Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEETS 68 AND 69 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTIES OF CAVAN, LEITRIM, AND MONAGHAN,

BY

HUGH LEONARD, F.G.S.,

WITH

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

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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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NOTICE.

The area comprised in the two sheets of maps described in this memoir consists chiefly of Lower Silurian, and of Carboniferous strata of the Carboniferous Limestone series. The latter occupy about two-thirds of the area. Associated with the former there is a mass of granite and a few small dykes of basalt, dolerite, and felspathic rocks. The whole area is much obscured by Boulder-clay, and the observer cannot fail to be struck with the numerous patches of peat which mark the whole region, and indicate the former existence of lakes now filled with alluvia and peaty vegetation.

Of all these formations the author has given a concise account easily intelligible to the reader.

ANDREW RAMSAY,
Director-General.

The district herein described was partly surveyed by the late Mr. W. B. Leonard, and by the author of the memoir; and inspected by me on several occasions during the years 1872–74. It is chiefly formed of those Lower Silurian beds which jut westward, from the shores of the Irish sea, into the central plain of Carboniferous Limestone; and is remarkable for the network of little lakes which occupy the depression of the Upper Erne to the north of Cavan, and which appear to have originated partly in the irregular distribution of Drift materials, and partly in the local solution of the Carboniferous Limestone by waters charged with carbonic acid.

EDWARD HULL,
Director of the Geological Survey of Ireland.

Dublin, 29th November, 1878.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEETS 68 AND 69 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND.

General Description.

The area comprised in these Sheets includes portions of the Counties Cavan, Leitrim, and Monaghan. The principal places in Sheet 68 are the towns of Cavan, Belturbet, Killashandra, part of Ballyconnell, and the villages of Ballyhaise, Redhill, Butler's Bridge, and Crossdoney, all in the county Cavan; with Carrigallen and Newtown Gore in the county Leitrim. In Sheet 69 the towns of Cootehill and Shercock, the village of Stradone, and hamlets of Tullyvin and New Bridge are all in the county Cavan; while the hamlets of Drum and Bellatrain are in the county Monaghan.

Physical Geography.

The greater portion of the area in this district is included in the catchment basin of the Erne. The source of the river Erne is on the eastern shoulder of Slieve Glah at an altitude of 653 feet. This river empties itself into Donegal Bay after a course of a little over 64 miles in length. About two miles south-west of Shercock the water-shed is situate, having Northlands on its crest, and bearing north-eastwards, and south-westwards. The waters on the one side finally falling into the Atlantic Ocean through the Erne catchment basin, and on the other side into the Irish sea, through the catchment basins of the rivers Glyde and Boyne.

The Glyde river rises about three miles south of the town of Shercock and running eastwards, flows into Dundalk Bay:—while along the south-eastern margin of the district we have the northern limits of the Boyne catchment basin, and also the source of the Blackwater a tributary of the river Boyne.

The highest point in the district is Slieve Glah, which attains an altitude of 1,057 feet, and is situate about three miles south-east of the town of Cavan. Shantamon is the next principal height; the trigonometrical point 715 is about four miles north of Slieve Glah and about five miles further north, the highest ground is the hill of Claragh, which is 492 feet above the level of the sea. The country east of these principal points consists of Silurian rocks, save one small outlier of the Carboniferous forma-

tion at Stradone, and some igneous intrusions, which will be hereafter described. It is generally wild and hilly, more specially along its southern margin. The valley of the Annalee lies in the centre of the region.

The Annalee river rises near the eastern margin of Sheet 69, at an altitude of 732 feet, and after describing a course of nearly 42 miles joins the Erne, near the outlet of Lough Oughter, which lake occupies the centre of Sheet 68.

The Annalee which lies due east and west, on its northern side receives as tributaries the Bunnoe and Dromore rivers:—the Dromore including the chain of picturesque lakes between Rockcorry and Cootehill, while on its southern side the Laragh river is its principal tributary. North of Shercock the upper waters of this river comprises 9 or 10 lakes within a distance of a little over six miles, and is called the "Knappagh Water" where it joins the drainage from Loughs Sillan and Tacker, on the roadside between Shercock and Cootehill. Lough Sillan is a picturesque sheet of water lying immediately north-west of Shercock, and is upwards of two miles in length.

The greatest elevation south of the Annalee valley is the trigonometrical height of 982 feet; it is about three miles due south of Shercock. Between this height and Slieve Glah we have an undulating mountainous country, which forms the watershed previously alluded to as situate between the Erne and the Boyne catchment basins, and which thus forms a part of the main watershed of Ireland. The principal heights on this bleak tableland, as we approach Slieve Glah are as follows:—778, 725, 680, 710, 620, 805, 745, 692, 625, 620, and 619 feet. There is an elevated spur from the western ridge bearing northwards, which, as it dies away towards Cootehill, has the following elevations:—857, 826, 805, 804, and 582 feet.

North of this valley the greatest altitude attained is towards the N.E. of Sheet 69, where the trigonometrical point was determined at 779 feet above the level of the sea; from this the ground gradually falls, while yet undulating, till we reach the margin of the limestone country of the great Central Plain of Ireland.

The country to the west and north-west consists of the undulating hills of the limestone plain:—the greatest altitude in this formation is Mullaghmore hill, 392 feet. This hill bounds on the south-east an extensive tract of moor locally called the Ballyheady mountain. Bounding this moor on the north-west is the Woodford river, (another tributary of the river Erne)—through this river the drainage of the district flows, from Garadice Lough on the western side of the Sheet, till it leaves it on its north-eastern margin at the town of Ballyconnell.

About midway in the southern portion of Sheet 68, the river Erne entering it, flows in a northern direction, through the granite tract alluded t in a previous memoir of the survey.*

* Memoirs of the Geological Survey. Explanatory Memoir to accompany Sheets 78, 79, and 80. By W B. Leonard and R. J. Cruise, with Palæontological notes by W. Hellier Baily, F.G.S.

A little north-west of the village of Crossdoney the Erne entering the limestone country expands into the ramifying and picturesque sheet of water known as Lough Oughter. The surface of this lake is 160 feet above the level of the sea. The north eastern and south-western margins of Lough Oughter nearly coincide with the boundaries of the Silurian and Carboniferous rocks, and here *the form of the ground* is in a great measure due to the denudation of the limestone, it being carried off in aqueous solution. In a direct line of about 12 miles, nearly due north of where it enters the Sheet, after describing a somewhat irregular course, the river Erne leaves it at about a mile north of Belturbet.

The district to the south-west, between the river Erne and Carrigallen, also consists of comparatively elevated Silurian ground and undulating like the Silurian country to the east. The principal varying elevations going westwards are 269, 420, 459, 444, 310, 436, and 485. The chief drainage of this tract is southwards into Lough Gowna in Sheet 79: this lough receives the Erne as it flows from its source on the eastern side of Slieve Glah, but from Gowna this river pursues its northern course.

Lough Oughter receives the drainage on its western side from the low ground south of Newtown Gore, and along the junction of the Silurian and Carboniferous rocks, where a small chain of lakes are formed, and all flow into Lough Oughter a little east of Killeshandra.

The only remaining drainage to be noticed is that flowing from the northern and western slopes of Slieve Glah and passing through the town of Cavan, where it is called the Cavan river. About three-and-a-half miles further north it joins the Annalee, just before the latter adds its waters to the Erne.

The highest summits before mentioned have as their underlying rock, massive quartzose conglomerates, or strong coarse grits, these beds having better resisted the abrading influences to which all the strata were subjected.

Formations and Groups of Rocks entering into the Structure of the District.

Age.	Aqueous Rocks.	Colour or Sign on Map.
Recent Accumulations.	Peat, (Bog), Alluvium, and other superficial covering.	*Pale Sepia.*
	Drift, Post Pliocene,	*Engraved dots.*
Carboniferous Series.	$d^{2'''}$ Upper Limestone,	*Prussian blue.*
	$d^{2''}$ Calp or Middle Limestone,	*Prussian blue and Indigo.*
	$d^{2'}$ Lower Limestone,	*Prussian blue, light.*
	d^{2} Sandstones in the Limestone,	*Prussian blue and Indian ink, dotted with chrome.*
Lower Silurian Rocks.	b^{2} Caradoc or Bala beds, with Conglomerates,	*Pale purple.*
	b^{1} Llandeilo beds ?	*do.*

Igneous Rocks.

	Colour or Sign on Map
B. Dolerite,	{Crimson lake and Burnt carmine.
F. Felstone,	Light Vermillion.
Fp. Felstone Porphyry,	Dark Vermillion.
Fm. Mica Trap,	{*Orange chrome and carmine.
Fs. Felspathic Ash,	Do.
G. Granite,	Crimson Lake.

Granite of Crossdoney.—This mass of granite is the result of metamorphism,—it is variable in its composition yet generally of an even-grained texture; a pinkish flesh coloured felspar, dullish opaque quartz, and black mica are its prevailing constituents. Occasionally nests of fine hornblende crystals occur and pieces of fine hornblende schist are found in patches and nodules like those in the metamorphic Omey granite (See Ex. Memoir 93, 94, &c.). On its north-eastern bounds it consists of finely crystalline greyish granite, having a pale pinkish felspar, glassy quartz and black mica all uniformly developed. In the vicinity of Bellahillan Bridge and westwards where the road branches it is greyish or pinkish as a pale milky or flesh coloured felspar prevails with a glassy quartz and black mica; nests of hornblende were also noted, also some specks of chlorite. It is generally fine grained and varies in colour as its different constituents predominate, from dark grey to black, as at Crossdoney. On its north-west limits in Drummora Great, the junction of the granite with the fine dark grey grits is well seen, the strike of the Silurian beds is steady, and the grits merging into the granite may be well noted; the passage is very gradual and in allusion to this Professor Hull writes: "the phænomena observable here regarding the passage during the metamorphic process of the Silurian grits and slates into the form of granite are similar to those which I have observed in the case of the Slieve Croob granite near Newry"†

The granite is generally broken up by irregular jointing, and thus can be little used for building purposes.

The whole of this tract of granite is surrounded by the Lower Silurian rocks, and a mass of the latter is enclosed towards its north eastern limits, and is probably faulted on its western side."‡

Igneous Rocks.

Dolerite B.—This rock occurs in numerous places within the district, particularly in sheet 69, and varies in character from coarsely crystalline to fine grained. In it the labradorite occurs as small light coloured scales, or with numerous grains of olivine weathering into rusty specks. It generally weathers in large spheroids producing a coarse brown sand, occasionally the

* This is a compound colour.

† Explanatory Memoir 78, &c.

‡ On page 11 of the Explanatory Memoir to Sheets 78, 79, and 80 it is stated in error that "a small outlier" from the Carboniferous rocks "occurs near the centre of the mass," and a foot note on the same page says: "This is shown on Griffiths' map, and occurs in Sheet 68, not yet published." This mistake may have arisen from the examination of an inaccurate copy of Griffiths' map.

spheroids are small, when the rock has a pisolitic appearance. About a mile-and-a-half E.N.E. of Redhill at the junction of the counties Cavan and Monaghan, a dyke of this dolerite forms a prominent ridge striking N.N.W. and S.S.E. at intervals for a distance of fifteen miles a similar rock was traced as far as Newbridge.

Felstone F. When porphyritic Fp.—A few dykes of these occur, they consist of a pale bluish grey felspathic base, generally containing specks of iron pyrites, they are sometimes porphyritic when crystals of orthoclase are developed, a small exposure occurs N. W. of Drumheel and three dykes are seen about ¾ of a mile N. E. of Cavan, they vary from greenish to grayish and weather with the white characteristic crust of the felstones.

Mica Trap Fm.—Several veins of this rock are noted as occurring interbedded with the Silurian strata, it is described as a fine grained grey rock, with numerous small plates of dark or bronze coloured mica. It very generally weathers into a yellowish sand, but where undecomposed, as at Drumleague, about a mile south of Tullyvin, the rock consists of flakes of black mica and a reddish felspar.

Felspathic ash.—Interstratified with these Silurian beds occur several of felspathic ash; these are exposed at intervals along a line bearing from N.W. to N.E. of sheet 69, varying only where the Silurian rock itself deviates from the normal strike. The rock is generally flaky, consisting of granules of felspar enclosing rounded and occasionally angular blocks and pebbles of some species of rock. In one place it shows no pebbles, is steatitic and weathers soft, and of a pale white. It is sometimes vesicular and amygdaloidal, the cavities being filled with greenish crystals, probably chlorite. Numerous rounded cells of pale zeolites were also noted.

Aqueous Rocks.

Lower Silurian. Llandeilo Beds *b*.[1]—These beds consist of dark to black shales and slates; they are generally vertical and occur along the many sharp anticlinal folds which exist throughout the lower Silurian rocks. Immediately outside the town of Cavan in the road cutting towards Ballyhaise, they are well exposed, and again about two miles south of Shercock. Near the latter place, they consist of dark grey graptolitic slates, and thin smooth flags with a bed of soft earthy carbonaceous shale. This bed of anthracitic shale has been worked in several localities, hereabouts, coming to the surface probably along lines of an anticlinal flexure.

Caradoc or Bala Beds *b*.[2]—Massive and thick bedded grey and greenish grits, graduating into quartzose sandstones and fine conglomerates, or interstratified with grey green and dark slates, shales and thin smooth flags. The slates and flags are occasionally purple from the presence of oxide of iron, or again black from the earthy oxide of manganese. They are generally broken, jointed and much contorted, and seldom dip for any considerable distance in the same direction, being frequently repeated over the district in anticlinal curves.

Detailed Description.

Lower Silurian Formation in Sheets 68 *and* 69.

The Silurian rocks forming the greatest elevation of the district, Slieve Glah 1,057 feet, consist of strong grey grits more or less massive, and occasionally interbedded crumpled slates and shales. They are well seen on its north east shoulder in bosses, some of which retain ice striæ bearing N.W. Towards the east and north-east the beds consist of fine grey grits, strong greenish grits, and bluish shattered shales and slates all more or less jointed and broken up. Westwards, and about Moynehall, the beds are also greatly jointed and consist chiefly of thick and thin bedded felspathic greenish and greyish grits, with slatey layers and shales: some black shale bands are exposed on the road between Green Lough and Moynehall. Ice striæ bearing N. 20 W. is to be seen on several exposures south of Green Lough. Between Moynehall and the mass of granite at Castle Cosby the beds consist of massive grey grits, some thin beds, however, occur associated with some shaley partings.

On Shantemon Hill, 715 feet, numerous crags and knolls of thick and thin bedded strong grits with layers of brown slates occur,—the bosses of rock are ice rounded, and preserve striæ bearing N. 30 W.—In the grits were observed numerous surface holes due to the weathering out of calcareous nodules. North-east and east of Beaghy, thick and thin bedded fine green grits with shale partings are exposed and showing folds at high angles.

Between Cross Forts and Butler's Bridge extensive exposures are observed, the beds dipping in all directions and varying from the vertical to angles of a few degrees:—the rocks are greenish and greyish felspathic grits, shattered and broken by irregular jointing and having occasional shale partings:—many of the bosses are ice worn and have striæ bearing N. 25 W.—South of Cross Forts ferruginous shales with thin grey grits are seen along both roads.

On both sides of the road leading from Ballyhaise to Cootehill the rocks are well seen, and consist of five grained thick bedded greenish grey grits, with some gritty shale beds and shale partings. Anticlinal folds are also to be noted.

At Butler's Bridge strong bedded grey grits with some beds of greenish shale are exposed along the river: at the Corn Mill ice striæ bearing N. 25 W. is seen. North of Butler's Bridge on both sides of the railway cutting greenish and greyish grits with slatey layers occur.

Near Urney Church thick and thin bedded greyish grits with some gritty shale beds are seen in the river, and in the neighbourhood the exposed bosses consist of strong bedded to massive greyish grits. At Ashgrove strong grey grits interstratified with some shattered shale beds abound.

Immediately north of Broomfield shattered ferruginous shales occur, and further north towards Shannow Wood knolls of strong greyish and greenish and greyish grits are numerous.

On both sides of the road leading from Redhill to Cootehill and in the vicinity of Claragh numerous bosses of coarse green grits occur: westwards of the church they are interstratified with furruginous beds (see page 22) and all are broken up and contorted by both folds and jointing. At Claragh they consist of reddish to blackish ferruginous shales and greenish grits, and further north, of reddish shales and jasperized beds, rolling at low angles and broken up by irregular jointing.

Southwards of Killashandra and between Rockfield and Lough Oughter, massive greenish and greyish grits with slatey layers prevail, some coarse quartzose beds occur south-west, and south of mill lough, interbedded with some shattered shales. Ice striæ and grooving are frequent, varying from N. 20 W. to N. 30 W. In the vicinity of Rockfield some red hæmatite beds are noted. Strong grey grits are exposed at Drumhart, while at Derrylane Church and eastwards towards Lakeview greenish and greyish grits and shattered slates all greatly jointed are seen: the greenish grits prevail and shaley partings are more or less developed.

The rocks north east of Carrigallen consist of strong greenish and greyish grits with quartz strings, but towards Killygar and Dunaweel these have slatey beds interstratified, and all are greatly broken up by jointing:—to the south and south-west in the vicinity of Mullanadarragh, greyish grits with slatey partings prevail where also all are much jointed and shattered.

Cootehill and Stradone District.—In the railway cutting N.E. of the Cootehill terminus occur thick and thin shattered fine grained grits, interbedded with green shales and slates, the latter occasionally preserving single graptolites—over the old deer park to the east these beds are exposed in bosses and knolls, which are frequently ice rounded, the general dip is S. 30 E. at 60°, but near the forking of the road N. of the old race course they are horizontal, and further S. westwards they return to their normal dip. A similar fold is exposed to the S.W. in a deep road cutting under the workhouse in thin bedded grits, flags, and green shales—the beds without altering their dip repeating themselves by an anticlinal curve. East of Dung Lough beds of thin smooth grits, green shales and thick strong grits, undulate at low angles. The thin fine grits yield flagstones and building stones; and supplied those used in the erection of the Union Workhouse. East of the race course over a large area thin greenish flags or what may be called tilestones are exposed. At Skerrig veins in these beds were noted filled with quartz and associated with arragonite. South of Skerrig fine quartzose conglomerates occur, which may be traced both to the south, west, and north-east. North-west of the Roman Catholic Chapel a quarry is opened in green flagstones and thin grits, lying nearly horizontal and dipping in every possible direction. Half a mile south of Cootehill and south of the old pound in green shales dipping eastwards at 10° single graptolites were also procured. Three miles west of Cootehill in the neighbourhood of the cross roads and at White Lough, west of Ashfield Church thick green glossy quartzose and dark grey slates are interstratified with thick strong green grits.

Roches Moutonnées are common, the slates being equally rounded with the grits in the same knoll. In the Bunnoe river to the west, thick and thin grey grits and green shales dip north eastward at 60°, while to the south over a large area in the neighbourhood of Drung Church and Roman Catholic Chapel and eastward to the bridge over the Laragh river, green strong grits, green shales and grey ribboned gritty slates dip or vary slightly from south eastward at angles from 90° to 45.°

A short distance up the stream which joins the Laragh river, at the bridge, and north of the road, green glossy quartzose shales and dark slates dip S. 30 E. at 45°. By the roadside, 500 yards east of the church, vertical thin-bedded grits and dark slates strike N.N.W. Along the old road, going southwards as far as the church in ruins, thick and thin-bedded green grits, grey and dark slates with grit bands dip eastwards

at 60°. In these beds, and striking N.N.W., occurs a red sandy ochre, probably in situ, and a product of the decomposition of an augitic rock.

Three miles S.W. of Cootehill, near the hamlet of Tullyvin, on both sides of the plantation, are scattered grey and green slates and grits, with jointed and cut up slates. About a mile S. of Tullyvin, where the stream crosses the road, greenish and greatly crushed shales and slates dip S. 15 W. at 80°, while to the west of the road thick grey grits and great beds of shale and slate dip S. 30 E. at 60°, the latter greatly cut up by vertical cleavage and jointing. To the east over the rocky tract fine conglomerates occur dipping S. and S.S.W. at low angles. *Roches Moutonnées* are also numerous. At Drumeltan House, E. of the church, strong grits interbedded with thin grits, green flags, and shales occur, the latter containing single graptolites. To the east, in the neighbourhood of the lode of galena marked on the map, the rocks exposed are fine conglomerates, interbedded occasionally with thin grits and shattered flags and shales. Further eastward, by the side of the stream falling into the Annagh River, at Drumgoon Bridge, these fine conglomerates stand vertical; some of the beds are very massive, varying from twelve to fifteen feet in thickness. Southwards from Drumgoon Bridge, and along the road from Cootehill to Bailieboro, in the neighbourhood of the several cross roads, and as far as Drumgoon church, great beds of shale and slate and fine green grits are exposed. In the field north of the lower cross roads, and half a mile north of the church, a quarry is opened in much jointed strong green grits, and over the brow of this quarry to the S., a boss of the felspathic ash in the form of a massive agglomerate is exposed. South-west of Killyrue Lough black carbonaceous shale was turned up by the road side from the bed of a stream. Again S. and N.E. of the church, in a bog at the schoolhouse (not marked on one-inch map), a similar carbonaceous bed is said to exist. The rocks are dark fine quartzose grits and greenish shales. These carbonaceous beds may belong to the Llandeilo beds, brought to the surface by anticlinal curves, but are not sufficiently exposed for identification. About 500 yards along the Bailieboro road, S. of the church and to the westward, fine conglomerates are exposed, and are probably the beds which appear to the north repeated. To the west along a small stream a section for some distance shows the green shales and fine green grits of the cross-roads, and like them, dipping in every possible direction. By the east side of the road going south, in the townland of Muff, and S. of where a stream crosses the road, a quarry shews thin grits and purple and green shales folding in the line of dip, repeating themselves, without altering the direction, which is S.W. at 70°. To the S.E., by the side of the Cootehill and Bailieboro road, in the bed of the small stream, an exposure of glossy anthracitic shale occurs.

At Newbridge, under the corn mill, to the east of the road, a bed of weathered minette strikes N.E., with grits and shales, it weathers into a coarse sand full of numerous flakes of bronze coloured Mica. Above the mill, in the millrace, crystalline dark grey Dolerite is exposed, weathering in places spheroidally into a brown sand, and in one place developing columnar structure. Near the west wall of the dyke is a low anticlinal curve in grits and slates, the axis dipping S.E. at 5°. This Dolerite dyke is probably the continuation of the large dyke S. of Tullyvin; the Dolerite being exposed in three places between Newbridge and Tullyvin, all in a line bearing north-westwards. At Drutamon this large dyke strikes W.N.W. through shattered grits and grey shales, and where unweathered shows a sub-columnar structure, but generally it

weathers by large spheroids into a brown sand. A smaller dyke also in the stream, a few feet in width, strikes N.N.W., and is probably a branch of the larger one. At Leighlin corn mill this rock is much weathered, and bears N. 30 W. in greenish and purplish shales. Half a mile south of the corn mill on the west side of the road, vertical dark and purple hematitic shales, and pale grey slaty beds strike north-westwards—the hæmatite is associated with grey oxide of manganese. At Drumatread the Dolerite dyke is 40 yards in width, and strikes in the direction of the Tullyvin large dyke, through undulating and contorted green shales and tilestones. South of this dyke, and east of the road, a weathered bed of minette is exposed in several pits made for the yellowish micaceous sand, which is used for building purposes. On the west side of the road a small fault brings shattered thick grits against thin bedded grits shales and flags.

At Tievenanass cross-roads, and southwards to the Beehive, massive strong grits, and shale beds are freely exposed, undulating, contorted and dipping in all directions. One mile along the road going westwards, on its southern side, at Carrickallen, trigonometrical point 719. A quarry is opened in grey and green shales and tilestones, the beds of which are cut through by a dyke of crystalline Dolerite 10 feet in width, and bearing N. and S. Four hundred yards further west, and on the north side of the road, thick bedded grits and iron stained slates, are cut through in the same direction by a similar dyke measuring twelve feet from wall to wall. Immediately south of the alluvium of the stream flowing into the Drumcalpin Loughs an anticlinal curve is shown in crushed and broken shales and flags. Single graptolites are here numerous. A short distance to the S.W. numerous quarries, road cuttings, and bosses show contorted shales and flags, and a quarry on the N. side of the road exposes a narrow dyke of crystalline Dolerite, striking north north-eastwards. Due S. of the Drumcalpin Loughs, by the side of an occupation lane is a large exposure of the Felspathic Ash—going northwards along the lane, brown crumbly beds, with small rounded pebbles, give place to a massive bed of agglomerate, the enclosed blocks of which are always of one species of felstone, sometimes measuring $10 \times 12 \times 18$ inches, and not always rounded. The junction of these beds, with the grits and shales, is not exposed, so that their thickness could not be ascertained. Further westwards the fine conglomerates are exposed, lying horizontal, and dipping S.S.E. at low angles, and showing roches moutonnées, and ice-planed surfaces, with ice striæ bearing N.W. and S.E. Less than a mile northwards by the roadside greenish gritty shales contain single graptolites. About 300 yards N. of the green graptolite shale on the floor of an old lane, a small exposure of the crumbly ash was observed, and to the N. over the area around trigonometrical point 717, the beds exposed are the fine conglomerates—all three, the graptolite shale, ash, and conglomerates, are probably the beds just noticed to the south repeated.

One mile east of Stradone, over a large area massive strong grits interbedded with thin grits and great beds of green shale strike N. and S. and undulate at low angles about half-a-mile S. of Stradone and between the forking of the road grits and shale beds occur, and contain a fine grained bed of minette weathered into a light coloured micaceous sand. On the shore of Lavey Lough strong grey grits contain quartz pebbles beautifully ice planed with the matrix of the rock. Two miles S. E. of Stradone and north of where the new Bailieboro line branches from the old road, fine yellowish micaceous sand striking N. to W. along the road, seems to point out the site of a bed of minette. To the S.E. in the townland of

Drumack thin grits and slates are brought against thick bedded grits by a fault, and again at trigonometrical point 592 a similar fault is proved.

Shercock and Bellatrain District.—Three miles N.W. of Shercock along the Knappagh Water where it falls into the Annagh River thick and thin grits, flaggy beds and iron stained slates occur. To the east along the road bearing N. thick gray grits with grey and dark slates dip S. 30 E. at 50°—the slates show cleavage in the same direction at an angle of 45° so that the rock splits into somewhat regular small prism like blocks. Over a large area to the W. of the Annagh River the fine conglomerates are exposed interbedded with shattered grits and slate beds.

At Drumhillagh Mills, two miles west of Shercock, green graptolite shales and grits dip S.E. and S.W. at 50.° South of Shercock the beds are well exposed in great crags and bosses occasionally ice planed and showing striæ from the N.W. A section through this exposure can be well seen along either of the roads going southward and eastward, they are thick, occasionally coarse massive grits with fine thin grits and shattered shales, flags and slates.

Half-a-mile south and west of Milltown Lough, and N.E. of the trigonometrical point 725 a cutting has been made in black carbonaceous pyritous shale, grey slate and dark grit bands—fragments of graptolites were noted. The presence of the carbonaceous bed points to the probability of their being Llandeilo Beds. To the S.E. along the road crushed slates dip eastwards.

Three miles S.W. of Shercock on the road to Baileboro, and at the forking of the road a small dyke of fine grained Dolerite strikes nearly E. and W. through fine grits and dark grey slates.

In the neighbourhood of Lough Taghart massive strong green grits interbedded with crushed iron stained slates and thin grits show several sharp undulations in the line of dip. Two miles S.E. of Shercock in the County Monaghan and eastward of Greaghlone Lough, thin grits flags, and shales are cut by a small dyke bearing in a N.N.E. direction—it is 2 to 3 feet in width and weathers spheroidally into a brown micaceous coarse sand—an unweathered fracture shows crystals of felspar and hornblende with numerous plates of brown mica. East of Shercock and S.W. of Corvally Meeting House, the gritty shales and flags are more than ordinary hæmatitic, and again at Corduff Roman Catholic Chapel hæmatite is associated with grey oxide of manganese. The washings of these beds give rise to deposits of bog iron ore in the form of a hard black recent conglomerate, similar to that noticed in the mountain streams of Tievenanass, S. of Cootehill.

North-west of Bellatrain, by the road side, thick grits, flags and shattered slates are broken by an E. and W. fault. Throughout Shantonagh House demesne, green grits, smooth flags, gray and green slates, dip in every possible direction, show several anticlinal curves, and in the stream south of Farm Hill are broken by an N. and S. fault. On the south shore of Shantonagh Lough a similar small fault is seen in grits and flaggy beds. One mile N. of Shantonagh and S. of Tievaleny Lough a dyke of dark gray finely crystalline Dolerite strikes N.W., and is more finely crystalline than usual in the district; the felspar crystals are only seen in light small scales; it is hard and splintery, and forms a bluff feature across the hill. Two miles N.E., and on the S.W. side of the Carrickmacross and Ballybay road a large dyke of Dolerite cuts through green shales, flags, and grey grits for a distance of upwards of a mile. It is 100 feet in width, and generally weathers by very small spheroids into a coarse sand, giving the rock a pisolitic appearance. In a few places it inclines to a columnar structure. It consists of a crystalline granular matrix, enclosing crystals of Labradorite and Augite.

South of Carrickatee Lough the felspathic ash is exposed in the tough flaky breccia form, and dipping with the Silurian grits and slates. A short distance northwards from the Carrickatee cross roads, and on the west side of the road, a small N. and S. fault is seen in vertical beds of massive strong grits, shewing quartz pebbles and calcareous nodules, which latter weather into holes. One mile S. from the cross roads the felspathic ash is again seen striking N.N.E. It occurs here in the hard conglomerate form, a hard fine splintery pale green base containing numerous small rounded pebbles of the felstone. To the S.W. in numerous places both the breccia and conglomerate form of this ash are interbedded with strong grits and shattered slates. At Lackan Bridge tough breccia ash beds are interstratified with hard agglomerates. The best exposure of this ash is half-a-mile W. of Lackan Bridge, where a great crag rears itself in the alluvium of the stream which flows into Black Lough. There is here a thickness of over 70 feet well exposed. Some of the beds are tough flaky breccias, others thick agglomerates, with small and large blocks of the felstone, and again thin beds of fine pale green compact grit, without pebbles, and a few flags. One tough earthy bed weathers soft, and of a dirty white, but internally it is green and steatitic. One of the flaky beds contains numerous white worn crystals of felspar, the source of which was probably a porphyrite. The embedded blocks of felstone are of the usual kind, pale compact matrix showing dark oblong patches, vesicular and amygdaloidal, the cavities being filled with chlorite. These beds of ash dip S.S.W. at about 30°, probably the dip of the Silurian strata, which are not seen here in actual contact. The repetition of these beds at and east of Lackan Bridge is probably by anticlinal curves.

Lower Carboniferous Sandstone, d^1 and grits in Limestone.—At the small outlier of carboniferous rocks at Stradone, the lowest exposed beds consist of thin brown sandstones and flags, with earthy beds, passing upwards into uneven-bedded dark grey crystalline, and highly fossiliferous limestones, associated with some flags and grey earthy partings.

A few inliers of sandstone are also found in the wide expanse of carboniferous rocks occupying the centre and north-eastern portions of Sheet 68, these carboniferous rocks forming a part of the great Central Plain of Ireland. In Cullies, a little north-east of the town of Cavan, purplish and brown uneven-bedded sandstones, and brown and whitish flags, occur. From a quarry on the west side of the road, but now closed, the sandstones used in the erection of the Cavan Workhouse were procured. An inlier further east, and which almost rests on the Silurian rocks, consists of purplish micaceous sandstones. At Ture Lodge, about two miles south-east of Ballyconnell, another small inlier occurs.

Lower Limestone, d^2.—The lowest beds seen near Cavan and Kilmore consist of thin bedded, smooth and dark grey limestones, with occasional shaley partings, above these are great shale beds, as near Milltown and Croaghan, while the uppermost beds about Belturbet and Ballyconnell consist of thick and thin bedded limestones, ranging from crystalline to finely crystalline, and varying from a light to a very dark grey: they are often earthy and fetid. Cherty nodules and bands and shaley partings are frequent, particularly west of Ballyconnell, and in the district to the south of that town.

Calp or Middle Limestone, $d^{2''}$, and Upper Limestone, $d^{2'''}$.—These divisions of the Carboniferous series only occur along the N.W. margin of sheet 68, they are bounded by faults, but as no exposures are seen they are described in the memoir of sheet 67, where they are more fully developed.

Palæontological Notes.

Localities from which Fossils were collected.

No. of Locality.	Quarter Sheet of 6 inch Map.	Townland.	Situation, Geological Formation, and Sheet of 1-inch Map.
		County of Cavan.	Lower Silurian. Sheet 68.
1	16/1	Knockroe, . .	A little south of Redhill Railway Station; dark grey slates.
2	16/1	Mullanavarrionge, .	About half a mile south of Redhill; black slates.
3	19/4	Drumhildagh, .	About one and a half miles south of Killashandra; black slates.
4	20/4	Drumalee, . .	About half a mile north-east of Cavan; close to road; dark gray and black slates.
			Sheet 69.
5	17/2	Lisawaum, . .	In railway cutting, about one mile east of Cootehill; dark grey slates.
6	17/4	Pottlebog, . .	About three quarters of a mile south-east of Cootehill; dark gray slates.
7	22/1	Cornabeagh, . .	On road side, a little west of Drumeltan House, about three miles south-west of Cootehill; dark gray slates.
8	22/3	Tullyunshin, . .	About three and a half miles east of Stradone; dark gray slates.
9	22/3	Artonagh, . .	Three miles south-west of Stradone; dark gray slates with iron pyrites.
10	23/3	Drumhillagh, North.	About two and a half miles west of Shercock; dark gray, nearly black slates.
11	28/2	Glasleck, . .	Two miles south of Shercock; dark grey slates.
		County of Monaghan.	
12	23/4	Lisnagalliagh, .	Two miles south-east of Rockcorry Railway Station; dark gray slates.
		County of Cavan.	Carboniferous. Sheet 68.
13	9/4	Clontycarnaghan, .	In a stream half a mile north west of Corrabeagh, two miles west of Ballyconnell; dark gray shales.
14	9/4	Killywaum & Killycrin boundary, .	In stream a little north-east of Springhill, about three miles west of Ballyconnell; dark brown arenaceous and argillaceous shales.
15	9/4	Killycrin, . .	Three miles from Ballyconnell, road to Bawnboy; light gray cherty limestone.
16	10/3	Mullinacre, lower, .	Quarries south of road one mile west of Ballyconnell; light gray cherty limestone.
17	10/3	Derryginny, . .	Quarry about half a mile south-west of Ballyconnell; light gray crinoidal limestone (crooked river.)
18	10/3	Moher and Mullinacre lower boundary, . .	In stream south of road a little north of Corn Mill, one and a half mile west of Ballyconnell; black argillaceous shales and limestone.
19	10/3	Moher and Mullinacre lower boundary, . . .	In same stream, north side of road, one and a half mile west of Ballyconnell; brown and black argillaceous shales.
20	10/4	Ardue, . . .	A little east of Ardue House, about two miles south-east of Ballyconnell; gray limestone.
21	11/3	Kilconny, . .	About a quarter of a mile north-west of Belturbet gray crinoidal limestone.
22	11/3	Do., . .	A little north of Belturbet; gray crinoidal limestone.
23	11/3	Do., . .	A little south of Belturbet bridge, banks of river Erne; gray crinoidal limestone.
24	11/4	Clonandra? . .	Quarry, one mile and a half north-west of Redhill; black limestone

Localities from which Fossils were collected—*continued.*

No. of Locality.	Quarter Sheet of 6-inch Map.	Townland.	Situation, Geological Formation, and Sheet of 1-inch Map.
25	13/2	Tonyrevan, . .	Quarry close to road, about two miles south-west of Ballyconnell; light gray limestone.
26	13/2	Lissanover, . .	Quarries each side of road, near Lissanover, three miles south-west of Ballyconnell; dark gray limestone.
27	13/2	Gortnaleck, . .	A little east of Gortnaleck Lake, about three miles south-west of Ballyconnell; gray cherty limestone.
28	13/4	Kittynaskellan, .	Near Lock House, on Woodford Canal, four miles south-west of Ballyconnell; gray limestone.
29	14/1	Carrigan, . .	South of Lough Rud, about two miles south-east of Ballyconnell; light gray very crinoidal limestone.
30	14/1	Clontygrigny, .	Quarry close to road, about three miles south-west of Ballyconnell; sandstone and gray limestone.
31	14/2	Ture, . . .	Close to Ture Lodge, two and a half miles south-east of Ballyconnell; sandstone and chert.
32	14/2	Derrygeeraghan, .	Half a mile north of Milltown; black limestone and shale.
33	13/4	Burren, . . .	About two miles north-east of Newtown Gore; gray limestone.
34	14/4	Drumgesh, . .	Close to Nixon Lodge, one mile south-west of Milltown; dark gray limestone and shales.
35	14/4	Creeny, . . .	Quarry on road near Nixon Lodge, about one mile south-west of Milltown; dark gray limestone and shales.
36	19/2	Disert, . . .	A little north-west of Croaghan, about one mile north-west of Killashandra; black shales.
37	20/4	Drumavanagh, .	Close to Cavan Railway Station; calcareous, grit, sandstone, limestone, and dark gray shales.
38	20/4	Swellan, upper, .	Old Quarry, close to road, a little north-east of Cavan; dark gray limestone and shales.
39	20/4	Lisdaran, . .	Railway cutting about one mile north north-west of Cavan; dark gray shales.
40	21/4	Countenan, . .	Half a mile south of Countenan House, about four miles east of Cavan; dark gray limestone and shales.
41	25/1	Coolnagor or Rice Hill, . . .	A little south of Rice Hill, two and a half miles south-west of Cavan; dark gray limestone and shales.
42	25/2	Coolnagor or Rice Hill, . . .	Close to road, one and a half miles north of Crossdoney, about three miles south-west of Cavan; dark gray shales.
		County of Leitrim.	
43	26/3	Newtown Gore, .	Quarry close to church, Newtown Gore; gray cherty limestone.
44	26/3	Tullynorth, . .	Quarry close to road, a little north-east of Newtown Gore; gray cherty limestone.
45	30/2	Aghavilla, . .	East side of road between Carrigallen and Newtown Gore; gray shales.
		County of Cavan.	Sheet 69.
46	21/2	Cornadimpan Glebe,	About two and a half miles east of Stradone; dark gray limestone and sandy shales.
47	21/4	Killycrone, . .	Close to church, about one and a half miles north-east of Stradone; sandstone.
48	21/4	Liseguy, . .	Quarry close to river, about two miles north-east of Stradone; dark gray crinoidal limestone and shales.

List of the Fossils collected from the Localities mentioned in the preceding Table.

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

LOWER SILURIAN.

Hydrozoa: *Graptolites.*

	Localities.
Graptolithus Hisingeri,	2, ×10.
,, tenuis,	2, ×5, 8, 9.
Diplograptus pristis,	1, 2, 3, 4, 6, ××××7, ×8, 9, ×××10, ×11, 12.
Didymograptus sextans?	6.

CARBONIFEROUS SANDSTONE, SHALE, AND LIMESTONE.

Plantæ.

Sphenopteris?	14.
Plant remains,	14, ? 42, 46, 47.

Actinozoa: *Corals.*

Alveolites depressa,	40.
Chætetes tumidus,	15, 28, 39, 41.
Cyathophyllum or Zaphrentis (small turbinated corals),	13, 17, 23, 29, 32, 34, 38, 41, 45, 48.
Lithodendron affinis,	25, ××××26, ×××27, ×28, 29, 30, 43, 44, 45.
,, junceum,	27, 39, 42, 43.
Michelinea favosa,	40.
Syringopora geniculata,	××××37.
Zaphrentis cylindrica,	40.

Echinodermata.

Actinocrinus lævis,	24.
,, triacontadactylus,	44.
,, stems and joints,	20, 24, 28, ××31, 32, 36, 41, ××44.
Archæocidaris vetusta,	33, 44.
,, sp. indet,	36.
Crinoid stems and joints,	13, 16, 17, 18, 19, 20, ××××23, ×××24, ×25, 26, 28, ×××× 29, ××× 30, 31, ××32, ××××34, ×××36, ××37, ××××39, ××××41, ××××44, ×45.
Palæchinus sp. indet,	36.
Pentremites Derbiensis,	44.
Platycrinus lævis,	36.
Poteriocrinus crassus,	20, 28, 34.

Polyzoa.

Ceriopora rhombifera,	30, ××32, 36.
,, gracilis,	44.
,, interporosa,	41.
Fenestella antiqua,	20, ×25, 28, ××××30, ××31, 32, 33, ××××34, 36, ××37, 39, 40, ×××41, 43, ×××48.
,, crassa,	25.
,, membranacea,	15, 16, 27, 30.
,, Morrisii,	27.
,, undulata,	30, 36.
Polypora fastuosa,	25, 30.
Vincularia multangularis,	36.

Brachiopoda.

Athyris ambigua,	25.
,, lamellosa,	48.
,, planosulcata,	22, 26, 27, 29, 30, ××32, 34 36, 38, 39, 40, 41, 45, 48.

Brachiopoda—continued.

	Localities.
Chonetes Hardrensis,	13, 32, ×× 34, 41.
,, papilionacea,	34, 38, 48.
Orthis Michelini,	45, 48.
,, resupinata,	16, 23, 30, 34.
Productus aculeatus,	33.
,, fimbriatus,	25, 27.
,, giganteus,	21, 26, 27, 43, 45.
,, mesolobus,	20.
,, punctatus,	17, 20. 25, 26, 28, 29, 30, × 32 34, 43.
,, pustulosus,	24, 25.
,, scabriculus,	28, 29, 30, 32, 34, 39, 48.
,, semireticulatus,	16, 18, 20, × 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 36, 38, 40, ×××× 41, 43, 44, 45, 48.
Rhynchonella pleurodon,	32, ×× 37, 43, ××× 46.
,, pugnus,	25.
Spirifera bisulcata,	17, × 23, 25, 26, 28, 29, 30, 33, 36, 40.
,, cuspidata,	24, 29, 34, 41, 48.
,, glabra,	32.
,, laminosa,	× 22, ? 28, ×× 32, 34, 40, 41, 43, 48.
,, lineata,	? 18, 24, 26, 30, 32, 40, 44.
,, striata,	20, 21, 22, 24, 30, 32, 34, 38, 41, 43.
Spiriferina cristata,	27, ? 28, 32, 36, 40, 41, ×× 44, 45.
Streptorhynchus crenistria,	21, 24, 27, 30, 31, × ×× 32, 33 36, 38, 39, 40, 41, ×× 45, ××× 48.
Strophomena analoga,	32, 34, 38.
Terebratula hastata,	20, 26, 27.

Mollusca.—*Lamellibranchiata.*

Anodontopsis, sp. indet.,	19.
Aviculopecten interstitialis,	30.
,, megalotus,	30.
,, sp. indet.,	27, 41.
Leda, sp. indet,	39.
Modiola MacAdami,	37, 42.
Myalina, sp. indet,	45.
Posidonomya vetusta,	? 30.
Sanguinolites plicatus,	19.
,, sp. indet.,	32, 45, 48.

Gasteropoda.

Euomphalus Dionysii,	32, 48.
,, pentangulatus,	18, 41.
,, sp. indet.,	41, ? 47.
Loxonema ,,	18, 41.
Pleurotomaria ,,	18.

Nucleobranchiata.

Bellerophon decussatus,	×× 13, 18.
,, sp. indet.,	20, 41.

Cephalopoda.

Goniatites sp. indet.,	19.
Orthoceras undulatum,	13, 18, 19.

Crustacea.—*Entomostraca.*

Leperditia Okeni,	××××13, ×××37, 39, ×××× 42, 45, 48.

Trilobita.

Phillipsia Derbiensis,	30, 43, 45.

Vertebrata.—*Pisces.*

Helodus gibberulus,	40.
,, ?	32.
Pœciliodus transversus, ?	41.

The fossils collected within the area included by sheet 68 and 69 are from Lower Silurian and Carboniferous rocks; those from the oldest (Silurian) strata, believed to be of Llandeilo age, consisting exclusively of Graptolites, of which three species only are satisfactorily identified, from collections made at twelve localities, eight of them being situated on sheet sixty-nine.

The most abundant of these Hydrozoan Zoophytes is the double-celled form *Diplograptus pristis*, which was found at all the localities except one, being especially numerous at localities six and ten on sheet sixty-nine. The others, except a specimen doubtfully referred to the rare and diverging species *Didymograptus sextans*, are all single-celled graptolites referred to *G. tenuis* and *G. Hisingeri*, all occur in dark gray and occasionally black indurated slates.

Carboniferous limestone fossils were collected at thirty-six localities, thirty-three of these being situated on sheet 68, and the majority by their prevalent species, furnishing strong evidence of lower limestone strata, dark gray and blackish limestones (occasionally sandstones), shales, and cherty beds predominating.

Plant remains where collected at a few places only, in shales and sandstone, being found associated with marine shells at localities forty-six and forty-seven.

Corals were not found to be abundant in this district; small turbinated species, in which, however, the arrangement of septæ distinguishing the genera *Cyathophyllum* and *Zaphrentis* was not clearly visible, were the most widely distributed, occurring principally in shale beds at ten localities. The fasciculate and branching forms, *Lithodendron affinis* and *L. junceum*, the former being most plentiful, especially at localities twenty-six and twenty-seven, and *Syringopora geniculata* at locality thirty-seven, with the characteristic lower limestone species *Zaphrentis cylindrica* and *Michelinea favosa*, both from locality forty, together with *Chætetes tumidus* and *Alveolites depressus* constituted the whole assemblage.

Crinoid stems and joints were abundant at several of the Carboniferous limestone localities; plates and spines of *Archæocidaris* and *Palæchinus* were collected at localities thirty-three, thirty-six and forty, and *Pentremites Derbiensis* at locality forty-four.

Of the Polyzoa, *Fenestella antiqua*, a characteristic fossil of lower limestone shale, was observed at fifteen localities, being remarkably abundant at several places, viz., localities thirty, thirty-four, forty-one and forty-eight.

The Brachiopoda in this collection also includes several lower limestone species, viz., *Athyris plano sulcata* from fourteen localities, *Chonetes Hardrensis*, *Orthis Michelini*, *Productus punctatus* from ten localities, *Rhynchonella pleurodon*, *Spirifera laminosa*, *Spiriferina cristata*, *Streptorhynchus crenistria*, at fourteen localities, and *Strophomena analoga*.

Mollusca proper, including the ordinary bivalves and univalve shells, were found to be comparatively few, amongst the former the small bivalve *Modiola Macadami*, eminently characteristic of the Lower Carboniferous shale, was found associated with minute entomostracan crustacea, *Leperditia Okeni* at localities thirty-seven and forty-two.

The Nucleobranch or Heteropod shell, *Bellerophon decussatus*, was observed to be not unfrequent in shales referred to the lower limestone, accompanied by the Cephalopod, *Orthoceras undulatum*, at localities thirteen and eighteen.

In addition to the small Crustacean carapaces of *Leperditia* before mentioned, which were remarkably abundant in shale, at localities thirteen, thirty-seven and forty-two, almost entirely covering the layers

between which they were impressed; one species of Trilobite only, *Phillipsia Derbiensis*, was collected at three localities in the Carboniferous Limestone, viz., thirty, forty-three and forty-five.

A few palatal teeth of Cestraciont fish referred to *Helodus* and *Pœcilodus* are the only representatives of the vertebrata in the collection made from this district.

WILLIAM HELLIER BAILY.

October 8th, 1877.

POST PLIOCENE (DRIFT).

The drift which covers this district consists almost exclusively of Lower Boulder clay. Between Cootehill and Redhill and southwards towards Stradone the country is covered with great undulating drift mounds, and again eastward stretching towards Ballybay like accumulations abound. Throughout the lake district, and towards Ballyconnell, the drift is arranged in more or less regular low hills. Some small patches of sands and gravels occur, as at Kildallon, which are likely the remnants of interglacial beds. The character of the drift varies with that of the subjacent rock; it is generally the ordinary brown boulder clay containing Silurian boulders and blocks and some fragments of dolerite, with occasionally small tracts of fine brown sand and well-washed Silurian and limestone pebbles; more rarely, as at Skerrig E. of Coothill, the Boulder clay contains blocks of mica schist, which must have travelled a considerable distance.

In the various cuttings along the Cavan Railway good sections are seen containing large and well-scratched Silurian blocks and angular fragments, enclosed in a stiff clayey matrix—this character predominates, also some patches of ferruginous sands and gravels occur.

The ice striæ over the area comprised in sheet sixty-eight and a portion of sheet sixty-nine, as indicated on the maps, strike north-westwards and generally agree with the bearing of the drumlins of drift which are numerous in the north-west region. To the south and westward of sheet sixty-nine the ice moved from N. W. to S. E. as the striæ bear south-eastward. Over the low limestone district of sheet sixty-eight the longer axis of the drift mounds corresponds with the direction in which the glaciation occurred, and, besides, these mounds are frequently seen cragging north-westwards and tailing south-eastwards.

RECENT ACCUMULATIONS (PEAT, ALLUVIUM, &C.).

The various patches of bog and alluvium throughout the district all point to the existence of more extensive lakes which are being silted up.

In numerous places have the remains of the *Megaceros Hibernicus* been found. The Rev. W. Prior Moore had the head, antlers and numerous bones, raised from the Green Lough and also from the marshes south of the College. In Tonymore Lough, which is now a marsh, the line of Railway passing through it, two "heads were found, one of which is now in the possession of Lord Farnham."*

Near Lislin House, on the banks of the Annalee River, a fine head, antlers and bones were also found.

In the alluvial flats, and under the bog in numerous places both north and south of Cavan, a fresh-water shelly marl occurs, frequently a couple of feet in thickness and resting on a thin stratum of plastic

* Proceedings of the Royal Irish Academy, vol. viii., p. 275.

bluish clay. An abundant shell in this marl at Lisdaran, about a mile north-west of the town, is referred by Mr. Baily to *Limnœa peregeri*; small bivalves accompanying it he identifies with *Cyclas cornea*.

On the line of railway midway between Cavan and Crossdoney at Tonymore Lough, before mentioned, "is the only Irish crannoge that has ever been '(1863)' thoroughly examined from summit to base." It was explored under the directions of Dr. Malcomson of Cavan for the late Lord Farnham, and the numerous relics found were presented through the late Sir W. R. Wilde to the Royal Irish Academy.*

Mines and Mineral Localities.

Redhill Iron Ore.—At Claragh, about a mile and a half south-west of Redhill, extensive workings were carried on in the black and red hæmatitic shales and slates by the Redhill Mining Co., and large quantities were shipped from Dundalk principally to Barrow-on-Furness.

The strata are greatly contorted and broken by irregular jointing; the ore appears to occur in very irregular lenticular beds, but the general strike of the strata is N. E. and S. W. It is much obscured by the drift, but has been found both to the N. E. and S. W. of the hill of Claragh (492 feet). This hill was considered the most favourable spot for carrying on the workings.

Mr John Cameron, F.C.S., of Askham-in-Furness, made the following analysis of the Ironstone for the Redhill Mining Company :—

†Peroxide of Iron,	57·57
Peroxide of Manganese,	traces
Protoxide of Manganese,	6·20
Alumina,	8·93
Carbonate of Lime,	0·50
Silica,	22·80
Water of Combination,	3·00
Soluble matter,	1·00
	100·00

As will be seen from the analysis the absence of sulphur and phosphorus, the two elements which render iron ores worthless as a source for pig iron for either the Bessemer process or conversion into malleable iron, as it is these elements which respectively produce *hot and cold shortness*—hot shortness being that quality which induces it when heated for the anvil to powder under the hammer, and cold shortness that which induces it to snap or break during frost under pressure or friction. This quality of ironstone was for sometime in special request; however, we were informed that the percentage of silica on the further workings appeared to so increase and the peroxide of iron to so diminish that the workings were abandoned.

Professor Hull describes the occurrence of this ore in his "Notes on Hæmatites of Counties of Cavan and Longford," read before the Royal Dublin Society.‡

Galena has been tried for in several places within the district. Three miles S. of Cootehill (Cavan $\frac{2,2}{2}$), in the townland of Cornanurney, in a line bearing N. and S. several pits were opened. Specimens of the ore obtained from the old workings consisted of massive and lamellar-structured galena. Arsenic and antimony probably occur as sulphides with

* See proceedings of the Royal Irish Academy, vol. viii., pp. 274-278, 289-292.
† Equal to Metallic Iron 40·30 per cent.
‡ See proceedings Royal Dublin Society.

the lead. The earth thrown up from the pits has blackened from exposure to the atmosphere, is fatal to fowls, and will not support vegetable life. In the debris quartz, calcite and heavy spar, also some earthy oxide of manganese were observed.

Two miles E. of Cootehill (Cavan $\frac{1,7}{4}$), in the townland of Cloghstuckagh, pits were said to have been opened in line bearing N.N.W. Near a well by an old road here cubes of glistening galena were observed associated with quartz and calcite, all of which were embedded in a pale green clay, filling a fissure in the greenish slates. The workings were abandoned better than forty years ago.

About six miles E.N.E. of Cootehill, and S.W. of Drumfaldra House, a lode of argentiferous galena was found bearing north-eastward. The matrix of this lode was a pale green felspathic clay.

Along the banks of the deep-cutting mountain streams, about six miles S. of Cootehill, at Tievenanass, occurs a compact black earthy recent conglomerate, comparatively rich in hæmatite and black oxide of manganese. This is due to the washings of the rocks of higher levels, which are hæmatitic, and shew steel gray specs of oxide of manganese. Similar black recent conglomerates are found at Corduff, about three miles E.N.E. of Shercock (Monaghan, sheet twenty-seven).

In Sir Richard Griffiths' Catalogue of Mines and Metalliferous Indications, it is stated that copper was found in the Farnham Demesne (Cavan, sheet 20). This is likely due to tumblers in the drift, but no reliable information could be obtained respecting it. Bog iron ore is commonly met with over the district.

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