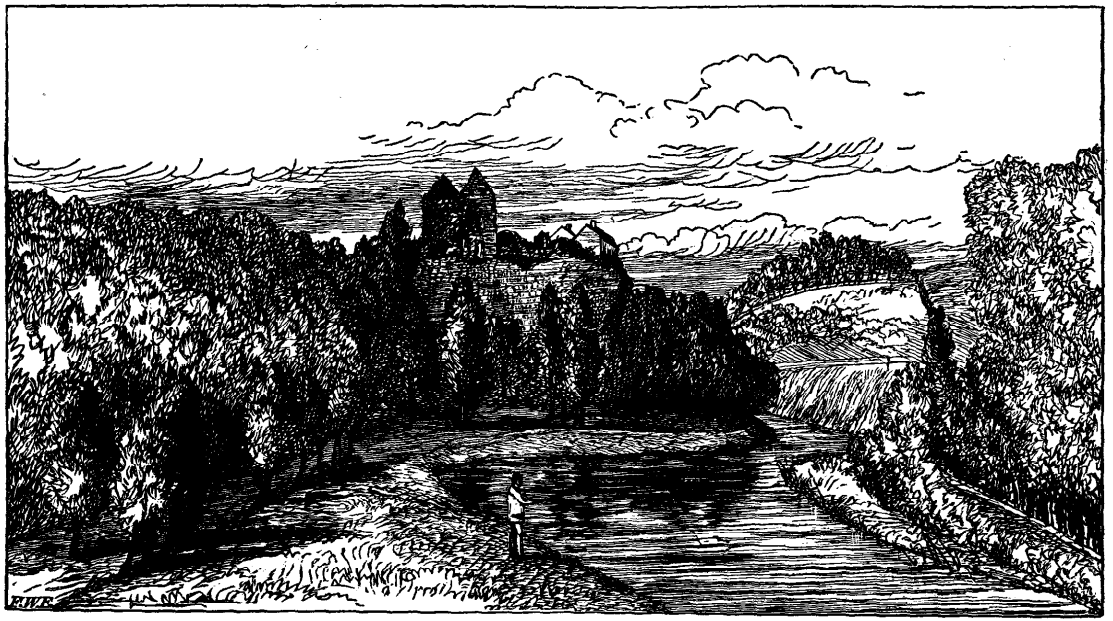

Benburb Castle and River Blackwater.