Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 57 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

INCLUDING

PARTS OF FERMANAGH, MONAGHAN, AND CAVAN.

BY

S. B. WILKINSON,

AND

J. R. KILROE.

WITH

PALÆONTOLOGICAL NOTES BY W. H. BAILY, F.G.S.

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PREFACE.

THE district described in this Explanatory Memoir was geologically surveyed during the years 1866–67, by the authors: the district lying west of the valley of the Erne having been examined by Mr. Wilkinson, that east of this valley, by Mr. Kilroe. It contains the principal portion of the Upper Lough—consisting of a net-work of little hills and canal-shaped branches and arms of the River Erne—which imparts to this part of the country an appearance as if half submerged. The authors have endeavoured to account, on physical grounds, for the peculiarity of its aspect.

EDWARD HULL, *Director*

Geological Survey Office, Dublin,
17*th September*, 1881.

THE

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

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

A. C. RAMSAY, LL.D., F.R.S.

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

IRISH BRANCH.

Office, 14, *Hume-street, Dublin.*

DIRECTOR:

EDWARD HULL, M.A., LL.D., F.R.S.

DISTRICT SURVEYOR:

G. H. KINAHAN, M.R.I.A., &c.

SENIOR GEOLOGISTS:

W. H. BAILY, F.G.S. & L.S. (Acting Palæontologist); J. O'KELLY, M.A., M.R.I.A. R. G. SYMES, M.A., F.G.S.; S. B. N. WILKINSON.

ASSISTANT GEOLOGISTS:

J. NOLAN, M.R.I.A.; R. J. CRUISE, M.R.I.A.; F. W. EGAN, B.A.; E. T. HARDMAN, J. R. KILROE; W. F. MITCHELL; and A. M'HENRY.

FOSSIL COLLECTOR:

R. CLARK.

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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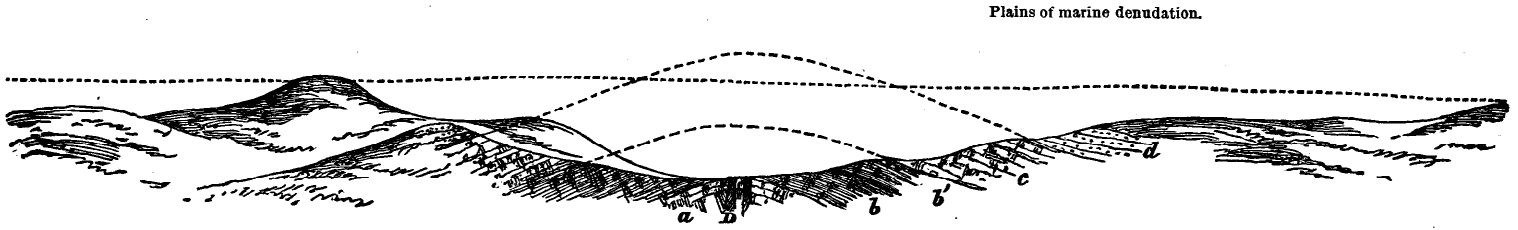
FIG. 1. SECTIONAL VIEW OF THE VALLEY OF THE UPPER ERNE.



EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 57 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND.

General Description.

The area about to be described includes parts of Fermanagh, Monaghan, and Cavan. It lies between east and west lines passing through Maguiresbridge, just beyond the margin, on the north, and through Ballyconnell on the south; also between the meridians through Bawnboy and Scotshouse in the S. W. and S. E. corners respectively. The chief towns in the district are Lisnaskea and Newtownbutler.

Physical Geography.

(Eastern Portion.)

An escarpment, well developed at Carnmore Hill (1,034), runs westward towards Donagh, and thence northward, becoming less marked and irregular until at Nutfield, on the north margin, it is scarcely perceptible. The foot of this escarpment is determined by a narrow valley, separated from the flats bordering Lough Erne by a broken line of high ground striking southward from Lisnaskea to Moor Lough, and thence by Mill Lough to Annaghilly on the east margin. The escarpment bounds, on the west and south-east, an undulating plateau (the Lisnaskea Mountains, so-called), which slopes away gently towards the north and west from Carnmore, and has a covering of peat over a third of its surface. The country bordering Upper Lough Erne is flat, consisting on the east side of a network of bog and alluvium, broken by hillocks of drift which rise to various heights up to eighty or ninety feet above the surrounding level. So little is the general level of the flat higher than the ordinary Summer level of the lough (151), that a rise of ten feet in the latter would cause its expansion to more than double, nearly three times its present width, as indeed is the case in wet seasons.*

* Such as 1879.

Drainage.—Upper Lough Erne occupies an area of about 29 square miles, including 5·3 for islands, with a shore line of 100 miles. From Castle Saunderson to Crum, the seat of the Earl of Erne, it is a mere network of natural channels; but from this point northward it expands, so that here the proportion of water to included islands is 19 : 3. It receives the Colebrooke River on the north, and on the south the Erne, Woodford, and Finn Rivers, the last of which, rising near Carnmore Hill (though the reputed source is an abundant spring in the townland of Crocknagross), re-enters the sheet in the S. E. corner.

The valley of Upper Lough Erne, lying between the Lisnaskea Hills on the east, and Slieve Rushen, north of Ballyconnell, on the west, though forming a channel for a great ice stream in glacial times, as Professor Hull asserts, owes its existence doubtless to the combined chemical and erosive action of water. That flowing from the central plain has therein found a passage to the sea, whilst the contour of the country was being moulded into its present shape. The valley lies normal to the range of high ground running from Lough Allen towards Dungannon, and there is no evidence to show that that direction has been necessitated or initiated by faulting. On the contrary, the strata dip away from the valley on either side, which implies an anticlinal axis along its central line; and had the more easily denuded lower Carboniferous beds been by this means brought against the plain of marine denudation† along which the same strata were truncated over the Silurian ground ranging N.E. and S. W. by Cavan, and over the Old Red Sandstone ground north-east of Enniskillen, the water flowing northward would have selected this course,‡ leaving untouched the grits which cap the Lisnaskea Hills and Slieve Rushen. That this has actually been the case is highly probable, because—

Firstly, judging from the thickness of calp and upper limestone hereafter given, a plain passing through the highest points§ of the surrounding country would cut the latter member directly over the lough. *See* fig. 1.

Secondly, were the grits continuous across the valley, on emergence, they would rise above the adjacent outcrop of the more easily-denuded calcareous members below, and the drainage in consequence pass off by Smithborough north-eastward, or by Ballinamore into the Shannon basin, the watershed at these points even now being not more than about 100 feet higher than the level of Erne Valley.

J. R. K.

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* Phys. Geo., Ireland, p. 200.

† Referred to by Prof. Hull, *Ibid.*, p. 161.

‡ The great dolerite dykes described on page 28 indicate a line of weakness along the valley near its centre, which would also facilitate its formation.

§ Cuilcagh (2,188), Slieve Beagh (1,255), &c.

Physical Geography.

Sheet 57.—Western Portion.

Slieve Rushen and Knockninny hills are the highest points in this district; the former attains the heights of 1,279 feet and 1,269 feet, and the latter 628 feet.

The top of Slieve Rushen is more or less a table land, covered by a considerable thickness of peat bog; on all sides innumerable little runners and streamlets carry off the water which accumulates in the bog and contribute to form the Claddagh or Swanlinbar river to the north, and the Woodford river to the south, both eventually reaching Upper Lough Erne.

Knockninny is a huge bluff of limestone which stands up well from the surrounding smaller drift hills, flat bogs and alluvial deposits.

To the north and east of Slieve Rushen hills the country is covered extensively by drift and boggy flats. The general form of the hill is oblong hog-backed and surrounded almost invariably with either alluvial flats or thick flow bogs.

Owing to the slight elevation above Lough Erne, these flats are easily flooded, and in winter, and occasionally in summer, hundreds of acres are submerged.

S. B. W.

Rock Formations and Divisions.

Aqueous Rocks.

Name.		Colour on Map.
Recent Accumulations,	Peat (bog), Alluvium, and other Superficial covering,	*Pale Sepia.*
	Drift, Post-Pliocene,	*Engraved dots.*
Lower Carboniferous Series,	d^3 Yoredale Sandstone,	*Yellow and Red dots.*
	$d^{2'''}$ Upper Limestone,	*Deep Prussian blue.*
	$d^{2''}$ Middle Limestone ("Calp")	*Dark indigo.*
	$d^{2'}$ Lower Limestone,	*Light Prussian blue.*
	b^2 Lower Silurian,	*Pale Purple.*

Igneous Rocks.

B. Dolerite and Basalt,	*Burnt Carmine.*

Lower Silurian.—There are no exposures of these rocks in the district, but they occur in the maps to the S. and E. quite close to the margin of the sheet, where they consist of massive greenish quartzose grits. Angular blocks of Silurian rocks are numerous about Scotshouse, which are evidently not far removed from the parent rock. It is on the foregoing evidence that the boundary line has been drawn.

R. J. C.

Lower Limestone.—This member stretches from Clones westward, and occupies a large tract in the southern portion of the sheet. It also occurs in the northern half, though concealed by drift and alluvium, west of Lisnaskea. This is probably linked with the former extensive outcrop by a narrow band, of undefinable width, beneath Lough Erne, as fine light grey compact limestone comes to the surface in the island of Inishcorkish, and large subangular blocks of dark grey limestone, which I suppose to be from the subjacent rock, are found in the islands stretching southeastward from Inish Rath.

The lowest beds, resting unconformably on the Silurian, seem to consist of grey calcareous sandstone and arenaceous limestone. The numerous openings met with in crossing the country from Newtownbutler to the Finn River, show the lower limestone beds to consist of good sound stone suitable for burning, varying in colour from light to dark and bluish grey, compact and subcrystalline in structure, with a variable percentage of clay—as a rule small, and containing brachiopods in abundance, and some corals. So numerous are the former that, in places, beds are wholly formed of distinguishable *Spirifers* and *Producti* cemented together. Chert is rare, but occurs in the blue limestone on the shore of the small lough opposite Lakeview House, and near the roadside about a quarter of a mile east of Gortnacarrow bridge. The beds are sometimes found up to eighteen inches thick, though usually thinner, occasionally flaggy, and are often separated by thin partings of carbonaceous shale, some of which show fucoidal markings.

Lower Limestone (*western portion*).—There is a very small area in this portion of the sheet occupied by these rocks. At the northwest corner of the sheet, at the little hamlet of Skea, the southern boundary comes into the sheet, and travelling in a south-easterly direction passes Belisle, and bends round in a north-easterly direction into the eastern portion of the sheet. This boundary is more or less undefined, as there is no rock *in situ*, although immediately at the north in sheet 45 the limestone is well seen.

At the hamlet of Kinawley, this rock is seen. It is a grey compact highly crystaline limestone, also fossiliferous. A little to the north-east it outcrops again, being much jointed. Still on a few hundred yards north-east there are four outcrops, but in no place is the dip or bedding to be seen. It is the same class of rock as that seen at the large quarry at Enniskillen workhouse, but is hardly as crystaline, or traversed by the same number of carbonate of lime veins.

In the south-west corner of the sheet about a mile east of Bawnboy, a fault brings up the lower limestone against the Yoredale beds.

They are noticed by Mr. H. Leonard, in the stream which crosses the old road at right angles and immediately south of the fault, as thick beds of softer shales and dark smooth limestone dipping E. at from 10° to 35°, and there is a note to the effect that "to the south of the fault Mr. Baily considers the rock to be lower limestone." It joins the larger area of lower limestone formation a little east of Ballyconnell.

Middle Limestone.—This member may be advantageously divided into two parts; one, forming the broken ridge of elevated ground which runs parallel to the escarpment from Lisnaskea by Donagh to the east margin; the other stretching from the foot of this ridge to Lough Erne on the west—a tract much obscured by drift and alluvial deposits, and to the Lower Limestone boundary on the south. The latter division is well seen in the streams N.E. of Newtownbutler, and is replete with corals of various genera, which may be said to characterize it in the locality. It is also linked with the Lower Limestone by its molluscous fauna. It is, however, much more earthy than the Lower Limestone, being in parts little more than a calcareous shale; even the most solid-looking beds, on exposure to atmospheric agents, decrepitate into shaley splinters, coloured deep brown by the oxidized iron of pyrites which is of common occurrence over the whole district, especially throughout this member; the extruded sulphur often forms a mealy coating on exposed surfaces of the rock.*

The upper division of this member, so far as has been ascertained, is destitute of (at least *visible*) molluscous and coralline forms alike, and is allied to the succeeding member in containing chert; this too, abundantly, towards the middle of its section, as in the uppermost beds of the Lisnaskea quarries, which re-appear at the railway crossing west of Moor Lough, and on the bye-road, crossing the hill northward, near the mill east of Drumgallon Lough. The chert occurs in layers up to two inches thick, as nodules more or less regular, as stringy bands or even as a siliceous ingredient rendering the stone tough, often splintery and a good road metal. The labourers in Lisnaskea quarry report liquid bituminous matter in the centre of some of the chert nodules, which I have not been able to verify. The rock is always thin-bedded, occasionally flaggy, of a peculiar light opaque blue colour banded with gray; and on hammering much of it displays a greater disposition to split parallel to the bedding than to break across. From the quantity of chert it contains it is never burned for lime; it also contains a large proportion of clay, but the contrast with the Upper Limestone in this respect is by no means so marked as that between the Lower Limestone and the lower division of this member. The upper part of the calp is cut off north of Lisnaskea by a fault crossing Lough Erne.

The thickness of the middle limestone is inascertainable with certainty. A measured section of the lower part gives a thickness of 633 feet; and as this does not extend across more than half the width of the outcrop it is probable the thickness is much greater. The upper division seems no less than 400 feet at Lisnaskea. North of Newtownbutler the outcrop of the same division is wider, and the dips, at the few openings met with, are greater and very regular; but the strata there may be repeated by faulting or bent, for the thickness can scarcely be much more

* The pyrites usually occurs as filmy linings on the small cracks and joints, sometimes as cubes up to a quarter of an inch size.

than is indicated east of Lisnaskea. The aggregate thickness of the calp in this locality would then be greater than 1,033 feet.

Middle (or Calp) Limestone (western portion).—The Middle (or Calp) Limestone is largely represented in the western portion of the sheet. It stretches from the north-west corner across the valley of Kinawley—with the exception of the hummock of lower limestone which outcrops at the hamlet of Kinawley, all the valley is occupied by it. It is connected with the area north of Ballyconnell by the valley of Derrylin, where it is well seen. About a mile north-west of the hamlet of Kinawley, and on the margin of the sheet, the limestones are impure with shale bands, being highly fossiliferous and lying horizontally, with a slight inclination to dip south.

Due south of Kinawley in the Claddagh river, blue shales with impure limestones occur at intervals, all very highly fossiliferous; they dip away from the upper limestone owing to the disturbance caused by the large fault, which has been noticed by Mr. Kilroe, on the east of Lough Erne, and also by Professor Hull as having been traced from Mayo. At Glasdrumman bridge these rocks are well exposed to view, also at the corn-mill of the same name, a little south of the bridge.

South-west of Derrylin chapel, in the little streamlet which runs down to the hamlet, shales with bands of impure limestone occur. The bands of limestone are from one inch to three inches in thickness, they are highly fossiliferous, also contain stools of corals.

A little to the east of Stonebrook there are earthy coralline limestones with shales, highly fossiliferous showing an anticlinal bend.

There is a great deal of blue clay along the flats which makes a very fair brick; this clay is undoubtedly decomposed shale.

S. B. W.

Upper Limestone.—The escarpment bounding the high ground in the north-east is formed of Upper Limestone; in traversing which, considerable variety is noticed, as to colour of the rock, its structure, fossil contents, and amount of extraneous matter. By way of illustration it may be well to describe the different varities met with at points where partial sections, ranged across the outcrop, are rendered available either through the removal of drift by streams, or by artificial openings on hill sides where there is little or no drift. This is in lieu of complete sections across the entire outcrop, none of which are found. Thus:—

At Nutfield, where the lowest beds seem to be cut out by a fault, the yellow sandstones (Yoredale) pass down through pale grey shales into dark grey earthy limestone with chert, weathering into "rottenstone" which overlies a section giving the following varieties:—Slatey highly-fetid limestone, dark grey limestone with fossils; black compact comparatively pure, and dark grey solid beds with chert throughout.

From Forfey westward to Lisnaskea Moat; dark grey limestone, with chert near the top, over black compact, earthy, very

fetid; dark gray, compact, conchoidal fracture, with black chert bands up to two inches thick; over light grey splintery limestone with nodular chert, which contains cavities lined with calc spar; and near the base, grey limestone with uneven fracture containing chert, at the Moat Roman Catholic chapel.

In Ballagh, beginning at the top, Yoredale shales over very earthy limestones weathering shaley, resting upon tough dark grey limestone, which passes down into a compact, highly fossiliferous variety; dark grey earthy, highly-fetid with nodular chert, and grey compact, also containing chert over light grey with fossils; dark grey, slatey over black compact limestone, conchoidal fracture, with chert; coarsely crystalline grey, black splintery, and tough slatey beds, over some almost wholly consisting of chert, seen in a stream between Ballagh and Kilturk. These beds apparently overlie the representatives, on the west side of the fault in Ballagh, of about thirty feet of coarsely crystalline light grey massive-bedded limestone with encrinites, seen on the old lane running along the hill side in Ballagh. The stone here has been extensively worked for burning and road metal; and contains sand. It overlies black compact fetid limestone with fossils; and at the Calp junction, near Ballagh corn-mill, is seen dark grey, tough, earthy limestone, weathering quite shaley, with chert.

The numerous openings on crinoidal limestone similar to that just described, along a line normal to the outcrop for a distance of 800 yards, with a dip of twenty degrees, and scarcely a mile further east, indicate a sudden thickening of this variety of rock, difficult to account for. The thickness decreases just as suddenly on the same horizon still further east; but crinoidal coarsely crystalline limestone again appears north of Coolnamarrow Lough, near the Yoredale boundary. It may be added that these are the only evidences for the existence of this kind of rock in the whole area under description.

The stream flowing down the escarpment from Carnmore lays bare the last section of upper limestone met with in this sheet eastward. The lowest visible beds consist of arenaceous limestone which weathers into a friable light brown porous mass (rottenstone). Some distance up stream the following succession is met with:—Dark grey fetid limestone under bluish grey, compact and crystalline, weathering rapidly in parts, with beds of black shale; calcareous shale with thin compact limestone beds.

The upper boundary of this member is well established. But the lower is no more than approximate, because of the prevailing similarity between its lowest beds and the highest beds of the Calp as already noticed, and because of the obscurity of the tract along which the junction is evidently to be sought. The estimated thickness could therefore be only approximate, were there even good sections to rely upon. Selecting two points where the dips are regular and comparatively numerous on a line across the outcrop, such as at Ballagh and east of Lisnaskea, the former gives 1,200 feet, against a thousand for the latter, but a probable

fault through the Hollybrook alluvium may cut out a certain thickness of beds. At Donagh, however, the thickness seems to be much less, exclusive of the Donagh quarry beds, which have been relegated to the middle limestone from their very earthy nature, and their resemblance to those at Lisnaskea.

J. R. K.

Upper (or Mountain) Limestone (western portion).—Knockninny hill is a good example of this rock, standing out in bold relief from the surrounding country, with escarpments on its north-west and south-west sides. The dip is very hard to ascertain for several reasons, viz., the nature of this rock appears to be to weather along the joints which occur frequently; it is also very massive in its structure, and has a splintery appearance, with chert dispersed throughout the mass; also there are several faults, which on the north-west and south-west sides of the bluff cause the beds to be disturbed; thus at Knockninny hotel the dip is south-east at 60°.

Probably the general dip is in a north-north-easterly direction at a very low angle.

The rock is a grey, crystalline limestone, in places cherty, apparently very massively bedded; it also contains fossils.

On the island of Innishlirroo, grey, crystalline limestone is seen. Due east of this island, on the mainland, grey, crystalline limestone outcrops from under the drift; it has a few cherty bands, dip uncertain, the rock apparently very massively bedded, and well rounded by ice action.

On Innishleague Island there is a fine quarry open, showing compact grey, crystalline limestone, jointed and water-worn (joints having no particular direction) apparently nearly horizontal.

Probably the only district where the beds are undisturbed is in the south-west corner of the Sheet, about Bawnboy. Here the boundary can be determined very accurately. The limestones are generally thinly bedded, cherty, sometimes reddish in colour, and crystalline. They dip at an angle of 5° under the Yoredale shales, which are exposed lying immediately on the limestone.

North of Ballyconnell the upper limestone is abruptly terminated by a fault; it is a spintery, cherty rock, the chert weathering quite white in places, and at first sight it looks like chalk. This band of limestone can be traced at the base of the Yoredale beds, along the eastern slope of the Slieve Rushen Hills; it still retains its cherty appearance. It appears here to be much more easily acted on by the action of water, in many places it is cavernous, and the little runners are rapidly making their way into the strata. The dip is much disturbed, probably owing to portions of the bedding slipping, owing to the cavernous nature mentioned. It is traceable still northward, at the base of the Yoredale beds, the line of boundary being much broken by faults. It forms a slight escarpment on the north-west of the hill, facing Knockninny Hill, where it is cut off by a series of faults, but repeated again in Gorgesh, where the section is clearly seen.

Here the fault, which runs nearly north and south, has innumerable smaller faults and breaks in connexion with it, and consequently the beds are seen in the stream nearly vertical, or dipping at some very high angle.

Gortoral or Prospect Hill is composed of blue, crystalline limestone, and not having nearly as much chert in its composition. The dip is undefined; the rock is cut off from the limestone before mentioned by a fault (referred to further back as having been traced from county Mayo) which here causes the Yoredale grits to dip at an angle of 30° towards the limestone.

S. B. W.

Yoredale Beds (eastern portion).—These beds form the north-eastern plateau, known as the "Lisnaskea Mountains," and chiefly consist of pale and yellow grits, often white, fine-grained, and massive. The rock is generally stained with iron oxide, which in most instances spoils its appearance; in other respects it would be an excellent building material. In certain places, where the percolation of ferrous waters has been abundant and their oxidation free, as on exposed faces, a concretionary structure is induced, the rock weathering into masses which exfoliate along spheroidal surfaces, lined by crusts of ferric oxide.

When the rock is homogeneous it splits into well-shaped blocks and flags, with comparative ease. The massive beds often contain coarse patches with pebbles of white and pink vein-quartz.

Deposits of calcareous shale of various thickness, usually containing nodules or nodular bands of clay iron-stone are of frequent occurrence, but are not indicated, being comparatively unimportant, and because of the difficulty experienced in attempting to trace them with any degree of precision, if they are indeed at all continuous for any considerable distances. The mode in which these shale deposits occur, as a rule, is a gradual increase of the argillaceous ingredient, the rock changing *pari passu* from pale "free" sandstone to greenish, gray tough thin-bedded grit, with mica flakes, thin interbedded shales also coming in, which increase in proportionate quantity until the grit entirely vanishes. Overlying the shales directly, then, comes the massive-bedded sandstone once more.

This gives rise to numerous small dells met with in the district under description: streams fall from a thick bed of sandstone into a natural cutting through the more easily-eroded underlying shales. Ripple marks were observed on the grit beds accompanying the shale deposits.

Fine building stone has been quarried at many points, several years since, at Kilturk, Knocknalosset, Corraghy, Slush hill, Eshbralley, Knocknagowan, Carnmore, and Altnabrock. The first four are now almost abandoned; Eshbralley is still worked in a small way, yielding fine-grained, white, easily-wrought blocks, and whet-stones. Flags for tomb-stones are still obtained from Knocknagowan quarry. Carnmore, which formerly supplied a

very active trade in millstones, now yields a strong building material, though coarse and pebbly. At Altnabrock, the beautiful clean fine-grained massive rock is systematically quarried and wrought.

J. R. K.

Yoredale Beds (*western portion*).—In the south-west corner of the sheet in the neighbourhood of Bawnboy, the upper limestone passes into earthy limestones and blue shales all along the line of boundary, gradually ascending they occur with quartzose sandstones and grits, well bedded. Sometimes they possess a very ferruginous appearance with thin ribbons of smooth limestone. They are eventually capped with alternate bands of shales and sandstones, and the table land is entirely formed of massive quartzose sandstones, grits and fine conglomerates. These sandstones are yellow or white, but all have more or less a ferruginous stain when exposed to the air. On the east of the Slieve Rushen hills the bands of shale and sandstones do not appear in anything like the same thickness as above Bawnboy. The sandstones are nearly horizontal, on the southern portion of the table land of Slieve Rushen, but at the northern extremity of the hills the ground becomes broken up into valleys, and the sandstones are found dipping south-east at 25° to 30°. This is owing to the innumerable faults and breaks which occur in this neighbourhood. They may be described as massively bedded, but much jointed, grits and sandstones. Sometimes they become highly quartzose, yellowish white conglomerates, and are well rounded by glacial action.

S. B. W.

Post-Pliocene (*Drift*).—Reference has already been made to the ice stream which moved outwards towards the ocean, through "the valley of the Upper Erne," from the great central snowfield. And this according to Professor Hull ranged from the confines of Galway and Mayo to Antrim, through the drainage basin of the River Erne, near the southern extremity of the Lough.*

The drift is distributed along the valley in irregular hillocks, amongst which the Erne wends its way, and around the bases of which are the extensive deposits of peat and alluvium already noticed; it stretches eastward to the escarpment, but the plateau in the north-east is almost destitute of anything more than inconsiderable local accumulations. Near the escarpment, and to the north-east of Newtownbutler the drift is shallow, for the streams there as a rule flow along a rock bottom, and doubtless cut through a certain thickness of the rock also, judging from its easily-eroded nature. The same remark as to the drift will hold south-east of Newtownbutler, where the rock is exposed in so many places; nor can it be very deep even along the Lough, as the rock is seen at several places around Crum, and at the northern extremity. Indeed this might have been anticipated from the close proximity of the source of the ice stream under which the drift had been accumulated.

* Physical Geology and Geography of Ireland, p. 211.

Omitting the slight thickness of subsoil, which contains many rolling stones of grit, especially on the west side of the valley, the drift consists of a tough dark grey or blue clay with large blocks of limestone of a local character, often scratched. The drift, where very shallow, is a product of the subjacent rock; and this remark applies to the deeper portions of it when of considerable thickness.

J. R. K.

Post-Pliocene (Drift) (western portion).—The low-lying lands to the north and east of the Slieve Rushen hills are a succession of drift hills, composed as a rule of tough blue clay, with well rounded boulders of limestone, which in many instances show well-marked scratches on their surface. In the immediate vicinity of the Slieve Rushen hills there are also many boulders and angular blocks of sandstone and grit. These are probably local and once formed part of the table lands.

North of Ballyconnell, the road to Derrylin cuts through banks of stratified gravel, principally limestone. It is much used for road metal for which purpose it is excellent.

S. B. W.

Recent and Post-Glacial.

Alluvium Brick Clays.—Alluvial products washed into the numerous flats by streams draining the drifts and easily denuded limestone, are worked at various points above the valley, and usually yield a good building material when burnt. The burning is carried on by the small farmers during the slack time of the year, chiefly for home uses; and for this there is a plentiful supply of peat for fuel, so that the bricks cost little more than the labour of working and moulding the clay. The bricks are nowhere in the locality systematically burnt to any extent.

The bogs along the shores of Lough Erne are deep, and contain scattered logs of oak and fir.* Towards the borders, near the upland, the bog falls away, and frequent floodings, which reach these portions, mix the peat with loam, rendering much of the bog available for cultivation.

This extensive network of bog and alluvium, stretching from Lough Erne on either side, together with the numerous inclosed loughlets, bears testimony to a former extension of the lough. Reeds, moss, and other vegetable accumulations, similar to what now line the lake margins, encroached upon the waters, gradually displacing them, and this resulted in a contraction of the lough to its present limits.†

* The following note, sent me by a friend, describes a section of peat south-west of Lisnaskea. After cutting through a few feet of brown turf "lough weeds, or leaves like water-lily" are met with. "Beneath these are willow and hazel roots, and branches with hazel nuts," shape well preserved. Still further down, as high as five or six feet above the clay, is found the oak, which "invariably underlies" all other varieties of wood. "The cutting I have indicated would be in all sixteen or eighteen feet deep," and in the lowest six feet, the oak stumps are found quite undisturbed. No mention is made of fir stumps, but logs of fir seem to mingle with those of oak, so as generally to indicate the same horizon of growth.

† This, though not within the memory of the oldest inhabitants, seems to be somewhat recent, as the subsidiary loughs are still spoken of as "The Lough."

On the plateau to the N.E., the peat varies from six or eight feet to a foot in thickness, and, as has been already stated, covers a large proportionate area.

J. R. K.

Recent and Post-Glacial.

Western portion.

Alluvial tracts are well represented in the valleys of Kinawley and Knockninny; as a rule they stretch from the drift hills, and often skirt the tracts of bog; they are, however, subject to long periods of flooding during the winter months. Along many of the streams, fine blue clay which can be worked into excellent bricks is found. The natives work this in a small way, but, as a rule, turn out a very rough brick; but at Arney Bridge, on the river of that name, the Earl of Enniskillen has established kilns for some years, and turned out last year, 1880, from 1st April to 1st November, from a list which I now have before me, about 402,795 pipes of different sizes, 100,000 bricks, 29,200 flooring and roofing tiles, and 120 yards of ridge tiles 1,023 dozen flower pots, 100 dozen saucers, and a few other articles, such as chimney pots, &c.

The bogs are very numerous, those of the low-lying lands being often of great depth. If they could be drained, all these bogs might be reclaimed; and by mixing the boulder clay with the peat, in a comparatively short time they would be fit for cultivation; the difficulty is the very small fall to take the water off. The table-land of Slieve Rushen is covered by a tract of bog averaging about nine feet thick.

S. B. W.

Igneous Rocks.

Dolerite and Basalt.—Two large dykes of dolerite running parallel, and half a mile apart, occur on the east shore of Upper Lough Erne, one traceable from Gortnacarrow Bridge to Kilmore Lough, a distance of four miles; the other by Loughs Cornabrass and Nacallagh, for a distance of about three miles. The walls of neither are to be seen, but the exposed width of the former measures about seventy-five yards at Bun, near the roadside, on the way from Newtownbutler to Crum, and this amount probably indicates as much as 100 yards for the entire width. The latter seems to be not less than sixty yards across. A rude columnar structure is developed normal to the direction of the dykes in each case, and the internal structure is coarsely crystalline. Crystals of augite are found in the former up to $\frac{3}{8}$-inch long at the northern extremity, near Kilmore Lough, and as the rock there weathers freely, these crystals may be almost separated from the labradorite, although in a weathered condition. Olivine occurs as an accessory mineral, and there is a remarkable absence of zeolites, &c. In Derrychaan, near Kilmore Lough, hard, tough, compact cherty limestone is seen in the course of the dyke, and within a few yards of dolerite *in situ*; this may be an included mass,* yet possessing the ordinary dark, grey colour.

* It is possible, as in Scotland and elsewhere, the dolerite may disappear from the surface here to reappear on the shore of Kilmore Lough, half a mile to the N.W.

A dyke of unknown width and extent is met with at Holly brooke in the river, of bluish dark grey dolerite. It cuts through the limestone which it has changed into a white mottled marble at and near the junction.

A few small dykes of basalt are met with in the north east of the sheet, none of which demand a particular description.

J. R. K.

Igneous Rocks (western portion).—On the lake shore a little east of Bellisle bridge, a dyke appears running in a north-west and south-east direction; it is a dark greenish blue rock, slightly columnar in structure, and crystaline granular. This may be the continuation, in a north-west direction, of the dyke mentioned before by Mr. Kilroe, and which he has traced for a distance of nine miles.

There is a small dyke traced for about a mile on the northern spur of the Slieve Rushen hills; it runs in a north-west and south-east direction past the trig. station 928 feet. It is about thirty feet wide, and is a dark greenish dolerite. Where exposed to the atmosphere, it weathers into a ferruginous sand.

S. B. W.

Account of Minerals and Principal Faults.

Eastern and Western portion.

Minerals.—No evidence of minerals has been obtained, and no mining operations have been carried on in the district.

J. R. K. and S. B. W.

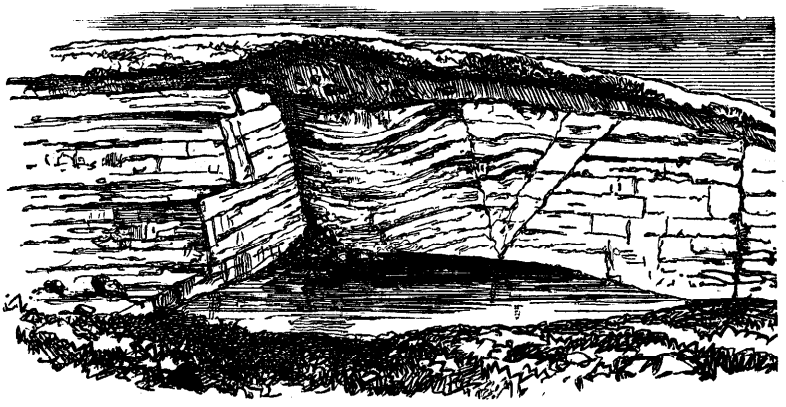
Principal Faults.—The faulting through the valley runs east-north-east as a rule, with downthrow to the south, and is more recent than the dolerite dykes above described, which penetrate the carboniferous rocks, inasmuch as it cuts and displaces them. It includes the great break * traceable from the county of Mayo, by Lough Allen towards Lough Neagh. This fault enters the sheet at Abbey Lodge, near Maguiresbridge, and runs through the obscure ground to the west of Lisnaskea, crossing Lough Erne near Belleisle. Another break runs south by Nutfield, and branches westward, cutting out the Lisnaskea beds north of that town. The evidence for a fault by Fawney along the Hollybrook river, as indicated, is abundant. In four or more places the bedding is contorted, or set vertical; and the rock boundaries are displaced. That scarcely a mile distant from the last mentioned, running between Carrick and Fairview, seems to be one of considerable magnitude also. It throws the upper limestone boundaries towards the west, forming quite an elbow on the escarpment north of Fairview House. The evidences for its continuation north-east by Edensharry hill are slight, but they become more distinct near the north margin; and it may be traced three miles at least beyond the sheet line. A fault is seen in Legmacaffry quarry near the Clones road, about one mile east of Newtownbutler, running east-north-east, (Fig. 2), to join another by Gortraw House, which throws down Calp beds against

* Mentioned by Prof. Hull, "Phys. Geology and Geography of Ireland," p. 191.

the lower limestone, as indicated. The great dolerite dyke above described is displaced by a fault running north-east through Feugh concealed by alluvium.

J. R. K.

Fig. 2. Fault through Legmacaffry Quarry.



Principal Faults (western portion).—The large fault mentioned by Mr. Kilroe as crossing Lough Erne near Bellisle, is traced in a western portion of this sheet as running in a north-easterly and south-westerly direction past Knockninny hill, and leaves the sheet south of Prospect hill. Another break occurs running from this large fault from Glasdrumman bridge through the valley of Gorgesh, repeating the upper limestone, and in connexion with this fault there are innumerable lesser breaks.

The limestone beds in the Gorgesh valley are cut off by a fault running from the head of the valley parallel to the great fault first mentioned, running in a north-east direction south of Knockninny hill and further east crosses Lough Erne. A little further south of the last mentioned fault, another break occurs running parallel to it, the limestone rocks being disturbed by it near Mount Tempest. A large fault occurs east of Bawnboy and is traceable along the country north of Ballyconnell, it becomes lost in the valley, but crosses Lough Erne in the neighbourhood of St. Huberts. This fault cuts off abruptly the upper limestone and Yoredale beds on the north and the lower limestone is brought into immediate contact with them cutting out the Calp beds.

There is a small fault running along the south-west face of Knockninny hill.

S. B. W.

GLACIAL STRIÆ OBSERVED IN THIS DISTRICT.

Townland.	Direction.	Remarks.
Carrowmaculla, . . .	N. 40 E. or S. 40 W.	Flow doubtful.
,, . . .	N. or S.	Flow doubtful, apparently newer.
Tully, ...	N. 40 E. or S. 40 W.	Flow doubtful.
Kimran, ...	N. 40 E. or S. 40 W.	,,
,, ...	N. or S.	Flow doubtful, apparently newer.
Carnmore, ...	N. 40 E. or S. 40 W.	Flow doubtful.

Palæontological Notes, Sheet 57.

Localities from which Fossils were collected.

No. of Locality.	County.	Carboniferous Limestone, Sandstone, and Shale.
1	Fermanagh, . .	On east shore of Upper Lough Erne, a little north of Lough Doo, about three miles south-west of Lisnaskea; dark gray calcareous limestone; "Calp, or Middle Limestone," on Map.
2	Do., . . .	Quarry at Lisnaskea; dark gray limestone and shale; "Calp, or Middle Limestone," on Map.
3	Do., . . .	Quarry in plantation, left side of road from Lisnaskea to Newtown Butler, a little north of Moor Lake; gray cherty limestone; "Upper Limestone" on Map.
4	Do., . . .	Quarry at Donagh, left side of road from Lisnaskea to Newtown Butler; dark bluish gray cherty limestone; "Calp, or Middle Limestone," on Map.
5	Do., . . .	Stonebrook, near Derrylin, about six miles south-west of Lisnaskea; dark gray shales and limestone; "Calp, or Middle Limestone," on Map.
6	Do., . . .	Kinawley, about eight miles south-east of Lisnaskea; gray limestone; "Lower Limestone" on Map.
7	Do., . . .	In stream, a little west of Glasdrumman-bridge, about two miles south-east of Kinawley; dark gray shales and limestone; "Calp, or Middle Limestone," on Map.
8	Do., . . .	Quarries near Manor Court, on left side of road leading from cross-roads, about two miles from Donagh; light gray crinoidal limestone; "Upper Limestone" on Map.
9	Do., . . .	On left side of road to Magheraveely, about two miles from cross-roads south-east of Manor Court; dark gray shales; "Calp, or Middle Limestone" on Map.
10	Do., . . .	A little north-east of Highgate Lodge, one and a half miles north-east of Newtown Butler; dark gray compact limestone; "Lower Limestone" on Map.
11	Do., . . .	Quarry close to road, half a mile south-east of Kilmackbrack Lough; two miles north of Newtown Butler; decomposing limestone; "Calp, or Middle Limestone," on Map.
12	Do., . . .	Quarry, about one mile north-west of old Church, Clonmony, three miles south-east of Newtown Butler; dark gray limestone; "Lower Limestone" on Map.
13	Do., . . .	On Cavan and Clones Railway, a little south-east of Lake View, about three and a half miles south-east of Newtown Butler; dark gray limestone and shale; "Lower Limestone" on Map.
14	Do., . . .	Road-side, a little east of Gortnacarrow-bridge, about four miles south-east of Newtown Butler; gray compact limestone; "Lower Limestone" on Map.
15	Do., . . .	A little south-east of Aghaderryloman-bridge, about two miles south-east of Kinawley; buff-coloured sandstone; "Yoredale Beds" on Map.

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

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

CARBONIFEROUS SANDSTONE, LIMESTONE, AND SHALE.

YOREDALE BEDS.

PLANTÆ.

	Localities.
Plant fragments indeterminable,	15.

LIMESTONE AND SHALE.

ACTINOZOA: *Zoantharia.*

Chætetes tumidus,	5, 8, 10.
Cyathophyllum ceratites,	1, 8, 10.
Isastrea Portlocki,	8.
Lithodendron affinis,	1, ××5, 6, 7, 8, 10.
„ junceum,	7.
Michelinea, species indeterminable,	5.
Syringopora geniculata,	5, 7, 13.
Zaphrentis cylindrica,	1, 5, ×××7.
„ or Cyathophyllum,	2, 5, 8.

Polyzoa.

Fenestella antiqua (F. plebeia, M'Coy),	××1, 3, ××5, ×××6, 7, 9, 10.
„ crassa,	8.
„ ejuncida,	1.
„ membranacea (Hemitrypa Hibernica, M'Coy),	8.
„ tenuifila,	4, 5, 7.
„ varicosa,	1.

Brachiopoda.

Athyris planosulcata,	1, ? 8, 10, 14.
Chonetes Hardrensis,	4, 8.
„ papilionacea,	1.
Orthis Michelini,	5.
„ resupinata,	1.
Productus aculeatus,	8, 11, 12, 13, 14.
„ fimbriatus,	1, 2.
„ giganteus,	4, 5, 6, 7, 8, 12, 13.
„ punctatus,	1, ×××2, 3, 6, 8, 12, 14.
„ pustulosus,	2, 13.
„ scabriculus,	×2, 7, 8, 12, 13, 14.
„ semireticulatus,	××1, ×2, ××3, 5, 6, 7, 8, 9, 10, 12, 13, 14.
Rhynchonella pleurodon,	2, 6.
Spirifera bisulcata,	6, 7, 8.
„ cuspidata,	2.
„ glabra,	6.
„ laminosa,	2, 5, 7.
„ striata,	1, 4, 5, 7, 12.
Spiriferina cristata,	3.
Streptorhynchus crenistria,	1, 4, 5, 9, 12, 13, 14.

Lamellibranchiata.

Aviculopecten arenosus,	12.
„ ellipticus?	13.
„ flabellulum?	9.
„ granosus,	2, 4.
„ plicatus,	1.
„ Sowerbii,	3, 12.
„ variabilis?	9.
Gervillia sp. indet.,	1.
Modiolopsis, „	5.
Myacites Omaliana,	14.
Small bivalves of the genera Axinus, Edmondia, and Sanguinolites,	8.

	Localities.
ACTINOZOA: *Gasteropoda.*	
Euomphalus carbonarius,	2.
,, Dionysii,	13.
,, sp. indet.,	1.
Loxonema, ,,	3, 10, 14.
Natica elliptica,	13.
Heteropoda.	
Bellerophon apertus,	14.
Cephalopoda.	
Orthoceras, sp. indet.,	1, 12, 14.
ECHINODERMATA: *Blastoidea.*	
Pentremites Derbiensis,	11.
Crinoidea.	
Actinocrinus, sp. indet.,	1, 5, 11, 12.
Crinoid stems and joints,	1, ×××2, 3, 4, 5, 6, 7, ×××8, ××9, 10, 11, ×××12, ×××13.
Echinoidea.	
Archæocidaris vetusta,	7, 8.
CRUSTACEA: *Entomostraca.*	
Leperditia Okeni,	1, ×××9.
Trilobita.	
Griffithides globiceps,	10.
Phillipsia Derbiensis,	5.

REMARKS ON THE FOSSILS.

The rocks coloured and described on this sheet of the Map as "Yoredale Beds" were, for the most part, found to be unfossiliferous; at one locality only (number 15) the sandstone so described contained fragments of plant stems.

The divisions of the Carboniferous Limestone do not in all cases agree with the assemblage of fossils found in them. More especially is this the case at localities Nos. 5 and 9, which are described on the Map as Calp, or Middle Limestone, but according to the fossil evidence clearly show the deposit in which they were imbedded to be Lower Limestone Shale.

These discrepancies I have before alluded to in the Explanatory Memoir to Sheet 65 (Remarks on the Fossils, p. 20). Upon this Professor Hull has commented in his Preface to that Memoir; I cannot, however, accept his explanation (which is merely theoretical) against my own experience, and because such a probability as he suggests would tend to stultify the evidence of fossils as characteristic of certain formations and divisions of the same.

WILLIAM HELLIER BAILY.

September 20th, 1881.

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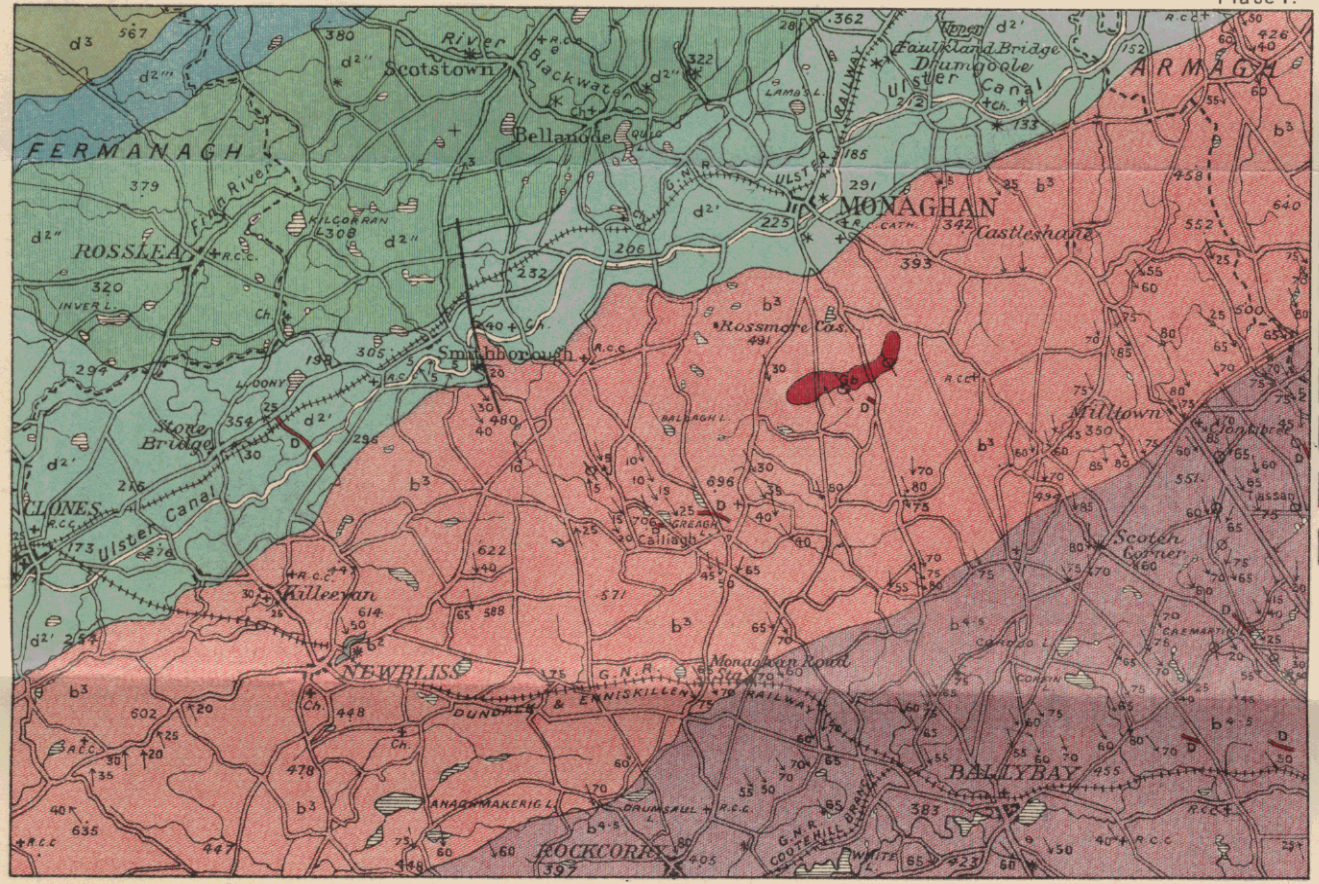
[P. 126.—250.—10/81.]

Mem. Sheet 58.

GEOLOGICAL SURVEY OF IRELAND

Plate I.



INDEX

d³	Yoredale Sandstones.	Carboniferous
d²‴	Upper Limestone.	
d²″	Middle or Calp Limestone.	
d²′	Lower Limestone.	
b⁴·⁵	Llandovery.	Silurian
b³	Caradoc or Bala.	
b²	Llandilo.	
Gb	Gabbro.	
D	Dolerite & Basalt.	

↘ Dips.
\+ Horizontal.
✳ Fossil localities.
Lead.
—o— Glacial Striæ.
—— Fault.

SCALE. 0 1 2 3 4 5 6 7 8 9 10 MILES.

Reduced from revised One Inch Map, sheet 58.

Ordnance Survey, Southampton, 1914.