Fig. 1. Killary Harbour, with Mweelrea. Taken from the southern shore.

Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEETS 73 AND 74 (IN PART) 83 AND 84 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

INCLUDING THE

COUNTRY AROUND WESTPORT, ERIFF VALLEY, KILLARY HARBOUR, AND WESTERN SHORES OF LOUGH MASK,

BY

G. H. KINAHAN, M.R.I.A., R. G. SYMES, B.A., F.G.S., S. B. WILKINSON, JOSEPH NOLAN, M.R.I.A., and H. LEONARD, M.R.I.A.,

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 Explanatory Memoirs.

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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PREFACE.

THE district described in the following pages was geologically surveyed by Messrs. Kinahan and Symes, the late Mr. Warren, Messrs. Wilkinson, Nolan, and H. Leonard. Mr. Kinahan, as District Surveyor, had a general superintendence of the operations in the field, while on several occasions, I visited and inspected various parts of the district as the survey progressed; and it is a great satisfaction to me to be able to bear testimony to the zeal and ability with which the officers of the Survey executed the laborious duties entrusted to them, the country being in many places difficult of access, and its geological structure highly intricate.

In commencing the description of the geology of West Mayo, it is necessary to refer to the labours of our predecessors in the same field. The geological map of Sir R. Griffith (1855), in which, for the first time, the formations were laid down, shows very clearly the main divisions amongst the rocks, viz., the granites, schists, quartzites, and some of the more important masses of trap-rock, while the great series of metamorphic beds, consisting of the rocks above enumerated, are separated from the (upper) Silurian beds of the Mweelrea, Bengorm, and Formnamore mountains; and although (for reasons presently to be stated) we have arrived at somewhat different conclusions, regarding the geological age of some of the metamorphic rocks, from the distinguished author of the "Geological Map of Ireland," it may be asserted that those conclusions were fully warranted by the facts then known in reference to the structure of British and Irish rocks, along their extreme westerly and northerly limits. Sir R. Griffith has, in fact, placed the quartzites of the Twelve Binns of Connemara and their associated schists, limestones, and serpentines, in the Cambrian group, and the metamorphic schists in the northern part of our own district, and also to the south of the Twelve Binns, on a still lower horizon.

The determination by Sir R. Murchison of the true base of the Lower Silurian series in the Highlands of Scotland, in the years 1859–60, threw fresh light, not only on the whole structure of that part of the British Isles, but also on that of the rocks of Donegal, Sligo, West Mayo, and Galway, which are composed of masses equivalent in age to those of the Central Highlands of Scotland, and remarkably similar in mineral composition. Now,

no such base to the metamorphosed Silurian beds anywhere occurs in the west of Ireland as is found in Sutherlandshire; where the bottom beds, consisting of quartzites, crystalline limestones, and schists, are found resting in a highly discordant manner on the Cambrian conglomerates, and these again on Laurentian gneiss. The whole of the metamorphic rocks of West Mayo and Galway, consisting of various schists, gneiss, quartzites, serpentines, and crystalline limestones, appear to form one unbroken series, the lowest beds of which reach the surface in the quartzite mountains of Connemara. It is not improbable that these quartzites are the representatives of the Lower Silurian quartzites of Sutherlandshire, which rest directly upon the Cambrian sandstones; but their base in the West Highlands of Ireland never comes into view, and without such a base we feel justified in referring the whole series to the Lower Silurian system, a view strongly insisted upon by Sir R. I. Murchison himself,* and supported more recently by Professor Harkness.† The former refers the metamorphic series of the west of Ireland to the ages of the "Caradoc" and "Llandeilo beds" of North Wales, while the latter points out that the metamorphic action which has converted slates and sandstones into schists and quartzites must have taken place during that period represented by the "Lower Llandovery beds" of Wales, as the Upper Llandovery beds of West Mayo and Connemara are, with only occasional exceptions, absolutely unaltered; while, on the other hand, amongst their conglomerates are found fragments of the metamorphic rocks themselves.

The evidence derived from stratigraphical considerations is strengthened by the occurrence at rare intervals of Lower Silurian fossils, where the beds have almost escaped metamorphism, as at Aillemore and Lettereeneen; from which it may be truly inferred that the amount of alteration varies with the locality, and was probably greatest in the case of the deeply seated beds. The schists of "the Doo Lough series" are in fact in a condition but little, if at all, removed from that of ordinary clay slate; these having been originally superimposed on the metamorphosed strata, which have been brought up against them by faults to the east and west, and have been laid bare by denudation.

EDWARD HULL.

29th November, 1875.

* "Siluria," 4 edit., p. 180–2.

† "On the Metamorphic and Fossiliferous Rocks of the County of Galway," Quart. Journ. Geol. Soc. Lond., vol. xxii., p. 506. Though Professor Harkness's observations apply chiefly to county Galway, they are also applicable to West Mayo.

EXPLANATORY MEMOIR

TO ACCOMPANY THOSE PORTIONS OF

SHEETS 73, 74, 83, AND 84 OF THE MAPS,

SITUATED BETWEEN

CLEW AND KILLARY BAYS, AND THAT PART OF SHEET 85 LYING WEST OF LOUGH MASK,

OF THE

GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

THE country now to be described includes a part of the county Mayo with a small portion of the county Galway. In the first will be found nearly the whole of the barony of Murrisk with portions of Burrishoole and Carra, while the latter contains a part of the barony of Ross. This tract is bounded on the west by the Atlantic; on the north by the south shore of Clew Bay, and parallel of latitude 53° 50′ 1″; on the east by the Aille river and Lough Mask; and on the south by Killary bay and the eastern part of the south margin of Sheet 84.

The principal places within the area are the town of Westport and the village called Louisburg on the Bunowen, both in Sheet 74. Other places that may be mentioned are the hill called Croagh Patrick in the same Sheet, the village of Tulla with the island and harbour of Bofin in Sheet 83; Mweelrea the highest hill in Connaught, Killary harbour and the hamlet called Aasleagh, in Sheet 84; while in Sheet 85 is the long straggling village of Toormakeady or Cappaduff on Lough Mask.

1. *Form of the Ground.*

Toward the S.E. of the area now to be described is a mountainous tract, the only highlands, properly speaking, in this part of Ireland, in which the N.E. portion is called Slieve Partry, and the rest, the Formnamore mountains. This highland is bounded on the east by a low-lying tract margining Lough Mask, on the N.W. by the valley of the Errif and Aille rivers, while on the south it extends in places into the district on the south. From the low land to the east, the ground rises gradually until it reaches the summit heights of Slieve Partry, but towards the west the slopes of the latter are rather abrupt, while those of the Formnamore mountains are generally steep, sometimes being nearly perpendicular.

The Formnamore mountains are a slightly undulating and sloping table-land, with a low ridge or irregular line of summits at its northern edge. The main ridge of the high land in Slieve Partry runs nearly parallel to Lough Mask, beginning in the low ground to the north at Derleash, and extending in a slightly irregular line to the bounds of Mayo and Galway in the Formnamore mountains, a few miles east of Lough Glenawough,* from which point it turns S.W. to the Devil's-mother over Aasleagh, and from thence southward over Bengorriff into the country on the south. The table-land has a slight slope to the S.E. and S.S.E. with short spurs extending from it, while in places it is indented by deep valleys, the most marked being that of the Owenbrin and Glenagleragh; others, which are generally occupied by tarns, are Glenawough, and those called after Loughs Anshee, Dirkbeg, Dirkmore, and Nambrackkeagh. There are also smaller bowl-shaped lugs or deep hollows cut into the hillsides, those over the Erriff valley being well marked, and on the same horizon.

In Slieve Partry the highest summit is Bohaun, 1,294 feet; while Formnamore is seldom below 2,000 feet; the highest points being 2,010 (Gowlan); 2,046, 2,207, 1,926 (Skeltia); 2,239 (Benwee), the highest point; 2,039 (Glenagleragh Hill); 1,919 (Knocklaur); 1,983 (Devil's-mother†), and 2,131 (Bengorriff).

The valley to the N.W. of the highland is drained by the Erriff and Aille rivers, the watershed being in the bog N.E. of the hamlet of Derrycraff, having an altitude of about 300 feet. North-east of this portion of the Aille river is a low undulating country containing some small hills and ridges from 400 to about 700 feet in height, while west of the Erriff river valley in the country north of Killary bay are massive hills that may be called the *Mweelrea mountains* from the name of the highest summit.‡

The Mweelrea Mountains are divided into three groups by deep-seated branching valleys. The main valley runs north from Bundorragha on Killary Bay to Doolough, where it bifurcates, one branch running due east along Glenummera, passing Tawnyard Lough into the Erriff Valley, and the other N.W. passing through Glencullin into the low country south of Louisburgh. The floor of this valley is usually low; the two highest points in it being the water-shed (300 feet) in the valley between Glenummera River and Tawnyard Lough, and a point in the bog between Glencullin and the flats of the Carrownisky. In these groups there are seven summits that exceed 2,000 feet in altitude, while three of these are over 2,500 feet high, namely, Mweelrea (2,688 feet), Benlugmore (2,618), and a neighbouring peak (2,610 feet), all in the S.W. group.§

* In the country hereabouts glen is pronounced glaun.

† This name is unknown by the country people.

‡ As the inhabitants of these hills have been exterminated, the name of the group seems to have been lost, it however receives various names from the people now inhabiting the neighbouring countries, namely, Mayo hills, Mweelrea mountains, Lugmore mountains, Kilgeever mountains, Murrish mountains, the Doolough mountains, according to the side they are viewed from.

§ Benlugmore and the neighbouring peak both seem to be called by the one name; they are usually in clouds, on which account they are supposed by the people of the country to be higher than Mweelrea.

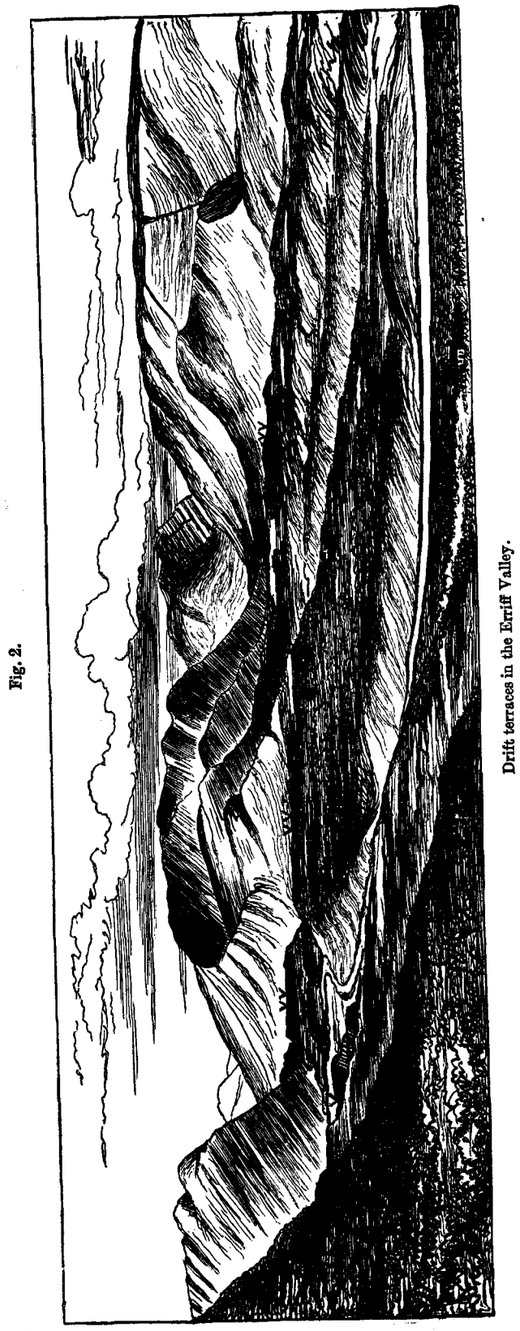

Fig. 2.

Drift terraces in the Erriff Valley.

vv. Upper Terrace (margin of Esker Sea?). v. Terraces sloping westward.

In general the slopes of these hills are steep, but especially those along the previously mentioned valley. On the south in a distance of less than half a mile, the ground rises to altitudes of 1,623, 1,259, and 1,183 feet, while from Doolough (124 feet) the land on the N.E. in half a mile reaches 2,474 feet, and on the S.W. in a mile to 2,618, part of the cliff over Lugmore being nearly perpendicular. On the north of the N.E. group, there is also an abrupt escarpment, steep towards the base and gradual in the upper portion. Furthermore, a little below the upper portion, there is a series of "lugs" (fig. 3) very similar to those previously mentioned, as occurring in the slopes of the Formnamore table-land south of the Erriff River Valley.

Fig. 3.

Lugs, or flat-bottomed valleys, in the north slopes of the Mweelrea Mountains.

To the westward towards the Atlantic, in places the slopes are also steep, while towards the east some are gradual.

To the north of the Mweelrea Mountains is a low slightly undulating wild country separated on the north from Clew Bay by the ridge of Croagh Patrick and the high ground extending therefrom towards the S.W., forming hills called Knockfadda (957), Knockaskeheen (1,288), and Corvockbrack (1,287). To the west of these hills is the low country unwatered by the Carrownisky and the Bunowen, this to the N.W. being separated from the sea by the high land in the vicinity of Old Head. Owing to its form the ridge of Croagh Patrick, when viewed from the west (in the direction of its axis), appears like a well-formed cone with steeply shelving sides terminating in an apex, reaching an elevation of 2,510 feet above the level of Clew Bay, which stretches along the northern base of the ridge for several miles.

Clew Bay itself is studded with numerous islands, while to the east of this bay is the Valley of Westport, that connects the low valleys before described with the central plain of Ireland.

In the Atlantic off the main land are some islands, the largest being Clare Island in Sheet 73, which is about four and a half miles long, from east to west, while its greatest breadth is not more than two and a half. To the west of the island are the steep cliffs of Knockmore which rise directly from the ocean to the height of 1,520 feet. Next in importance are Inishboffin, Inishshark, Inishturk and Cahir—most of these islands would appear to be the peaks of submerged ridges, Cahir and Inish-turk lying in a line with the ridge that extends from the Mweel-rea Mountains towards the N.W., north of Loughs Cunnel and Glencullin, and the Valley of the Owennadornaun to Cross Lough; while Inishboffin and Inishshark may be either on the ridge that forms the Rinvyle Promontory, or on the continuation of the ridge forming the promontory called Cleggan Head, both of which are included in the district to the south.

Fig. 4.

View of Croagh Patrick, from Clew Bay.

Clare Island.—On the eastern side of this rugged and wild island, is the only landing stage which is afforded by a smooth beach. Between the west and east coast the island is traversed by several ridges of moderate elevation culminating in that of Knockmore, which, as already stated, presents a bold and steep face to the Atlantic.

The northern portion of the island presents a very rugged appearance due to the unequal denudation of strata formed of different materials. The strata being composed of grits alternating with shales, in a nearly vertical position and having an east and west strike. The grits stand out in bold outline, whereas the shales have been denuded more deeply, leaving a series of small east and west valleys.

Islands in Westport Bay.—These Islands are remarkable for their uniformity, both in shape and composition, while their summits never rise to more than about 100 feet above the level of the sea. The form of these Islands is similar to that of the drumlins which occur in the country to the E., and which are described in the Explanation to accompany the Castlebar Sheet.* This form is apparently connected with the direction of the original glaciation of the district; but on the western side of each—save that of Inishgort, which is protected by Dorinish—marine action is making a perceptible change, leaving perpendicular cliffs, while towards the east the ground slopes to the water's edge.†

River Basins.—To the east is part of the catchment basin of Lough Corrib, from this area however, the waters first flow into Lough Mask, the principal tributary being the Aille River. The water-shed of the Lough Corrib basin, on the south, enters the district at about 9° 39′ W. Lon. (*Sheet* 84), and from that runs in a curved line to the summit of Bengorriff, from whence it extends in an irregular N.E. and S.W. line, along the barony boundary to the summit (1,290 feet) on the west of Glenmask, from which it has a general N.N.E. direction till it leaves the area on the north at about 9° 25′ 30″ W. Lon.

The catchment basin of the Erriff river is considerable. This stream receives the drainage of the N.W. slopes of the Formnamore mountains, some of Slieve Partry, and all the east portion of the Mweelrea Hill, its basin including a large portion of the S.W. part of the barony of Murrisk. Other river basins are those of the Bundorragha, the Owenwee, the Bunowen, and the Carrownisky, that respectively flow into the north side of Killary harbour, the south side of Westport bay, Clew bay two miles S.W. of Old head, and into the Atlantic ocean at Srumore point.

Lakes.—On the west coast are brackish water lagoons, through one of which, Roonah lake, the Carrownisky flows; these in general are flooded at spring tides. In the other portions of the area the most remarkable lakes are Doo Lough, Tawnyard, Glenawough, Nacorra, Moher, Lugacolliwee, and Glencullin.

* Explanation to accompany Sheet 73, p. 33.

† In Clew Bay, there is good anchorage to the east of Inishlyre, but the channel from that to the Quay of Westport is shallow and very intricate.

The high ground between Galway and Clew bays, when viewed from a distance, seems once to have been an undulating table land in which the valleys were carved out by various denuding agencies along the openings due to faults, joints, and other shrinkage fissures.

G. H. K. and R. G. S.

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

Age.	Name.	Colour or sign on Map.
Recent accumulations.	Alluvium and Bog,	*Pale sepia.*
	Postglacial Gravels and Drift,	*Engraved Dots.*
	Moraine Drift,	
	Boulder Clay Drift,	
Carboniferous Series.	d^2. Limestone,	*Prussian blue.*
	d^1. Sandstone Shales, &c.,	*Prussian blue, and Indian ink with yellow Dots.*
Upper Silurian Series.	b^4. Mweelrea Beds,	*Light purple.*
	b^3. Carrowbaun Beds,	
	l. Limestone,	*Cobalt.*
Lower Silurian Series.	b^2. Doolough Beds, with	*Pale purple.*
	l. Limestone,	*Cobalt.*
	δ. Dolomite,	*Green.*
	METAMORPHIC SEDIMENTARY ROCKS.	
Upper Silurian.	β^3. Schist principally,	*Pale pink.*
Lower Silurian.	β^2. Schist with some Gneiss,	*do.*
	q. Quartzite,	*Chrome yellow.*
	λ. Schistose Limestone,	*Cobalt.*
	δ. Schistose Dolomite,	
	σ. Serpentine, Ophicalcite, Steatite, &c.,	*Pink with green streaks.*
	IGNEOUS ROCKS AND TUFFS.	
	B. Dolerite (Melaphyre) and Gabbro,	*Burnt carmine.*
	D. Diorite (Greenstone),	*do.*
	Δ. When Metamorphosed,	*do.*
	Σ. When changed into Ophyte, Steatite, &c.,	
	Ds. Basic Tuff,	*Pale crimson with dark Dots.*
	Δs. do. do. when Metamorphosed.	
	F. Felstone,	*Light vermillion.*
	F↑. do. when intrusive,	*Dark vermillion.*
	Fp. Felstone Porphyry,	*do.*
	Fs. Felsitic Tuff,	*Light vermillion with dark Dots.*
	Σ. do. do. when changing into Steatite,	
	Fs. do. do. Calcareous,	*Light vermillion with dark and blue Dots.*

GRANITE ROCKS.

Age.	Name.	Colour or sign on Map.
	G. Granite,	*Light carmine.*
	E. Elvanite or Quartz Porphyry,	*Dark carmine.*
	S. Syenite,	*do.*

Granite.—The two rounded hills of Corvockbrack (1287 feet), and Knockaskeheen (of about the same altitude), standing out in bold relief in the comparatively low ground south of Croagh Patrick, indicate at some distance their geological composition, as they assume that peculiar mammillated appearance so common in granitic hills, while they are also almost entirely free from any covering of drift deposits, or heather. These two hills are separated from one another by a north-west valley, or gorge, lying along the line of a fault; on the north-east side of the gorge the waters of the Louisburgh River pass through, and the eastern side is bounded by massive vertical walls of granite. These walls follow the joints which are everywhere perceptible; those most noted having their bearings N. and S., E. and W., and N. 10 W.

The general appearance of the granite when fractured, presents a greyish colour, is, generally speaking, coarse in texture and friable, consisting of two felspars—orthoclase and oligoclase (?), black or green mica, quartz, and invariably a few crystals of iron pyrites.

This granite is irruptive, and of later date than the Upper Silurian period, as it is to be found penetrating the fossiliferous Upper Silurian beds at Cregganbaun. On the top of Knockaskeheen which lies to the north-east of Corvockbrack, the granite has caught up with it a mass of claret coloured schists, highly contorted and penetrated by granite veins, while both schists and granites are cut up by a large dyke of minutely crystalline basalt, which traversing the rocks in a N. E. and S. W. direction, passes through almost every description of rock in the district, which undoubtedly proclaims it to be the newest in the whole area under description. A microscopical examination of a specimen of granite from one of these hills was made by Professor Hull. *

Elvanite.—Associated with the granites, are dykes of a rock which undergo very many petrological changes throughout their passage through the metamorphic rocks, whereas in the granite, the veins have a constant character; these dykes have been called *elvanite* as being synonymous with the term used by the late Professor J. B. Jukes. †

The elvanite, where found in conjunction with the granite, is a fine grained mixture of quartz and felspar equally distributed; whereas in the metamorphic rocks apparently the same rock passes into a compact feltsone with or without particles of quartz—chiefly rounded, and finally into a platy felstone ‡

* See Journal Geological Society, Dublin, vol. IV., part I, new series, p. 4.
† See Jukes' Manual of Geology, p. 90.
‡ I have great doubts regarding the irruptive origin of some of these so called "felsite schists." It is not improbable they may be metamorphosed felspathic grits.—E. HULL.

These changes occur according as the dyke is further from the supposed seat of irruption; as for instance, the compact felstone base with disseminated crystals, is a mile and a half from the granite, while the felstones and platy felstone are from six to eight miles. The dykes to the east of the mass of granite at first cut across the planes of foliation of the metamorphic rocks, but in proportion as they recede from the mass they coincide with these planes; still further east they again cut across them.

An analysis of one of the dykes about a mile and a half east of the granite was made by Mr. A. Gages, for the late Professor Jukes. The following is part of Professor Jukes' letter to me:

"The rock is a granite in which albite predominates, but is not crystallized. There is a rock called Pontellarite by Breithaupt which is the nearest approach to this. Mr. A. Gages has analyzed it and found the following:—

Lime,	1·07
Magnesia,	0·17
Potash,	1·48
Soda,	4·99
Alumina and oxide of iron,	18·20
Silica,	74·30
	100·21

"R. G. S."

F. and Fp.—The felstones seem to belong to at least four distinct periods, namely:—1st, Lower Silurian; 2nd, Pre-Llandovery; 3rd, Upper Silurian; 4th, Post-Llandovery.

Lower Silurian Felstones.—These felstones for the most part are more or less metamorphosed—some however are so little affected that they seem to require a special description; all seem to occur as protrusions and in dykes. The normal colour of the unaltered felstones seems generally to be a pale green or ash gray, weathering rapidly into a dull cream colour; when in dykes they often have a peculiar brecciated structure, in aspect being more like a tuff, or a fault-rock, than a normal felstone; nevertheless such rocks can be traced until they graduated into one whose true character is undisputable, while the rocks in contact are often indurated into a kind of "hornstone." When this class of felstone is in mass, a considerable portion may be a scaly or mealy friable tuffoid rock, some portions, however, will always be similar to the compact parts of the dykes, while all may merge into a more or less unctuous rock as if the felstone was graduating into steatite. When metamorphosed they are more or less schistose, the tuffoid portions often changing into a steatitic felsite schist, or even a good steatite. As the steatites are also associated with metamorphosed basic-igneous rocks, all will be described hereafter together.

Pre-Llandovery Felstones.—These for the most part are highly siliceous felstones, the rock called *Petrosilex* by Brongniart, the

Felsite of Dana, Cotta, and others, usually they are corneoid in aspect, some however are saccharoid—generally they are very compact and homogeneous, and so highly silicated that they have been mistaken for quartzite.

They are green, gray, or blue in colour, weathering white; fracture, from sub-conchoidal to conchoidal, with sharp edges; translucent, may contain quartz blebs and crystals or may graduate into a porphyrite—they were only observed in dykes and intrusions. Some of these rocks seem to have been intruded during the deposition of the associated sedimentary rocks, and were in part denuded and disintegrated to form those rocks, while others evidently were intruded subsequent to the deposition of all the sedimentary rocks with which they are associated; but prior to the time when the metamorphic action invadid them, as all these felstones in parts are metamorphosed.

Upper Silurian Felstones.—These felstones occur for the most part as bedded masses interstratified with rocks supposed to be of Upper Llandovery age,* and as dykes among the metamorphic rocks. Usually when associated with the Upper Silurian rocks they are more or less regular, their upper portion being tuffose, while overlying some, a bed of tuff is present. This however is not always the case, as in places will be found an accumulation of plutonic rocks, felstone, tuffs, and agglomerates, sometimes more or less regular, at other times quite irregularly intermixed. Furthermore in such places they seem to form a mass in themselves that project upwards into the Upper Silurian rocks, around which the sedimentary rocks were deposited as if originally they had existed as a hill in the Silurian Sea. From the relative position it is evident that successive outbursts occurred, with longer or shorter intervals between them. These felstones are always either greenish or purplish in colour; generally are compact and homogeneous, but sometimes merge into granular crystalline or porphyritic rocks; crystals, or globules of quartz are not uncommon especially in some of the purple varieties; fracture, from rough conchoidal to uneven; while the bedlike masses are in places columnar. The columns are generally pentagonal in section and usually very regular. In Mr. Nolan's district there occurs an exposure of columns at a stream three and a half miles north of the village of Cappaghduff or Toormakeady, where well marked columnar structure occurs in the upper part of the mass of felstone, while the lower part has a structure like bedding, parallel to the stratification of the underlying tuffose rocks.

* Associated with these felstones in Slieve Partry, are limestones that contain Upper Llandovery Fossils. In the Mweelrea Hills no fossils could be detected in the rocks associated with them, while in the higher rocks there are fossil that seem to be of Wenlock age. From the above it appears to be suggested, that a few hundred feet at the base of the Upper Silurian rocks in the Mweelrea Hills may belong to the Upper Llandovery rocks, while the higher beds represent the Wenlock age. This subject is more fully entered into in the Memoir to accompany the district on the south. It also is put forward in a paper read before the Brit. Ass., Belfast, August, 1874. [See Geol. Mag., Dec. ii., Vol. i, No. 10, Oct., 1874].—G. H. K.

Where these felstones lie on the Lower Silurian shales the latter rocks are usually indurated into a rock like ribbon-hornstone. These felstones are all more or less basic. The purple varieties fuse on the edges of splinters, while the green rocks fuse with greater or less facility, being much more basic than the others, and some apparently graduating into whinstone. (See page 20.)

In one locality (S.W. of Doolough), at the junction of the Upper and Lower Silurians, a dyke of steatite (?) was noted; a variolitic pale green unctuous rock. The age of this rock is not absolutely certain, still however it appears to belong to these felstones, and to graduate into one of the green rocks—all these rocks evidently belong to Durocher's divisions of exotic rocks which he calls *Hybrid rocks*, and to the felstones called *Eurites* by Daubuisson.

The mechanical accompaniments of the bedded felstones may range from a fine compact or friable tuff, to coarse agglomerates, while associated with them in places are tuffose sandstones and shales, that seem to be due to the abrasion of the felstones. In other places also associated with the bedded felstones are limestones and calcareous tuffs. The latter consists of limestone concretions, nodules, or blocks, in a tuffose matrix, or tuffose blocks, fragments, and particles, joined together by a calcareous cement; the calcareous rocks being very varied in character, ranging from limestone to slightly calcareous tuffs.

Post-Llandovery Felstones.—These felstones are newer than the rocks of Llandovery age as they come up through them in dykes and intrusive masses; they probably also are newer than all the Upper Silurian rocks, as similar felstones are found as dykes in the Salrock slate (Ludlow age ?). In colour they vary from pale green to grey, weathering yellow, or dull white. They also seem all to be more or less basic. Although numerous in the district immediately to the south-west, only a few dykes and small protrusions were noted in this area.

The first two divisions of the felstones [Lower Silurian and Pre-Llandovery] are in part metamorphosed; when associated with the unaltered Doolough slates they are in their normal state, but when associated with the metamorphosed Doolough beds they are more or less altered, some being even granitoid, and graduating into a rock that may be called gneiss. This granitoid rock although fissile is a crystalline mass, and perhaps more properly ought to be classed as a granite (*Foliated granite*). Some of these felstones change into Hornblendic gneiss. Some of the altered felstones are more or less steatitic, due to subsequent alteration.

B. and D. *Dolerite, Basalt, and Diorite.*—These rocks seem to belong to four groups—1. Lower Silurian; 2. Pre-Llandovery; 3. Upper Silurian (Wenlock ?); 4. Carboniferous (?).

The ages of the first three are more or less apparent, but that of the fourth is obscure.

1. The oldest of the above groups of Lower Silurian age are altered and unaltered. Among the varieties of Hornblende rock, some seem to be diorites [hornblende and triclinic felspar], while

others contain orthoclase in addition to the triclinic felspar. Some seem to be pyroxenic, while others are micaceous, a few seem to be semi-pseudomorphous and changed into ophitic rocks. They are not very frequent in the area.

2. *Pre-Llandovery.*—These rocks seem principally if not wholly to belong to the sub-group of whinstones that have been called gabbro [pyroxene (diallage) + felspar (not orthoclase) + ripidolite], some however seem to merge into some of the more basic felstones. They vary from green and purple in colour, generally have a scaly aspect; some however are compact. These rocks were intruded subsequent to the first period of metamorphic action, but prior to the deposition of the Llandovery beds.

3. *Upper Silurian Whinstones.*—These principally consist of beds and dykes of black granular to compact melaphyre. There are also bedded rocks that seem to be diorites, the latter graduating into the green varieties of the basic felstones. Near Tourmakeady there is a bedded rock that has been pronounced by Mr. David Forbes, F.R.S., to be diabase.

4. *Carboniferous (?).*—These consist solely of melaphyres, very similar in aspect to the melaphyres just mentioned as interstratified with the Upper Silurian rocks; but evidently these are newer than them, and near Salrock in the district to the south it is apparent that these are newer, not only than the newest Upper Silurian rocks (Salrock beds), but also than the still more recent gabbro or diabase. On the other hand, it may be mentioned that no similar rocks were found in the Carboniferous district, nearer than Castlebar.

Basic tuff.—A greenish purplish compact rock in which are embedded distinct small fragments of foreign matter. At one locality it seems on the one hand to graduate into diabase, and on the other, into a tuffose sandstone. These rocks are sometimes metamorphose and steatitic.

Schist.—Many of the schists in this area are very slightly altered, but in all of these the surfaces of the cleavage planes and bedding which are the most conspicuous structures, are more or less glazed or micacised, and the old joint lines solidified; while such minerals as pyrite, chiastolite, and phyllite are developed principally on the structural surfaces, but also disseminated through the mass. In the Mweelrea hills and Slieve Partry, the rocks are principally varieties of argillite or clay schist (*sub-metamorphic rocks*), these however are in place associated with micalite or mica-schist, hornblendite or hornblende-schist, chlorilite or chlorite schist, talcite or talc-schist, and quartzite or quartz-schist. In the north portion of the area and in different zones, the metamorphic action seems to have been more intense than elsewhere, but in places the metamorphic rocks graduate into unaltered rocks, especially in the neighbourhood of Doolough, and in part of the Aille river valley; these unaltered rocks will be described immediately.

λ. δ. and σ.—Associated with the sub-metamorphic rocks in the Mweelrea mountains are subordinate and apparently lenticular,

small patches of schistose limestone and schistose dolomite, usually changing more or less into ophiolite or steatite. These are greyish, bluish, or greenish in colour, fissile with a mealy or fine flaky aspect. They never appear as beds, but are always most irregular, and would seem to be due to depositions in the vicinity of springs.

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Serpentine—Is of a considerable thickness, and stretches all along the northern slopes of the Croagh Patrick range of hills. It thins out towards Louisburgh and was seen in its greatest thickness in the railway cutting a mile and a half S.E. of the town of Westport. As a marketable commodity it is thoroughly useless, on account of its extreme hardness, dulness, and its fragmentary nature. As the railway cutting affords a good section, the following was there noted; 1st section of serpentine nearest Westport; greenish black, serpentinous shale, much weathered and decomposed, with an apparent dip to the E. at 35°; 2nd section; massive hard flinty dark green, light grayish green, and red serpentine, in some places much weathered. Where drift rests on it it is highly polished, and rounded by ice, and contains numerous veins of silvery green picrolite, a fibrous variety of serpentine; 3rd section; hard coarse light green, also reddish and purple serpentine, traversed by numerous veins of picrolite.

Resting on the serpentines are occasional beds of massive steatite very soft and unctuous. These serpentines are apparently pseudomorphic sedimentary rocks. A very small patch of serpentinous rock was observed on Clare Island.

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Lower Silurian rocks.—Doolough series.—In the neighbourhood of Doolough there are alternations of thin-bedded green grits, slates, and shales, or great thicknesses of green slate; above the latter there being a grit series. There is to the northward, and apparently lowest, a series of massive grits, above which is a slate series, and above all, or to the southward a grit series. In a few places are lenticular patches of argillous limestone or calcareous shale, but in very subordinate quantities. All these rocks, as previously mentioned, in places graduate into schists. Farther eastward in the Aille river valley are massive grits, often pebbly or conglomeritic, that appear to lie between two groups principally made up of slates and thin bedded grits.

In the neighbourhood of Toormakeady we have a few small exposures coming up through the Upper Silurian rocks, these consist principally of shale, in some places changed into hornstone, but in one locality are black graptolite shales [Llandeilo beds ?].

The Doolough series as observed in the northern portion of Clare Island, consist of alternations of black and green shales, some of which are micacized, and compact quartzose sandstones. The shales are very much contorted, and rapidly decompose on exposure to the weather, revealing concretionary masses, the

nuclei of which are generally lumps of iron pyrites; these lumps often weigh more than two pounds.

Upper Silurian rocks (Creggaunbaun rocks).—(*Upper Llandovery?*).—In general the Upper Silurian rocks in this area appear not to be as old as the lowest Upper Silurian rocks in the county Galway, in the district to the south; there is however one exception, namely, the exposure at Creggaunbaun, which contains numerous fossils determined by Mr. Baily to be of Upper Llandovery age. This patch consists of shales, grits, and limestones, that seem to rest on a conglomerate, while they seem to dip under schists and quartzite on the north, which apparently suggests that some of the schists hereabouts may be metamorphosed Upper Silurian rocks. These slightly indurated fossiliferous rocks are penetrated by numerous veins of granitic or granitoid rocks, and also by the Corvockbrack granite.

Mweelrea and Toormakeady Rocks.—These rocks consist principally of massive conglomerates and pebbly sandstones, above which are green and gray grits, sandstones, and shales, some of the latter being fossiliferous. In general the basal rock of the group is a bed of felstone; this, however, is sometimes absent, or it is replaced by a peculiar quartz-rock.*

This peculiar bed whenever it occurs, incorporates itself with the upturned edges of the underlying rocks, so that the junction between the two is hard to trace out accurately.

In Slieve Partry, but especially in the neighbourhood of Lough Mask, conglomerates are the prevailing rocks among the lower beds of the series, while farther westward, in most of the Formnamore mountains, and in the Mweelrea mountains, pebbly sandstones principally occur. In these latter hills, there are from three to five beds of interbedded felstone, separated from one another by sedimentary rocks. In Slieve Partry, these felstones appear in mass at the bottom of the series, associated with tuffs and limestones; the latter often fossiliferous. The limestones were not found farther west than Loughnafooey in the district on the south. Some of these limestones are tuffose or graduate into tuff, while others are brecciated or conglomeritic; while some are made up of angular or roundish fragments of a very pure limestone in a limestone base. These inliers are often very fossiliferous. The included fragments are often of bright shades of red, green, and yellow, giving the rocks a handsome variegated appearance, and some of them if polished might produce handsome marbles. The tuffs range from fine sandstone to coarse conglomerates, the calcareous varieties in places graduating into limestones.

The Upper Silurians are represented at Louisburgh by thick bedded purplish and red shales, beneath massive conglomerates

* Similar quartz-rocks have been met with in other places in Ireland. In those places, however, they were at the base of the Old Red Sandstone. They are described by A. B. Wynne and myself in the Descriptive Memoirs of portions of the counties Tipperary, Clare, &c.

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and sandstones, above which are flaggy sandstones indurated, and some bluish micaceous shales. The conglomerates have pebbles of vein quartz, quartzite and jasper, and although these beds are supposed to be analogous to those at Mweelrea and Toormakeady, yet the Louisburgh conglomerates do not contain the granite blocks, as well as blocks of other igneous rocks, which are so well exemplified in the bed of the river at Toormakeady, and in the north slopes of the Mweelrea mountains. The Upper Silurian in Clare Island resembles that at Louisburgh very much, the lowest beds being thick conglomerates, with pebbles of quartz, quartzite and red jasper, all much larger; and above these is a bed about twenty feet thick of coarse gray quartzose sandstone, traversed by innumerable small veins of quartz. This bed is observable all along the southern shore of Clare Island, and forms a barrier to the encroachments of the sea; over this coarse sandstone are very soft argillaceous beds, chiefly purple and green, that are almost vertical.

Carboniferous Rocks, Lower Sandstones, Shales, &c.—These rocks are represented by conglomerates, sandstones, and shales. In the south slopes of the Westport Valley, and south of Clew Bay, there is little evidence of their existence, but we find them in the bays of Carboniferous rocks that indent the country on the S.E. of Westport, where the group appears to be very thin. The conglomerates usually have a most siliceous matrix, more or less crystalline, containing, principally, pebbles of white vein quartz, and red jasper. The colours of the sandstones when unweathered are shades of green, red, and purple, but usually weathered more or less yellowish. Associated with the sandstones are beds of hard clay and shale, usually red, or reddish purple in colour, except when thin, then invariably, they seem to be green or grayish.

In the south slopes of the Westport Valley, the group seem to consist of more or less thin bedded flaggy sandstones, coarse grits, fine conglomerates, and thin arenaceous bluish and gray shales.*

In Clare Island where there is no limestone there is a tolerable thickness of sandstones, shales, and conglomerates, which from their lithological character, are identified with similar beds to the north of Clew Bay, and on which the Carboniferous limestone rests. The lowest bed of this group, is a red crumpled sandstone, over which is a considerable thickness of red argillaceous shales and sandstones, then a very fine red conglomerate, then alternations of brown and white quartzose sandstone with blue and gray argillaceous shales separating them, and on top of all, thick beds of green sandstone weathering white.

Carboniferous limestone.—In the neighbourhood of the Aille river we find over the sandstones blackish shales interstratified with thin limestones; but higher up the limestones have only parting of shale or clay.

In the Westport valley and in the vicinity of Clew bay, the

* Westport new church has just been completed, and built of the white coarse grits.

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limestones are of the ordinary type, highly crystalline and fossiliferous, grey crinoidal and compact, brown arenaceous beds, and rarely black shaly beds. To the west of Westport, near the old salt works, there is a quarry of bluish grey limestone, one bed of which about three feet thick contains very handsome nodules of native sulphur, some of which weighed more than two pounds. These also occur in the limestone exposed in the cutting a little to the east.*

Drift Deposits.—The drift consists of boulder-clay, moraine-matter, stratified drift, and post-glacial sands, gravels, &c.

In this area these are only small exposures of normal *boulder-clay*, which is similar in its general characters to that found elsewhere, consisting usually of a clayey matrix, containing a greater or less number of rounded, polished, and scratched blocks and fragments, principally of travelled rocks.

The *moraine-matter* may be a coarse accumulation consisting nearly altogether of blocks and fragments of local rocks; or it may be gravel; but more usually consists of accumulations of angular and rounded blocks and fragments of local rocks in a sandy or clayey base.

The *stratified drift* of this area is always more or less stratified, showing that it is subæqueous. It forms most of the coast drift-cliffs, also extensive sheets on some of the mountain slopes, often up to considerable height, that in the Owenbrin valley reaching an altitude of over 800 feet. As seen in the coast sections, this glacialoid drift consists of two distinct members, the lower being very similar to normal boulder-clay except that it is always distinctly stratified, the upper being somewhat like moraine-drift, also always stratified, but often not as distinctly as the structure in the lower member. Between the two members there is usually a thin sand or bookclay, from a mere line to one or two feet in thickness, apparently pointing to a period of rest between the deposition of each. Among the hills moraine-drift in places is found on the stratified drift. This latter may in such cases be rearranged boulder-clay or moraine drifts of older date, and probably is due to a sheet of ice or a glacier terminating in a sea or other mass of water, the contained foreign materials in the ice, as it melted, being stratified, but not otherwise affected by the water. It probably was accumulating at the same time as the normal glacial drifts.

Post-glacial drifts.—These are principally shingles, gravels, and sands, but with them in places are associated the different varieties of meteoric drift. The shingles, gravels, and sands, may

* At the time the map (sheet 74) was being prepared for publication, it was supposed by Mr. Symes and myself, that the relations of the Lower Carboniferous beds along the southern shores of Clew bay and near Westport to the metamorphic rocks might be explained by supposing the Carboniferous beds to have been deposited along (and over) a shelving sea-bottom, owing to which the basal beds would frequently be concealed. But we are now on further consideration, more inclined to conclude that this line of boundary is a fault, being a prolongation of that which brings the Upper Silurian beds against the metamorphic rocks at Louisburgh. The absence of sections near Westport showing the actual junction renders the question somewhat uncertain.—E. Hull.

occur in raised benches of different ages, or in mass on the older drifts, while the meteoric drifts are found principally on the mountain slopes.

Recent accumulations.—These consist of *blown sands* (siliceous and calcareous), *bog*, *alluvium*, &c., and will be mentioned in the detailed descriptions.

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4. *Relations between the form of the Ground and its internal structure, with some account of the latter.*—The S.W. and S.E. groups in the Mweelrea mountains are nearly entirely composed of sandstones, grits, shales, and conglomerates of Upper Silurian age, while the hills in the N.E. group, which nearly equal the others in their heights, are made up of older grits, slates, and shales, partly metamorphosed. These rocks in places contain fossils which seem to point to their being of Lower Silurian age. They are supposed to represent the rocks that near Galway Bay, in the country to the south, are found in the islands and on the mainland in the vicinity of Mannin, Roundstone, Kilkieran, and Greatman Bays.

Slieve Partry and Formnamore mountains are masses of Upper Silurian rocks, in places especially in the first group, being principally conglomerates. The table-land of the latter appears to be the levelled surface of the bottom of the ancient Carboniferous sea, as lying thereon are found small outliers of the basal beds of the Carboniferous formation.

In the low country, and in the valleys on the east, north, and west of Slieve Partry, also in some of the valleys of the Formnamore mountains, denudation has exposed Lower Silurian rocks, "Doolough beds," or schists, and similar rocks occur in small exposures in places immediately north of Killary Bay, and adjoining the sea west of Mweelrea, and from the latter extending along the valley to Doolough, and from that through Glenummera into the Erriff valley. The low country of the Erriff and Aille valley, also the valley north of the Mweelrea mountains is occupied by schists or grits and shales, principally of Lower Silurian age; while in the low country west and north of Corvockbrack and Knockaskeheen, there are schists probably of Upper Silurian age, Corvockbrack and Knockaskeheen being masses of intrusive granite.

The low hills west and north of Louisburgh, with the country in its vicinity, seem to be composed of Upper Silurian rocks, while the Croaghpatrick range consists of quartzite and other schists of Lower Silurian age, the peaked summit being formed of quartzite, or quartz schist, as is so usual in Connaught. Bounding the eastern portion along Lough Mask, also sending spurs into two or three of the low valleys, are Carboniferous sandstons, limestones, and shales.

In the country to the south (Sheets 93, 94, and 95) there are many systems of breaks along which are marked features; in this country systems also occur, but apparently not as frequent or conspicuous. Different N. and S. breaks shift the beds, but on none of them is there a deep valley except the break running from Bundorragha to the S.E. end of Doolough, but the seacoast west of Mweelrea has a similar bearing. Maum valley, extending from Killary bay to the N.W. arm of Lough Corrib in the country to the south, is known to run along a great line of fault. This fault can also be traced in the country now being described, as north of Killary bay, it crosses over the S.W. shoulder of Bengorm into the valley of Doolough, and from thence along the valley of the Carrowisky river into the low ground S.W. of Louisburgh, its valley running in a general N.W. and S.E. direction. Other marked valleys in the western portion of the district that have a similar general bearing are—the lower or western division of Killary bay, the upper part of the Bunowen valley, and the upper portion of the Owenmore valley; while in the east part of the area are the mountain-pass (or maum) N.W. of Toormakeady, the valley of the Owenbrin, and the valley of the Srahnalong rivers. Valleys that have nearly E. and W. bearings are the middle division of Killary bay, Glenummera, and Lough Cunnel valley; the two last are probably on the one line of fault that has been shifted by the new fault of the Maum valley. Marked features of a different character that have a similar bearing are the Croaghpatrick range of hill, and the south shore of Clew bay. Extending obliquely across the eastern portion of the district is the N.E. and S.W. valley occupied by the N.E. part of Killary bay, and the Erriff and Aille rivers, the fault along which is known to be Post-Carboniferous. Other valleys having a similar bearing are the small valley of the Carrowbeg river on the north-west, and the small valley called Glensaul to the south-east.

In the neighbourhood of Louisburgh, prior to the deposition of the Upper Silurian rocks, there seem to have been a system of breaks running nearly N. and S., while subsequent to the Carboniferous age there were other systems of breaks, the most marked being nearly E. and W. faults that in nearly all cases have downthrows to the northward, one of them being traceable from the Atlantic on the S.W. of Louisburgh, south of Clew bay. A marked parallel fault, with a down-throw to the southward, occurs on Clare Island.

The oldest rocks in the area as previously mentioned are supposed to be of Lower or Cambro-Silurian age. These rocks, both prior and subsequent to their metamorphosis, were twisted, broken, and displaced. The oldest Upper Silurian rocks in the area seem to be those in the country south and south-east of Louisburgh. These rocks also were in part metamorphosed probably in connection with the intrusion of the granites of Corvockbrack and the neighbouring hills, but whether it was this action or an earlier

one that metamorphosed the Lower Silurian rocks in this immediate neighbourhood is uncertain.*

After the intrusion of the Corvockbrack granite, the Upper Silurians of the Old Head hills with those of the Mweelrea and Formnamore mountains and Slieve Partry seem to have been deposited, the beginning of the period being marked by great fissure irruptions of basic felstones, associated with their accompanying tuffs conglomerates and agglomerates. Since then the Upper Silurian rocks have been more or less broken and displaced and subjected to denudation at different periods, both before the deposition of the Carboniferous rocks and subsequently, while some movements of the strata appear to have taken place since the Glacial period.

Since the great Glacial period, but probably while glaciers existed in at least some of the sheltered mountain valleys, the sea rose at least 350 feet higher than it is at present, its waters changing the features of all the valleys that came under their influence, while at the same time and subsequently atmospheric waste modified the higher portions of the country.

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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.
			Carboniferous. Sheet 74.
		County of Mayo.	
1	88/1	Cloonmonad, .	In Railway Cutting, a little west of Westport; Lower Limestone shale.
2	88/1	Do., . .	In same Railway Cutting, nearer Westport; Sandstone.
3	88/2	Do., . .	One mile N.E. of Kinlovey Lake, about two miles S.E. of Westport; Limestone.
			Sheet 84.
4	108/1 & 2	Do., . .	Quarry at Derrycraff, about half a mile west of old road between Leenane and Westport; Limestone.
			Silurian. Sheet 84.
5	96/3	Cregganbaun, .	At several places in this Townland, about five miles south of Louisburgh, grey calcareous grit; ? Upper Silurian.
6	96/3	Cregganawoddy, .	A little west of preceding locality; grey slates, ? Upper Silurian.
7	96/3	Feenune, . .	Derrygarve slate quarry, about five miles south-west of Louisburgh; grey slates, Lower Silurian.

* A long period must have intervened during which the Lower Silurian rocks were subjected to great denudation, producing depressions and corresponding ridges, amongst which on the resubmergence of the beds the Upper Silurian rocks were formed.

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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.
		County of MAYO—*continued.*	
8	96/3	Aillemore and Corrydavit Boundary.	On river bank a little south-east of Aillemore Lodge half a mile west of preceding locality; grey slates; Lower Silurian.
9	106/1	Derryheeagh, .	Close to old National School House, a little south-east of locality 5; grey slate, ? Lower Silurian.
10	106/3	Glenconnelly, .	Cliff above Lough Bellawaum; Mweelrea Mountain, north of Killary Harbour; green shales, Lower Silurian; Caradoc.
11	106/4	Clasheame, . .	North-east shore of Doo Lough; dark grey slates, Lower Silurian.
12	115/1	Glenconnelly, .	East side of Lough Bellawaum, north of Killary Harbour; green shales, ? Upper Silurian.
13	115/1	Derreennawinshin,	South slope of Mweelrea Mountain, a little north of Bunnaglass, Killary Harbour; Lower Silurian.
14	115/3	Uggool, . .	Near the shore, Killary Harbour, north-west of the village of Uggool; green shales, Lower Silurian; Caradoc.
15	115/3	Do., . .	Half a mile north-east of Gubderrynasliggan Killary Harbour; green slates; Lower Silurian.
		County of GALWAY.	
16	10/2	Salrock, . .	On road half way between Lough Muck and Salrock, south of Killary Bay, Little; red shales, Upper Silurian; Upper Llandovery.
17	10/2	Do., . .	A little north of preceding locality, south of Killary Bay, Little; greenish slates; Upper Silurian; Upper Llandovery.
18	10/2	Do., . .	A little north-west of Lough Muck Lodge, north-east shore of Lough Muck; Lower Silurian; Caradoc.
19	10/2	Do., . .	A little south of Salrock; green slates; Upper Silurian; Upper Llandovery.
20	10/2	Rossroe, . .	Several places on the north shore of Killary Harbour, north of Salrock Pass; grey slates; Lower Silurian; Llandeilo.
21	11/3	Letteretrin, . .	About a quarter of a mile north of Illaunroe, Lough Fee; gray calcareous grits, decomposing; Upper Silurian; Upper Llandovery.
22	11/3	Tullyconor, . .	Half a mile south of Derrynasliggan Lodge, south side of Killary Harbour, about three miles west of Leenane; Upper Silurian; Upper Llandovery.
23	13/2	Lettereeneen, .	About one mile south east of Barnahowna, and four miles south-west of Toormakeady; indurated black shales; Lower Silurian; Llandeilo.
		SHEET 85.	
24	3/4	Greenaun, . .	Glensaul, three miles south-west of Toormakeady; Lower Silurian limestone; Caradoc.
		County of MAYO.	
25	109/1	Gortbunacullin, .	At side of stream forming south-east boundary two and a half miles north-east of Toormakeady; Lower Silurian limestone; Caradoc.
26	109/3	Treanlaur, . .	A little west of Mount Partry, about three-quarters of a mile north-east of Toormakeady Lodge; Lower Silurian; Caradoc.

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 CARBONIFEROUS SANDSTONE.

Plantæ.

	Localities.
Knorria imbricata, branching,	2.
Calamites, allied to Suckowii,	2.
Plant fragments, linear,	×2.

Brachiopoda.

Streptorhynchus crenistria,	2.

CARBONIFEROUS LIMESTONE AND SHALE.

ACTINOZOA.—*Corals.*

Clætetes tumidus,	1, 3.
Lithodendron affinis,	× 3.
„ junceum,	× × 1, × × 3.
„ Portlocki,	× 1.
Michelinea favosa,	× 1, × × 3.
Zaphrentis cylindrica,	× 3.

MOLLUSCA.—*Polyzoa.*

Fenestella antiqua (in shales),	× × 1.

Brachiopoda.

Athyris planosulcata,	3.
Chonetes Hardrensis,	3.
„ papilionacea,	1, × 3.
Productus punctatus,	1.
„ scabriculus,	1, 3.
„ semireticulatus,	× 1, × 3.
Rhynchonella pleurodon,	1, 3.
Spirifera bisulcata,	1, 2.
„ cuspidata,	3.
„ laminosa (in shales),	× × 1.
Spiriferina cristata,	3.
Streptorhynchus crenistria,	3.
Terebratula hastata,	3.

Lamellibranchiata.

Aviculopecten lævigatus,	3.
„ species indet,	1.

Gasteropoda.

Euomphalus pentangulatus,	1, 3.
Loxonema impendens,	1, 3.

Nucleobranchiata.

Bellerophon apertus,	3

Cephalopoda.

Orthoceras sp. indet,	3.

Echinoidea.

Actinocrinus (stem),	1.
Archæocidaris Urii (spines),	1, 3.
Crinoid, joints and stems,	× × × 1, × × 3.

CRUSTACEA.—*Trilobita.*

Phillipsia Derbiensis,	3.
„ pustulata,	1, × 3.

VERTEBRATA.—*Pisces*, Cestraciontidæ.

Psammodus porosus (palatal tooth),	3.

UPPER SILURIAN.

PLANTÆ.

	Localities.
Fucoids?	17.

ACTINOZOA.

Cyathophyllum (Petraia) bina,	× × 5.
„ „ elongatum,	× × 5, 6.
Favosites aspera,	5.
„ cristatus,	× × × 5, 6.
„ fibrosus,	5.
„ Gothlandicus,	× × × 5.
Halysites catenularius,	5.
Heliolites interstinctus,	5.

ECHINODERMATA.

Crinoid stems and joints,	× × 5, 21.

ANNELIDA.

Cornulites serpularius,	21.

MOLLUSCA.—*Brachiopoda.*

Atrypa reticularis,	× 5.
„ hemisphærica,	× × × 21.
Leptæna sericea,	× × 12.
Lingula Symondsii,	9, × × × × 16, 17, × × 18, × × × 22.
Orthis calligramma,	5, 6, 12.
„ elegantula,	5, 12.
„ testudinaria,	5, 9, 12.
Pentamerus galeatus,	× 12.
„ Knightii,	× 5.
„ oblongus,	× 5.
Rhynchonella Llandoveriana,	× 5, × × × × 21.
Spirifera plicatella,	? 5.
Strophomena compressa,	6.
„ rhomboidalis,	5.
„ sp. indet,	9, 21.

LAMELLIBRANCHIATA.

Cleidophorus subcylindrica ?	21.
Orthonota, sp. indet,	21.
Pterinea lineatula,	5.
„ retroflexa,	17, 21.

GASTEROPODA.

Euomphalus sp. indet,	9.
Holopella cancellata?	12.
„ obsoleta,	21.
Trochus multitorquatus,	× × × × 18, 21.

NUCLEOBRANCHIATA.

Bellerophon trilobatus,	12, × 21.

PTEROPODA.

Conularia Sowerbyi,	5.

CEPHALOPODA.

Orthoceras angulatum,	21.
„ ibex, or perelegans,	5, 9
„ tenuicinctum,	12.

CRUSTACEA.—*Trilobita.*

Encrinurus punctatus,	5.
Phacops caudatus,	5.
„ sp. indet,	12.
Proetus latifrons,	5, 12.

LOWER SILURIAN.

ACTINOZOA.

	Localities.
Heliolites tubulatus,	14.

HYDROZOA.—*Graptolites.*

Cladograptus linearis ?	23.
Dendrograptus flexuosus ? (Hall.),	19.
„ gracilis (Hall.),	× 19.
„ Hallianus (Prout),	23.
Diplograptus pristis,	7, × × × 8, 11, × × 19, 23.
Graptolithus Hisingeri,	7, 11, 19, 23.
„ priodon,	18.
„ tenuis,	7, 11, 18.

ECHINODERMATA.

Glyptocrinus ? joints,	14, 18, × × × × 25.

MOLLUSCA.—*Brachiopoda.*

Leptæna sericea,	10, 13, 14, 15, 24, × 25.
„ quinquecostata,	25,
Lingula ovata,	10, 14.
„ sp. indet,	11.
Obolella ?	19.
Orthis biforata,	10, × × × 14, 15.
„ calligramma,	× × 9, 10, 13, × 14, × × 15.
„ elegantula,	24, 25.
„ insularis,	25.
„ tenuicincta,	25.
„ testudinaria,	× × 10, 13, 14, 15, 25.
„ vespertilio ?	10.
Porambonites intercedens,	10.
Strophomena deltoidea,	14.

Lamellibranchiata.

Ctenodonta anglica,	× 18.
„ transversa,	× 10.

Gasteropoda.

Euomphalus, sp. indet,	25.
Holopea concinna,	× 18.
Murchisonia obscura,	18.
„ (Pleurotomaria) trochiformis,	14.
„ sp. indet,	15.
Platyschisma helicites,	? 14, 15.
Raphistoma elliptica,	15.
„ sp. indet,	15.

Nucleobranchiata.

Bellerophon bilobatus,	10, 14.
„ trilobatus,	10, 13, 14.

Pteropoda.

Ecculiomphalus Bucklandi,	× × 14.
Theca reversa,	14.
„ triangularis,	14.
„ sp. indet,	19.

Cephalopoda.

Orthoceras ibex,	× × 10, × 14.
„ subundulatum,	15.
„ sp. indet,	19, 25.

CRUSTACEA.—*Trilobita.*

Asaphus radiatus,	× 10, × 14.
„ sp. indet,	15.
Cheirurus bimucronatus,	25.
Cybele verrucosa,	25.
Illænus Bowmanni,	× × × × 24, 25.
„ sp. indet,	18

Fossils from Carboniferous limestone, shale, and sandstone were collected at three localities only within this district, all of them situated on the southern portion of Sheet 74. Large plant stems, some of them uncompressed and branching, in sandstone, from the railway cutting between Westport and the dock (loc. 2), have been referred to *Knorria imbricata*. With respect to this genus, which has by some authors been incorporated with *Lepidodendron* (*Sagenaria*), Professor Schimper observes* :—"Le genre *Knorria* est évidemment distinct du genre *Lepidodendron* (*Sagenaria*), autant par le forme des conssinets foliares, forme qui ne se rencontre jamais dans les *Lepidodendron*, que par celle des cicatrices foliares et celle que laissent les coussinets après leur chute. Les *Knorria* paraissent être limités aux formations Dévoniennes supérieures et aux formations houillères les plus anciennes."

On the same slab of sandstone with the *Knorria* above mentioned is the impression of portion of the stem of a *Calamite*, showing a joint, with indistinct traces of leaf cicatrices. This fossil plant, from the character of its ribbed surface, has been doubtfully referred to *C. cannæformis*—a species having a wide geological as well as geographical range. M. Gœppert is cited by Professor Schimper† as recording this species from lower strata than the true coal in various countries, including the "grauwacke" of Silesia; and Dr. J. W. Dawson‡ alludes to specimens, probably referable to this species, as occuring in Lower Carboniferous strata near Riversdale, Canada, in the same horizon elsewhere, and also in Devonian strata in that country. Also on the same slab there are indistinct traces of marine shells, some of which appear to be referable to *Streptorhynchus crenistria*.

The collection of carboniferous limestone and shale fossils from the same railway cutting and from the south-east of Westport (localities 1 and 3) comprise several species of corals and shells which are characteristic of the lower limestone and shale.

The Silurian fossils were mostly collected from localities on sheet 84, in the counties of Mayo and Galway, a few localities only in the same counties being situated on the western part of Sheet 85.

From the identification of the fossils, they have been divided into Upper and Lower Silurian.

In the neighbourhood of Cregganbaun, S. of Louisburgh (locality 5), the rocks, hard calcareous schists, are highly charged with fossils of an Upper Silurian, probably Wenlock character, consisting mostly of corals and Brachiopod shells.

At locality 21, near the S.W. corner of Sheet 84, fossils of a true Upper Llandovery type, such as those at Blackwater-bridge, S. of Leenane and Maume, county Galway, are found to be distributed in great abundance in calcareous bands, *Rhynchonella Llandoveriana* and *Atrypa hemisphærica*, two characteristic Brachiopods of that formation, occurring in profusion.

In the same corner of the sheet, at the townland of Salrock, south of Killary Bay, Little, red and green micaceous shales are the prevailing rocks. The layers of red shales in some places are covered with a small Lingula, which Thomas Davidson, Esq., F.R.S., the eminent authority on Brachiopoda, pronounced to be in all probability identical with *Lingula Symondsii*, a characteristic Upper Llandovery shell belonging to this class. In the green shales it is more sparingly distributed, accompanied at one locality (No. 17) by an

* Traité de Paléontologie Végétale, &c., vol. ii., p. 46.
† *Ibid*, vol. i., p. 317.
‡ Report on Fossil Plants, Geological Survey of Canada, 1873, p. 30.

Aviculoid shell, *Pterinia retroflexa*, and at locality 18 by numerous examples of the characteristic Llandovery Gasteropod shell, *Trochus multitorquatus*, M'Coy.

Lower Silurian fossils of the Caradoc type were found to be abundant in greenish slates, N.W. of the deserted village of Uggool (locality 14). These fossils are evidently of contemporaneous age with those collected under Colonel Portlock's survey at Desertcreat, county Tyrone, in the north of Ireland—*Orthis biforata*, a Brachiopod shell, and the remarkable spirally-curved Pteropod *Ecculiomphalus Bucklandi*, a species also found at Desertcreat, being the most frequent. A large Trilobite referred to *Asaphus radiatus* (Salter) is equally prevalent at this place, and at what appears to be corresponding strata in the cliff above Lough Bellawaum, Mweelrea Mountain (locality 10), associated with an almost identical assemblage of species. At Derrygarve slate quarry, about five miles south-west of Louisburgh, the cleaved slates contained single and double graptolites, *G. Hisingeri* and *Diplograptus pristis*, with *Orthis calligramma*. At Aillemore, half a mile west (locality 8), similar cleaved gray slates were found to contain the double graptolite *D. pristis* in abundance; and on the north-east shore of Doo Lough (locality 11) graptolites of similar species were also found.

At several places on the north shore of Killary Harbour, north of Salrock Pass (locality 19), graptolites were found in gray calcareous slates, and also at the south-east corner of the same sheet 84 on indurated black shales, consisting of the ordinary species *Graptolithus Hisingeri* and *Diplograptus pristis*, together with branching forms, apparently identical with species figured and described by Professor James Hall, in Decade 2 of the Geological Survey of Canada, from the "Quebec group" of the American geologists, strata believed to be contemporaneous with the Llandeilo formation of the British Islands. These species are *Dendrograptus Hallianus* (Prout) and *D. gracilis* (Hall), with other forms doubtfully referred to *D. flexuosus* (Hall) and to *Cladograptus linearis* (Carruthers), all Llandeilo species; and therefore, we have in these rocks most probably the lowest fossiliferous beds of the west of Ireland.

Fossils believed to be of Caradoc age were also found to occur at the western part of sheet 85, at two localities (24 and 25), in a brecciated limestone formed of gray and red fragments, the red portions being the most fossiliferous. These fossils resemble very much those of the Lower Silurian limestone, Chair of Kildare, and are principally portions of Trilobites, of which *Illœnus Bowmanni* is the prevailing species, accompanied by *Cybele verrucosa* and a few Brachiopod shells. A somewhat similar set of derivative fossils was collected from an ash bed a little west of Mount Partry (locality 26), in the same district.

Various places in this difficult part of the country were examined for fossil evidence by myself and assistants, Messrs. M'Henry and Leeson. We were only occasionally successful; but the results, as shown in the list of species and the above remarks, are sufficient evidence of the value of Palæontological investigation as an indispensable aid to the geologist.

WILLIAM HELLIER BAILY.

December 30, 1875.

NOTES OF MICROSCOPIC SECTIONS OF ROCKS.

Clare Island.

BASALT.—One of two dykes penetrating black contorted shales at Maam village, in brookcourse. This section exhibits a pale greenish augitic (?) base tinged with chlorite, enclosing slender prisms of tri-

clinic felspar (Labradorite ?), and numerous crystalline black grains of magnetite or titano-ferrite.

Certain clouded patches are resolvable, with the 1-inch object-glass, into very minute crystals of this last-named mineral. The proportion of iron in this basalt must be very large.

Aillemore, S. of Louisburg.

DIORITE.—This rock penetrates slate at the quarries of Aillemore, and consists of short crystals of hornblende in a reddish felspathic base. Under the microscope, with 2-inch object-glass, the crystals of hornblende are seen to be well defined, with rich sap green to brown colours embedded in a colourless felspathic paste, in which a few very small grains of magnetite are also present.

The felspar is scarcely crystalline, except in a few cases, in which the fine hairlike lines characteristic of the triclinic group are visible.

The hornblende crystals are traversed by numerous cleavage planes, showing strong lines parallel to the axes of crystallization. The blunt terminal apex of the prism can also be observed in several cases. With the polariscope a rich play of colours from yellowish brown, through green to deep bronze, is seen on rotating the analyzer.

Magnetite, in the form of minute black crystalline grains, comes into view with the 1-inch object-glass, as also a few grains of silica, but this seems quite accidental.

GRANITE.—The description of the granite of Corvockbrack, &c., near Aillemore, has already been published by me in the Transactions of the Royal Geological Society (Vol. IV., Part I., New Series), but a short account may advantageously be given here.

Under the microscope a thin slice is seen to be composed of structureless quartz; felspar, partially crystalline and clouded; and mica, deeply scarred.

With the aid of the polariscope these minerals resolve themselves vividly.

The quartz adapts itself to the forms of the felspar and mica crystals, but, on rotating the analyzer, exhibits a beautiful play of prismatic colours, and with a high power is seen to be highly cellular; the cells containing fluid bubbles, which are visible with the $\frac{1}{4}$-inch object-glass. Along with these are tubes and dartlike bodies (belonites) traversing the silica in various directions.

The felspar consists of orthoclase and plagioclase (probably oligoclase). The orthoclase is clouded, and with polarized light exhibits the cross-bands, which with a high power resolve themselves into lines of cells. Some right angles are also visible amongst the crystals.

The plagioclase is well brought out under the polariscope, the fine hairlike lines parallel to the principal axis of the prism being clearly defined. One or two well formed crystals are to be seen imbedded in the silica.

A few minute black specks, probably of magnetite, are also visible under a high power.

EDWARD HULL.

DETAILED DESCRIPTION.

Northern portion of District under Explanation.

For the purpose of better description, this portion has been sub-divided into the following :—I. That portion of country surrounding Westport. II. That around Louisburgh and Clare Island. III. That around the Hills of Knockaskeheen and Corvock Brack.

I. *Country around Westport.*

Westport stands on the southern margin of the small basin of Carboniferous rocks which form the eastern boundary of Clew Bay, having high ground to the south, while to the north the ground for a considerable area rarely exceeds a height of 120 feet above the sea.

The Carboniferous rocks chiefly consist of blue compact limestone, with occasional bands of shales, and brownish arenaceous beds interstratified, all lying more or less horizontal, except when approaching the boundary on the south where they dip at rather high angles towards the boundary.* The best sections of these rocks occur at Carrowbeg, one mile to the N.E. of Westport; in Westport domain; and numerous quarries in the townlands of Cloonmonad and Ardmore, to the S.W. of the town. South of the Carboniferous boundary, the ground immediately commences to rise, and is composed entirely of metamorphic rocks, the foliation following the bedding. These rocks are traversed by numerous faults running more or less in a N.W. and S.E. direction, along which chasms in the hills have been formed, but not affecting the geology very much. The arrangement of these beds is as follows :—1. Schistose beds, with layers of quartz. 2. Compact schists. 3. Massive green and purplish serpentinous beds. 4. Thin band of schist. 5. Massive quartzites, in places flaggy. 6. Compact schists. Nearly all these beds dip northward at high angles, the strike being nearly E. and W., and they range from the sea W. of Louisburgh as far as the low ground on the E. close to Mount Brown. The schistose beds which are highly siliceous, occur in the new railway cutting S. of Westport, and were evidently a highly siliceous shale prior to metamorphism. Underneath these are compact schists of various degrees of texture, one bed of which is entirely black shales.† Below these are the massive serpentinous beds, being chiefly of a dark green colour. They are of no economic value, and are interspersed with numerous veins of silver, green, and white chrysotile, or the asbestiform serpentine. In the section in the railway E. of Westport, numerous varieties were observed, chiefly mottled green and black, interspersed with reddish and purplish masses. The quartzites below these are of the usual kind—sometimes amorphous, as on Croagh Patrick; sometimes thin, flaggy, with micaceous particles along the planes of foliation; and sometimes massive, interlaced with numerous small veins of quartz. On the top of these quartzites there is a band of conglomerate, consisting of pebbles of quartzite enclosed in schist, some pink, the foliation of the pebbles corresponding to the foliation of the district. Underneath the quartzites are schists of every variety, the band immediately below the quartzites being micaceous and easily decomposing. Underneath these are hornblendic and chloritic beds, and at Lanmore,‡ three miles S. of Westport, the schists are black, argillaceous, and mineralized. To the S. and S.E. of Lanmore the rocks below the slates are very gritty, very slightly metamorphosed, and have a general dip to the southward, in a direction contrary to that of the beds just described. In the neighbourhood of Westport there are but few igneous rocks : the most remarkable being a large dyke of dolerite which is plainly seen to the N. of the railway cutting about two and a half miles E.S.E. of the town. This dolerite, as before mentioned, is supposed

* As already stated I have come to the conclusion that this boundary is a fault, though at the time the survey was in progress the evidence did not appear sufficient to warrant this opinion.—R. G. S.

† A boring for coal was once made in these shales!

‡ The quarries at Lanmore have been worked for slates, part of Westport being slated from there. Apparently they are but slightly metamorphosed, except in places where dykes of felstone traverse them, and then the slates are changed into hornstones.

to be the newest rock of the entire district under explanation, and makes its appearance in several places, cutting through the granite hill of Corvock Brack to the S.W., and then taking a N.E. course through the schists, then traversing the Carboniferous rocks near Westport, and extending its course through the same rocks in the district to the E., as already explained in the memoir to accompany sheet 75.* This dolerite is very massive, sub-crystalline, and decomposes rapidly where exposed to the atmosphere. In connexion with the serpentines are two small felstone dykes; one of these which is to the E. of Belclare Bridge, crosses the serpentine diagonally and is metamorphosed; the other to the W. of the bridge, follows the strike of the serpentine and is not altered. Both of these dykes are very narrow, and are not continuous for any length. In the high ground to the S. of Slieve Mahanagh, which is about seven miles S. of Westport, are numerous felstone dykes which are continuous over a large area, and are newer than the schists through which they are irrupted. These dykes, although not very broad, are traceable from the Corvock Brack granite hills, and are changed from a granitoid rock to a felstone, and finally into a felsite schist; where exposed to atmospheric action they are reduced to a white, soft substance, whereas the normal specimen shows them to be a pale yellowish green granular rock. These dykes are eventually lost to view on the east by the capping of the newer rocks of the Carboniferous period.

II.—*The district around Louisburgh.*

Louisburgh is situated in low ground, having the comparatively small hills of Old Head and Carramore, which are composed of Silurian rocks, bounding it on the N. and N.W., and the hill of Kilgeever on the E., while to the S. is a low, undulating plain, covered, for the most part, with a large accumulation of drift and bog.

The rocks around Louisburgh are variable in character, and are supposed to be of Upper Silurian age chiefly from their resemblance to the beds of this age in the Muilrea range to the South; but we have been unable to verify this identification by an appeal to fossils, as none have hitherto been discovered in this neighbourhood.

The highest beds in the series, which are to the S. of the town, are coarse sandstones and fine conglomerates, which dip at high angles away from the large fault which, as already explained, traverses the entire district in an E. and W. direction, and which here forms the boundary between the Upper Silurians and the metamorphic rocks on the south. Beneath the coarse sandstones are thin bands of red argillaceous shales, and underneath them are variegated grits and shales, very much crumpled although vertical. This is very evident from the sections in the river and street of the town; in many places the strata are highly indurated.

North of these are the conglomerates and coarse sandstones of Old Head and Carramore Hills. The pebbles are for the most part of small size and are composed of vein quartz, with occasionally others of jasper and indurated rocks. Further north of these hills, in the low ground (chiefly covered by alluvial deposit and bog reclaimed), the rock wherever seen was found to consist of chiefly reddish brown and green argillaceous shales, to the north of which are conglomerates and coarse sandstones, forming the headland at Old Head.

The metamorphic rocks E. of Louisburgh correspond with those already described about Westport; the succession of the strata from

* Ex., p. 18.

the quartzite downwards, and the thickness being almost constant over a large area. A description, therefore, would only be a recapitulation.

In connexion with the Upper Silurian rocks along shore N. of Louisburgh are a few small, narrow, intrusive, igneous dykes; only one decomposed felstone is seen at Old Head, the remaining being minutely crystalline basalts. No igneous rocks were seen in the metamorphic series.

Clare Island is traversed by three large faults, two of which run parallel to one another in an E. and W. direction on the south of the island, throwing down the Upper Silurian rocks and exposing the metamorphic series; and the third running in a N.W. direction near the boundary of the Upper and Lower Silurian series.

The Upper Silurians are somewhat similar to those already described north of Louisburgh, the hills of Knocknaveen (729 feet), and Knockmore (1,453 feet) being formed of massive conglomerates with well rounded pebbles, interstratified with thin variegated shales, while the cliff section on the south of the island shows vertical beds of coarse white sandstones traversed by innumerable veins of quartz, and purplish green and blue argillaceous and micaceous flags and shales, with a nearly E. and W. strike; the latter beds at the western extremity of the island being slightly metamorphosed.

The Lower Silurians occur in the north of the island and extend for about a mile from the Light-house in a southerly direction; they are composed of alternations of greenish felspathic grits, and black and blue shales or slates dipping towards the south at high angles. These beds are very similar in appearance to those of "Llandeilo" age, as they are not metamorphosed in this locality, only indurated. Nevertheless, we failed, after a diligent search, to find any fossils. These beds are unconformable with the Upper Silurians. Resting on the Lower Silurians are beds of Lower Carboniferous age of considerable thickness, and consisting of red marly sandstones and shales passing upwards into quartzose conglomerate; and over these, and extending as far as Kinnacorra Point, which is the most eastern portion of the island, are massive mottled sandstones which have a general dip to the E.

The metamorphic strata are in a nearly vertical, or contorted position, consisting of chlorite, talc, and quartzose schist, bounded to the south by the fault which brings down the Upper Silurian beds, and on the north by conglomerates of the same age. Excellent sections are shown in the gullies and ravines along the shore.

Between the two faults which traverse the south of the island, and in the neighbourhood of the old Abbey there is a remarkable conglomerate amongst the metamorphic beds, consisting of rounded boulders and pebbles of coloured quartzite, vein quartz, schist, and red jasper, cemented together by schist. Some of the blocks are 12 or 14 inches in diameter; along with this are dark green schists.

At the western side of the island and S. of Knockmore, there is a dyke of trap with a dark green base, having crystals of carbonate of lime, and vesicles filled with a soft pale green mineral.* In the same neighbourhood (N. of Toormore) vertically contorted beds of calcareous grit and dolomite are exposed to view in a cliff, and were carefully searched for fossils, but without success.

Half a mile E. of Knockmore, there is a small boss of coarse, heavy, dark green hornblende and diallage rock; and very close to this, but not in

* For observations on the microscopic structure of this rock by Professor Hull, see page 33.

connexion, there is a small dyke of serpentine. To the E. of the Lighthouse there is a dyke of basalt, light blue, with a compact base, and in the brook to the N.W. of L. Avullin there are two small dykes of similar basalt: of which a description by Mr. Hull, from microscopic examination, is appended. North of these there is a large boss of hard dark green or bluish felstone, with compact base, much weathered at the surface, and containing numerous grains and veins of calc. spar. To the eastward it passes below the Carboniferous beds and disappears.

District around Knockaskeheen, &c.—A description of the granite has already been given above (page 16).

To the N. of the mass of granite several faults occur which have thrown down the schists and brought up the granite, as well as changing the position of part of the mass and the adjacent rocks very materially.

The dykes to the S.W. of the mass of granite are numerous, and consist of felstones, elvanites, diorites (very numerous), and syenite. These dykes traverse the beds along their bedding, and change them very slightly, as the fossil evidence at Cregganbaun proved. Through Knockaskeheen a dyke of dolerite runs in a N.E. and S.W. direction, and which is supposed to be the same as that already alluded to as occurring to the E. of Westport, and observed in many places in the Castlebar district. East of Aillemore, which lies west of Corvockbrack, a dyke of elvanite traverses the shales. Where it is in proximity with the shales or grits it assumes a schistose appearance. West of Aillemore there is a large dyke of diorite, a hundred feet across. It contains well formed short crystals of hornblende and white feldspar (sometimes red). There is also a greenish mineral mixed with the feldspar not determined. The metamorphic rocks of this portion of the district have for the most part a thick covering of drift and bog over them, except to the N.N.E. of Knockaskeheen, where a ridge of rocks runs almost as far as the base of Croagh Patrick. The general strike of these rocks is a N.W. direction, and curving gently towards the west subsequently; they are apparently but slightly metamorphosed, and consist of soft gray argillaceous schists, underneath which is a band of quartzite about 250 feet thick, and beneath this a thin band of conglomerate, and then schists. Between the quartzite and schists there is a slight trace of schistose limestone, the only one observable in the entire district. These rocks are cut up by numerous small faults, which were very easily traced through means of the quartzites and schists. The quartzite is eventually cut out on the east by a large N. and S. fault, which has been traced into the district to the south. This band of quartzite seems to be far below that which forms the ridge of Croagh Patrick.

West of Corvockbrack, and in the low ground around Cregganbaun, are grits and slates and occasional thin bands of limestones, all of which contain fossils, and which Mr. Baily has recognised as Upper Llandovery. The most of these beds are slightly indurated from the numerous irruptive rocks in conjunction. To the west of these Upper Llandovery beds, and separated from them by a fault, are numerous flags, grits, slates, and shales, all more or less metamorphosed, at same time retaining their fossil evidence intact. This is plainly seen at the Derrygarve slate quarries, where the slates, though containing remains of *Graptolites*, are mineralized.*

R. G. S.

* The Derrygarve slates have been used for slating in Louisburgh, and are a hard, bluish grey, heavy slate, with a rather uneven surface. The cleavage is the same as the strike, which is N. 50 W., and the dip is towards the S. at 80°.—R. G. S.

Islands off the West Coast.

Inishshark, Inishgort, Inishkinnymore, and Inishkinnybeg.—The first is the principal island in this group. It is bleak and wild, rocky towards the west and north-west, while there is an envelope of drift on the eastern slopes. At the north-west shore are high and almost perpendicular cliffs.

As the drift contains numerous angular and semi-angular blocks and fragments of local rocks, it is probably of moraine origin.

In all these islands the mass of the rocks belong to the sedimentary *Schist series*, but associated with them are some metamorphosed igneous rocks, also igneous rocks of newer and latter periods. The first are principally micasites, often the chloritic or talcose varieties; but associated with the former are subordinate beds of hornblende, chlorite, and talc schists, and a few of gneiss. To the N.E. of Shark there is also an intrusive mass of methylosised igneous rock. The general dip of the rocks is to the N.N.E., but in the neighbourhood of Shark Head there is an inversion, the rocks being folded on themselves.

In the vicinity of the hamlet, on Inishshark, also to the west of the previously mentioned mass of igneous rocks, are beds of fibrous quartzose mica schist, in which are numerous elongated amygdaloid or prism-like pieces of quartz, so arranged as to give the rocks a coarse woody aspect. The continuity of the strata on the island is more or less broken by faults, but none of them were proved to be considerable; but along these breaks the sea has indented the coast line and formed numerous small inlets and bays.

The methylosised igneous mass to the N.N.E. of the island consists principally of steatite, and in it are bomb-shaped masses of hornblende rock and ophihornblende rock. These rocks will be hereafter more particularly mentioned when we are describing similar rocks on Inishbofin.

On Inishshark there are also newer igneous rocks, the most frequent being a dark or blackish brown rock with an olive green tinge and subresinous lustre—apparently, principally an aggregate of pyroxene and felspar (plagioclase), and identical with rocks that have been called melaphyre by Mr. David Forbes. These occur in wide dykes, weathering much more rapidly than the associated schists, and form deep narrow ravines that have the local name of Boher-na-collig (*Anglice*, the road of the old hag or witch). These rocks nearly invariably have a platy structure parallel to the walls of the dykes, combined with a jointed structure perpendicular to the walls—the latter being developed more in the centre than at the sides; in places cutting the rocks into slabs the twentieth part of an inch in thickness. In some dykes the lines of viscid fusion are conspicuous.

On Inishgort is a nearly E. and W. dyke of a light green scaly or flaky kind of whinstone, probably a gabbro; it is from four to six feet wide.

Inishbofin has a general E. and W. bearing; on an average it is four miles long and two wide, but the north and south coasts are indented with bays, and at Lough Bofin from sea to sea, is not half a mile.*

The island consists of five hills, namely: Westquarter, its greatest

* The inhabitants of this island when fishing rarely follow the schools of fish round the western head, but carry their boats across this isthmus from Bofin harbour to the north beach. A canal cut from Bofin harbour to Bofin lake, a distance of 400 yards, would greatly facilitate the fishing and save the men much labour.

height being 292 feet; it forms a promontory nearly separate from the rest of the island, being connected by the previously mentioned low isthmus in which Lough Bofin is situated; Middlequarter, highest peak, 288 feet; Cloonamore, the N.E. hill having a height of 157 feet; Knock, the hill east of the harbour, 271 feet; and Inishlyon, 143 feet, which is a tidal island and separated from the other hills during high water. Most of the island is rocky having a thin peat coating, except the valley of Bofin harbour where there is a considerable thickness of drift which gives the island a verdant aspect when viewed from the southward.

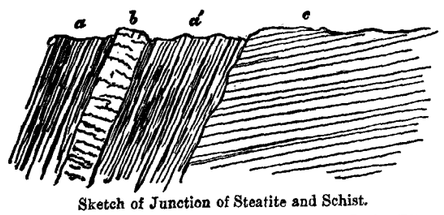
The rocks of Bofin, similar to those of Shark and the associated islands, principally belong to the *Schist series*, and have very similar igneous rocks associated with them. The schists consist of nearly identical groups, sub-groups, and varieties; here, however, was observed garnetiferous micasite on the east coast, N.E. of the Abbey. The fibrous quartzose micasite in Inishlyon is thus described: "It consists of a micaceous fissile matrix containing flattened almond-shaped pieces of quartz varying from the size of 'dust-shot' to two inches in length." In Port island to the S.E. of the harbour, this kind of rock is frequent and peculiar. This in its normal condition would seem to have been a fine conglomerate like those so frequent in the Cambro-silurian rocks south of Killaloe, co. Clare, if we suppose that the inliers of quartz have been elongated by the metamorphic action. From the west end of Inishlyon, and extending across Knock, near its south shore, is a chloritite that has a tendency to split into flags. All the schists on Bofin dip N.N.E. at angles varying from 30° to 89°; they are very much broken and displaced by faults, but on account of the similarity of all the rocks, the amount of the shifts are uncertain. Some of the principal breaks run nearly E. and W., others more or less transverse to these.

W.N.W. of Bofin harbour, and occupying a long narrow tract at the south coast of the island, are methylosised metamorphic intrusive rocks. The following description is from the field notes—"An irruptive mass with a bearing very similar to the general strike of the associated schist. The mass nevertheless is, at least in part, intrusive, as is proved by the section exposed in one of the cliffs, where these rocks in depth cut across the schist (fig. 5). Furthermore, farther east, on the north shore of the harbour, and apparently connected with this mass, is a dyke and two isolated patches. This intrusive mass, similar to that previously mentioned, on the N.N.E. coast of Shark, is principally a steatite, that in same places seems to graduate into a rock like hornblendite, while breaking up through it are pipes of fine and compact hornblende rock (fig. 5). It also has some peculiar bomb-shaped masses of similar rock (fig. 7), but most of these inliers are long and irregular. Some of these hornblende rocks on Bofin are ophitic, but none as much as a mass observed associated with the steatite of Shark. The steatite in general is very pure, but in places are small concretions of a spar which weathers ferruginous (Brown spar?). It is more or less fissile, the strike of the plates or leaves being similar to the foliation of the associated hornblendites. Associated with it are talc, chlorite, and hornblende schists.

"Between this mass of intrusive rocks, and one on the mainland to the N.W. of Doolough (page 47), there appear to be certain relations, although the latter is only slightly pseudomorphous. To the N.W. of Doolough the sedimentary rocks are only slightly altered, but breaking up through them is a mass of felstone that in general is tuffoid in aspect, and would be classed as tuff except for its intrusive character. This

mass is also fissile and steatitic, and apparently if it and the associated rocks had been subjected to a greater metamorphic action the mass would be a steatite similar to those of Bofin and Shark.

Fig. 5.



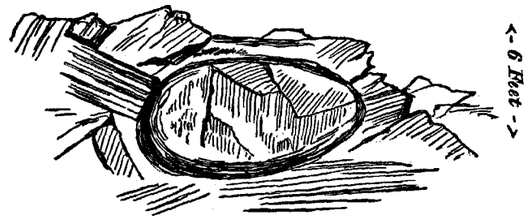
Sketch of Junction of Steatite and Schist.

a and *á* Platy Steatite. *b* Fine Hornblende rock. *c* Schist (Micaceous, Talcose, and Chloritic).

Fig. 6.

Protrusions of Hornblende rock through the Steatite, Inishbofin.

Fig. 7.



Bomb-shaped protrusion of Hornblende rock in Steatite, Inishbofin.

From certain relations in these different localities it would appear that the steatites of Bofin and Shark were originally intrusive rocks similar to those N.W. of Doolough (*Friable felstone*).*

The dykes of Plutonic rocks in Bofin are principally melaphyres, as defined by Mr. D. Forbes from specimens submitted to him. They are the same as those mentioned as occurring on Inishshark, and weathers, leaving similar wide trenches (*Bohernacollig*). Other dykes are older, and when the two kinds are associated together, the melaphyre cut the others. Specimen of the older rocks that were sent to Mr. Forbes were

* On the N. of Letterfrack, and in other places in the district to the south of that now being described, there are somewhat similar intrusions to those here mentioned, except that the methylosis rocks are principally ophites.

G. H. K.

called by him "diabase." These older rocks are of a green colour, scaly or flaky aspect, and seem to be principally an aggregate of diallage, felspar (plagioclase), and ripidolite. Some varieties are pyritous, micaceous, or magnetic.

North of the west end of the harbour is a small dyke, which seems to be a gabbro. South of the east end of the mass of steatite are three dykes and a pipe, the latter and one of the dykes being steatitic, while the other two dykes seem to be metaphyre. Between the detached portion of the mass of steatite and the sea-shore is an irregular, narrow dyke, apparently a dolerite-aphanite. On the west shore of the island, south of the Stags, are four nearly east and west dykes of gabbro; while, cutting them obliquely, are two dykes of melaphyre. The larger of the melaphyre dykes was also observed in the sea cliff half a mile to the N.E. A little N.W. of Lough Bofin are N. 70 W. dykes which apparently are portions of the gabbro dykes just now mentioned. Farther N.E., north-west and north-east of Bunnamullen Bay, are massive dykes of melaphyre; apparently portions of the same dykes, but separated from one another and shifted by faults. These have weathered considerably, and formed the deep marked fissures called "Boher-na-collig." To the S.W., in Inishlyon, are four dykes of a green felspathic rock.

Davillaun lies nearly a mile and a half east of Inishbofin; the rocks are principally micasite, some being talcose, chloritic or gneissoid. Towards the N. of the island, beds of schist and gneiss alternate, the schists being of a purplish colour and weather very ferruginous, due to the decomposition of the contained mica.

At the N. and N.E. of the island is a dyke which appears to be a gabbro, while to the S.E. is a compact dark greenish rock, an aphanite, probably a dolerite. Running obliquely N. 55 E. from the centre of the south shore is a perpendicular pyritous "killas" lode; that at the N. of the island underlies S.E. at 70; the back of this lode is very pyritous. To the S.W. of the island are two minute dykes striking with the bedding; they are probably gabbro-aphanite; while somewhat similar dykes were also observed at the S.W.

On this island there is scarcely any drift; but on the west end are two groups of granite blocks, one consisting of four and the other of six large blocks, two of the latter being split. The rocks on the island are much cut up and displaced by faults. In one place remarkable foliation perpendicular to the plane of stratification was observed in hornblendite, while the foliation in the associated rocks follows the planes of lamination.

Inishdalla is situated about a mile and a half S.E. of Inishturk, its highest point being 87 feet. The rocks seem to belong to the *Doolough series*, being purplish and greenish grits, slates, and shales, all slightly mineralized or micasized. They dip southward at the west of the island at low angles (5 to 20), but to the east, in the vicinity of the boat harbour, they are rolling at low angles. North of the boat harbour is a dyke of whinstone that seems to be slightly altered, while near the north shore is a massive greenish rock, that in places resembles felstone, and in others a grit, somewhat similar to the dykes in the neighbourhood of Doolough, and hereafter described.

Inishturk lies about five miles N.E. of Bofin, and eight from the mainland. The aspect of the island is rocky, but in the chinks and interstices of the rocks grows an herbage famed for fattening cattle. The surface is undulating; but, at the same time, there are four marked peaks—the N.W. or signal tower hill, 629 feet; the N.E., 428 feet; the S.E., 588 feet; and the S.W., 240 feet. The east and south-east coast is low, while on the west and north-west there are considerable cliffs, some of which are

nearly perpendicular and vary from 200 to 400 feet in height. The island in outline is somewhat like Ireland, but the longest axis bears nearly east and west, instead of north-east and south-west. The rocks seem to belong to the *Doolough series*, and consist principally of greenish and purplish slates, shales, and grits, that in general are slightly metamorphosed, some indeed being micaceous and chloritic, but more usually they are varieties of argillite, their cleavage or lamination planes being mineralized or micasized. Interstratified with the argillite are subordinate beds of grit, some of which are slightly mineralized.

The rocks have general east and west strikes, but it is evident that they lie in sharp, nearly E. and W. folds; besides they are greatly disturbed, broken, and displaced by faults and breaks, some of which shift the beds considerably.

To the S.W. of the island and S.W. of the fault that runs N.W. from Portdoon, there are many grits, some very massive; these are associated with greenish shales, also talcose, steatitic, chloritic, and micaceous argillites. Immediately N. of Dromore Head is a dyke of hornblende rock which appears to die out a short way inland, while south of the Head is a nearly E. and W. dark blue felstone, having in places drusy cavities lined with quartz. On the N. of the Portdoon fault, west and north-west of Tower hill the rocks are principally green shales and slates, that are often much twisted, contorted, and traversed by irregular quartz veins and strings; some of these rocks are steatitic or talcose. To the southward of Tower hill in the vicinity of the Portdoon fault is an E. and W. grey felstone dyke which could not be traced westward, and apparently is cut off by the fault; however, the previously mentioned felstone south of Dromore Head may be its western continuation; but at the extreme north of the island is an E. and W. felstone exactly similar to that just mentioned, and probably a portion of it shifted up here by the numerous faults that occur in the intervening space. To the south of the harbour some of the beds are very steatitic, and at the S.E. of the island the cleavage strikes N. 80, E. with a southerly dip of 30°.

In the rocks of this island quartz veins and strings are numerous, but in general do not seem to give much promise of being productive in economical mineral ores, but a little south of the harbour is an E. and W. lode very gausseny in places.

On this island these is scarcely any drift or bog, while the rocks are very much weathered, which has obliterated most of the ice striæ that may have been on them.

Caher and Ballybeg are situated about a mile and a half, and two miles, on the N.E. of Inishturk; and, although rocky, are famed as sheep pastures. The rocks belong to the *Doolough series*, and consist of red, purplish, greenish, and greyish, grits, slates, and shales, all the slates and shales being slightly altered similar to the rocks on Inishturk, and may be classed as micaceous, chloritic, talcose or steatitic slates. The cleavage of the slates strikes N. 25 W. and has a high dip to the N.E.

The strata is irregular, folded in sharp curves, or crumpled, bent and contorted, while they are much broken up and displaced by faults.

Near the coast of Caher, S. W. of the trig. point (201 ft.), is a nearly E. and W. reddish-grey granular felstone, weathering white. On the opposite coast a similar felstone was observed, probably portion of the same dyke, but the connexion between the two is broken by a fault. At Porttariff is the debris of hornblende rock, probably near a dyke.

Frehill and Govern Islands.—These rocky islets lie from one to two miles from the mainland, and are composed of very felspathic, massive, purplish and greenish grits and sandstones, often pebbly, and much cut up by quartz strings. They belong to the *Mweelrea series*.

Inishdegil More and Beg.—The rocks in these islands belong to the *Mweelrea series.* They consist of massive, coarse, purplish grits and pebbly sandstone, with which are interstratified subordinate beds of greyish grits. Near the N.E. point of the large island is a mass of purplish felstone, having at its west wall a narrow steatitic dyke; they seem to lie in a line of fault. These rocks cannot be traced across the island, but on the south shore the same rocks occur similarly circumstanced, and immediately west of these is a large mass of fault-rock. A very massive bed of purple basic felstone crosses the island; it is frequently shifted by faults, but none of them have large throws. At the S.E. point of Inishdegilbeg there is a bluish-green felstone. All the igneous rocks in these islands fuse readily before the blow-pipe.

Country immediately north of the mouth of Killary Harbour (sheet 83).—In this tract there are rocks belonging to the two different formations, the lower being part of the Doolough beds, and the upper or southern part of the Mweelrea series, the latter lying unconformably on the former. Towards the west the boundary lies immediately south of Allaran Point and extends in a very irregular east and west line to the east margin of the sheet (sheet 83), being displaced in at least six places by faults, all of which shift the boundary towards the south. None, however, are considerable, except the most eastern (close to the margin line of the maps), which throws the boundary on the surface towards the south about half a mile; as, however, the Upper Silurian rocks lie at low angles, and are also in nearly horizontal rolls, "the throw" is not a large one.

Rocks belonging to the Doolough series.—These rocks are for the most part greenish or purplish slates, all dipping S.S.W. at angles varying from 20° to 85°. To the north, about Tallavbaun Island, there is a N. 85 E. vertical cleavage, while further S.E. near the Lower Silurian rocks it is N. 60 W. and nearly vertical. These rocks are all slightly altered, having the conspicuous surfaces glazed or micasized, in some there is a stellated or irregular lined structure, while in others, minerals have been developed.

Rocks of the Mweelrea series—The lowest bed in this group towards the west is a greenish or purplish splintery rock, in places like one of the interstratified felstones, in others like a grit; it weathers with the white crust characteristic of a felstone. Over this are conglomeritic or pebbly massive sandstones, and in one place is a massive conglomerate containing blocks and fragments of felstone, granite, vein-quartz, quartzite, schists, and a remarkable rich blood-coloured jasper. The uppermost beds exposed on the south shore are green slates with an interlying massive conglomerate. A little below the boundary on the west shore is a rotten dyke (diabase?); close to this is a triangular mass of sandstone bounded on all sides by joints, and which appears to be altered into quartzite: Mr. Kinahan suggests that it was altered by an eruption of steam from beneath; the rock breaks into angular fragments. Further south in a little bay are three narrow dykes, the N. and S. seem to be gabbro, while the others are light green mottled rocks with quartz blebs. South of Tonakeera Point is a wide dyke of a greenish black rough rock with a semi-resinous lustre (melaphyre?) and close to it, between the sandstones and the green slates is a dyke-like mass of quartzite; the latter is very remarkable, as it does not look like a quartz vein. A quarter of a mile E.N.E. of the quartzite, and further east, south of Lackakeely lough are exposures of a purple compact semi-glassy felstone.

Country north of the mouth of Killary Harbour (*continued*) sheet 84.—This part, similarly to that just described, consists of rocks belonging to the "Doolough" and "Mweelrea series." The boundary, beginning

on the shore at the strand called Traleckachoolia, extends E.N.E. in an irregular line till it joins into the boundary hereafter described.

The Doolough beds are principally green, slightly altered, slates and shales, with some subordinate grits; west of the fault, bearing N.E. from Traleckachoolia, they strike N.W. and S.E. with a S.W. dip from 30° to nearly vertical, while east of the fault they are nearly vertical and strike east and west, except in one locality, immediately east of a dyke of melaphyre, where they strike N.E. and S.W. The melaphyre dyke can be traced, although shifted by slight faults, for over a mile from the sea-shore in a north-eastern direction to the slope of the hill, where all traces disappear as the hill is enveloped in a bank of gravelly drift.

The Upper Silurian rocks consist for the most part of massive coarse grits, sometimes graduating through pebbly beds into conglomerate, and sometimes contain beds of felstone.

H. L.

Mweelrea Mountains.

Country about Doogan Hill [Inch map, sheets 83 and 84].—The country now to be explained borders the Atlantic Ocean and lies on the north of the tract last described. In it the rocks seem all to belong to the *Doolough series;* but here they are more or less metamorphosed and have been generally described by Mr. Wilkinson as "indurated and slightly altered grits, slates, and shales, varying in colour from different shades of grey to different shades of blue and green." In general they are much obscured by drift and bog, but when exposed, as in the coast sections, they are found to be much displaced by faults, usually of small size; some, however, shift the rocks considerably. Two of these with fissures cross the ridge of high ground that extends north-westward from Doogan Hill, while farther to the north are others, one bearing nearly E. and W. and another about N. 80 W. Between the last two faults, the strike of the beds runs about N. 60 W., while south of the E. and W. fault, the normal strike is nearly E. and W.

North of the E. and W. fault last mentioned is a bed of green tuff. About three quarters of a mile N.W. of Doogan Hill are two igneous dykes, one a nearly E. and W. "splintery felstones, in some places looking rather shaly," the other a very granular felstone that bears about N.E. and S.W. A mile and a half S.W. of Doogan Hill, and a little north of the stream, Owennadornaun, is a "massive intrusive rib, in places like an indurated grit or slate, in others like a splintery felstone." These remarkable rocks, thus described by Mr. Wilkinson, are not uncommon as dykes among the rocks of the *Doolough series*, and probably are true intrusive rocks, as will appear from the notes hereafter given when describing similar rocks near Doolough.

Country about Doolough.—The boundary between the Doolough and Mweelrea beds is very irregular. Once it seemed to form a gentle curve, but this has been broken and shifted backwards and forwards by numerous faults. To the N.W. of the summit of Mweelrea is a large nearly E. and W. fault, that was traced from the sea into the drift country S.E. of Lough Bellawaum. This fault shifts the boundary between the Mweelrea and Doolough beds for nearly two miles. From the sea-coast in the country described by Mr. Leonard to a little N.W. of the summit of Mweelrea N.W. and N. of Lough Bellawaum, for a distance of about two miles, the boundary is curved, but in it six or seven faults were proved by Mr. Warren. Extending in a slight curve from Bellawaum Lake to Glencullin, is a wedge-shaped strip of ground contained in a trough

fault, and in the cliff N.E. of this Lake the fault is very conspicuous. Between the margins of this fault the boundary is slightly shifted towards the S.W., but south of it the boundary is displaced considerably, the Mweelrea beds extending for half a mile to the eastward, where they lie against a N.W. and S.E. dyke of felstone that has come up alongside a massive dyke of fault rock. This N.W. and S.E. dyke of fault rock (*Glencullin fault*) with its accompanying felstone, margins the Mweelrea beds for more than a mile to the S.E. before we again meet with the original boundary between the two groups of rocks. The Glencullin fault seems to be a disconnected portion of one of the faults in the Maum Valley, in the country to the south-east; it, however, seems to be much older than the newest line of fault traversing the Maum Valley. To the south-east, at Finlough, the Glencullin fault joins into the line of one of the newer faults; but here, as also in the Maum Valley, it was the older fault that so much displaced and shifted the rocks on each side of the valleys. East of the Glencullin fault the boundary extends nearly E. and W. to the Doolough Valley being once slightly shifted by the branch of the fault just mentioned. Extending south-eastward from the S.E. end of Doolough to Killary Bay is another line of fault which is supposed to be the main line of the recent fault of the Maum Valley; to the east of it, the boundary is shifted about a quarter of a mile towards the southward, but west of it, between it and the river, the geology is very complicated, patches of rocks belonging to the different groups coming up irregularly. This complication evidently is due to older faults along which the Bundorragha river valley has been excavated, but they cannot be traced out on account of the drift and bog in the river valley. East of the Bundorragha river, the boundary between Doolough and Mweelrea beds has a general bearing of E. and W., but it is very much shifted backwards and forwards by faults. Over a mile west of Townyard Lake, and extending for about a mile, is a narrow strip of the Doolough rocks in the Mweelrea beds, they being brought up by a nearly E. and W. fault. This strip of ground to the eastward is cut off by a nearly N. and S. fault, east of which the boundary is more regular.

The rocks belonging to the *Doolough series*, on the north of Mweelrea and west of the northern portion of the Doolough valley fault, are in a great measure obscured by drift and bog, but those which are exposed run rather regularly nearly E. and W. except in the vicinity of the numerous faults that cross them. The faults although in general forming features do not seem to cause great displacements compared with places in the country to the south, as the rocks that can be recognised on the different sides of the faults do not appear to be much shifted. On account, however, of the head of drift and bog, none of them could be worked out satisfactorily.*

In the vicinity of Derrygarvebeg Lough, which lies three miles to the N.W. of Doolough, the faults are numerous, and conspicuous on account of the displacement of beds of felsite. Six furlongs E.S.E. of Derrygarvebeg Lake, and east of the small flat bog, is a pale granular felstone that appears to be an interbedded rock, and partially altered similarly to the associated sedimentary rocks. Immediately south of this felstone there is an exposure of a small portion of an oblique dyke of green slightly quartzose felstone, while farther south, between two faults, is a small portion of a nearly N. and S. felstone dyke. Still farther south, north of Lough Cunnel, is a large dyke of white felstone, which in

* The small amount of horizontal displacement along these faults is generally due to the high angle of dip of the beds.—E. H.

places contains caught up pieces of the associated rocks. This dyke Mr. Wilkinson has proved to be shifted by at least three faults, while the rocks adjoining it are changed into hornstone, probably by steam that came up in the joint lines adjacent to the dyke. To the N.E. of this dyke, at the margin of the large flat bog, the same observer records a "whitish splintery felstone associated with hornstone;" this to the west is cut off by a fault.

E. and S.E of Lough Cunnel are two massive dykes of rocks similar to those previously mentioned to the S.W. of Doogan hill, being in places grit-like, in others like a felstone. Of these Mr. Wilkinson states—"In places like a felstone, in others like fault-rock." These are felstones of a shattery nature containing inlying pieces and fragments of the associated rocks; and to the S.E. of the last there is a bifurcating dyke of "bluish green, rather granular felstone," which, probably, is a portion of the dyke to the N.W., but shifted considerably towards the S.E. by a N.W. and S.E. fault. More than half a mile east of Lough Cunnel and N.W. of Glencullin Lake is a N. 20 W. "mottled felstone" dyke, while to the east of it, but on the other side of a fault, is a portion of a massive dyke of melaphyre that both on the north and south is cut off by faults. Near this no other portion of this dyke could be found, but half a mile due south, between two faults, Mr. Wilkinson discovered a portion of a dyke of melaphyre.

To the N.E. of the line of fault of the Doolough valley and east of Derrygarvebeg Lough, the geology is very complicated on account of the numerous faults and the bogs that exist. The rocks consist of slates, conglomerates, felsites, quartzites, gabbro, and felstone, together. The rocks supposed to be gabbro are evidently intrusive and in part metamorphosed; they, however, run with the strike of the associated sedimentary rocks. The felstones occur as intrusive masses and dykes and are remarkable for being in part tuffoid rocks and more or less steatitic. The conglomerate appears to be of a newer age (Upper Silurian) than that of the associated schists (Lower Silurian), and to be the basal bed of the group of rocks which, immediately to the north, in the country examined by Mr. Symes, contain numerous fossils of an Upper Silurian type (Upper Llandovery). This conglomerate is very much displaced by faults; to the *north-east* of the Carrowisky, N.W. of the old National school, it is associated with beds of limestone, while in the Doolough beds under it Mr. M'Henry has discovered fossils, in two or three places, that seem to be of a Lower Silurian type. All these rocks *N.E.* of the Carrowisky are very much displaced by dykes of elvanite, gabbro, and felstone. In the bed of the Carrowisky, a little to the S.W., at the north extremity of the townland of Srahroosky, various rocks are exposed.

The felstones, but especially those in mass a little west of the Carrowisky, are very tuffoid in aspect; they are evidently older than the period when the associated rocks were metamorphosed and are more or less altered. In many amplibole is developed, in some mica, and in a few places quartz, while all are more or less foliated. Associated with these felstones, but evidently interstratified with the associated schists and slates, are felsitites (felsite schists). The latter are more or less steatitic and may change into steatite, talcite, or garnetite; usually they graduate into the associated slates and mica schists, but in some places the change is abrupt and marked, as in the townland of Clegganawodda, where the one kind dovetails into the other. When the felsitite is in juxtaposition with the intrusive masses of tuffoid felstone it is often hard to separate them. From the relative position of these two distinct

rocks, it would seem to be suggested that the masses of felstone were intruded as bosses during the deposition of the rocks of the Doolough series, that these bosses were in part denuded, while the debris from them was deposited in their immediate vicinity forming the felsite schist.

Nearly half a mile south of the old National school, on the west of the Carrowisky, Mr. Wilkinson has mapped bed-like masses and dykes of similar felstones, also an irregular mass to the S.E., south of the alluvial flat, on the west of Glenkeen. To the west of the last mentioned mass of felstone, on both sides of the narrow flat margining a small N. and S. tributary of the Carrowisky, there are beds of felsitite and talcite interstratified with some micalites and argillites. These are considerably shifted to the S.E. by a fault that runs down the narrow flat.

In the Carrowisky coming up through the sedimentary rocks, Mr. Wilkinson records four or five large granite veins, probably offshoots from the mass of granite in the hills on the north [Corvockbrack and Knockaskeheen], an elvanite two felstones and a melaphyre dykes. One of these felstones is granitoid.

In the head waters of the Bunowen, there are numerous portion of dykes of different kinds of intrusive rocks, as felstones some graduating into elvanite, hornblende rock and a melaphyre. One of the felstones is highly siliceous (*Petrosilex*) while two are granitoid and appear to belong to the submetamorphic rocks. Of the felstones graduating into elvanite Mr. Wilkinson writes when describing those a little S.W. of the junction of the Owennasalliagh with the Bunowen—"Fine greyish elvanite or granitoid felstone, two of the dykes are nearly horizontal [10° to E.N.E.], they contain crystals of greyish or yellowish felspar, minute crystals and blebs of quartz, crystal of pyrite or marcasite and a black mineral that in places looks like hornblende, in others like mica," while of a dyke immediately to the S.W. he notes:—"Bluish grey crystalline rock containing crystals of greenish waxy felspar (plagioclase?) crystals of quartz, and of hornblende. It seems to be allied to the rocks last described, but in it there is no mistake as to the black mineral being hornblende. In places at the south wall the rock is steatitic."

To the W.S.W. of Lough Alisheen, as also N. of Glencullen Lough; on the N. shore of Doolough, and the south slopes of the hills east of Doolough and north of Glenummeragh are also dykes similar to those previously mentioned as being in places like grits, in others like fault rock.

North, east, and south of Doolough the rocks belong to the group that has been called after it. They are very little altered and in places consist of massive slates in which arenaceous rocks are subordinates, the general strike of the cleavage being about N.70.W. with a dip to the N.N.E. of from 35 to 80. In places, however, they consist of thin-bedded grits, alternating with slates and shales. Of the dip of the rocks on the south slopes of the hills east of Doolough, and north of Glenummera, Mr. Wilkinson, writes—"The rocks at the margins of the ravines dip at very low angles while at the bottom, the same beds generally are nearly vertical or dipping at a high angle, so that no dips on the mountain slopes can be relied on, except those seen in ravines and such like sections." This curvature of the beds seems to be accounted for by the pressure of a great mass of drift lying on the rocks above. In these rocks in different places near Doolough the Fossil collectors found fossils, which Mr. Baily considers to be of Lower Silurian types.

In the hills of Askaunacoppul and Laghtaoughter, N.W. and N. of

Tawnyard Lake, the rocks belonging to the Doolough series are in a slight degree more altered than those in the immediate vicinity of Doolough, and among them the late Mr. Warren has dectected some peculiar calcareous rocks, especially on Laghtaoughter and S.E. of Lugacolliwee Lake. In the cliff immediately south-west of Lugaloughaun, having three short arms extending from it, is a very irregular mass of "pale gray steatite mixed with serpentine, and to the south a black pyritous rock very unctuous to the touch," while north of the fault that extends S.W. from this lake is a small kidney-shaped boss of similar rock. Half a mile S.W. of Lugaloughaun, on the east and west of a fault, are small irregular bosses, the first being described as an "ophiolitic pale grey rock," and the other "a yellowish grey dolomite mixed with steel-grey unctuous schist." On the east and south-east of Lugacolliwee, are respectively, three and one similar bosses or pipes of siliceous dolomite. All these bosses of rock have an appearance as if they were deposited from the water of springs, that had come up irregularly and filled vacancies in the associated rocks. West of Lugaloughaun, are two pipes and two dykes of felstone, one of the latter holding hornblende; and of the sedimentary rocks in the vicinity of that lake, Mr. Warren writes—"There is a structure developed in these rocks which is either cleavage or foliation that strikes from N. 80 E. to N. 10 E., and dips from N. to N.E. ward, that at a short distance from it may be mistaken for the stratification." A mile to the N.N.E. of Lugacolliwee is a dyke of greyish splintery pyritous felstone, while a little to the S.E. of this felstone is a massive dyke that is trice shifted by faults, this appears to be an ancient sub-metamorphosed dyke of fault rock. In the hills east and south-east of Lugacolliwee, in the vicinity of the bosses of calcareous rocks are many veins, pipes and dykes of greenish felstone, that are more or less connected one with the other, one of the pipes having three small dykes branching from it. To the S.S.W. of Luggacolliwee, on the N.W. of Sheeffry, there is a dyke of green petrosilex or quartzoid felstone, while more than a mile W.S.W. of Sheeffry, there is a large mass of melaphyre. The exposure of melaphyre is of a roundish shape and remarkable for having a wall of hard compact rock, forming its west, south and east limits, while in the centre and to the northward there is a friable tuffoid rock, that weathers rapidly and consequently has been denuded away, leaving in the centre a hollow like the crater of a volcano, and to the north an undefined margin. This evidently was a centre of irruption for the melaphyre rocks, but scarcely can have been a volcanic neck, as no tuff or other mechanically formed accompaniment of a volcano is associated therewith.

On the hills a little north of Tawnyard Lake, are two dykes of pale green felstone, one of which was traced for a considerable distance and the other only a short way. Both are cut and displaced in places by faults, and extend eastward into the country hereafter described by Mr. Nolan. These dykes are very similar to those previously mentioned on the hill slopes east of Doolough and north of Glenummera, and probably are part of their eastern extremities.

The rocks of the Mweelrea series.—The rocks belonging to this group occupy the whole of the country between Killary harbour and the boundary previously traced from Mweelrea to Tawnyard lough, excepting two small patches of rocks belonging to the Doolough series that lie east and west of Bundorragha, and are brought up by one of the faults that occurs in the depression now forming the harbour. In the Erriff river valley to the N.E. of the hamlet called Aasleagh there is another small exposure of Doolough rock brought up by the Post-Carboniferous fault of that valley.

The rocks of the Mweelrea series contain fossils which seem to be of Upper Silurian types, and lie in a great synclinal fold, the main trough in the western portion (that is west of the Glencullen and Maum valley fault), running nearly E. and W. a little south of the summit of Mweelrea, while in the eastern portion, east of that fault, the trough of the synclinal fault has been shifted south and cut out by the longitudinal fault of the upper or north-eastern part of the Killary harbour. The upper beds of the Mweelrea series have thick shales associated with them that are found to be fossiliferous, while on few other geological horizons in these rocks have they been found, the lowest beds have from two to four thick beds of felstone, sometimes accompanied by tuffs, interstratified with them.

To the north, in the hills west of Lugmore, two beds of felstone were observed, one forming the basal rock, while further eastward, in the trough of the double fault that extends from Bellawaun to Lugmore, neither was found; but there is, however, a dyke of similar rock that is slightly shifted toward the east by the south fault, and at the junction of the Mweelrea and Doolough rocks a dyke of fault rock (*Glencullin fault*), bounded on the N.E. by a dyke of mottled green steatite. This dyke of fault rock is shifted by the south fault about 1,900 feet to the eastward; and in the cliffs east of Lugmore it is again met with, and can be traced for over two miles to the south-eastward, to Lough Fin, but in its course it is shifted by different newer faults. Alongside this fault rock, for nearly a mile from its northern end, is a dyke, described by the late Mr. Warren as compact purple felstone, with blebs of quartz.

Fossiliferous green shales have been observed N.W. and N.E. (Bellawaun) of the summit of Mweelrea, and in the cliffs south of Lugmore. To the S.S.E. of the last locality, and immediately S.E. of Benlugmore, the late Mr. Warren found portions of two dykes of melaphyre, the nearest to the hill running along a line of fault.

On the south of the trough of Mweelrea rocks, in the neighbourhood of Bundorragha, there are four beds of the felstone, and here the lowest has about 100 feet in thickness of the Mweelrea rocks under it. This bed (No. 1), also the highest (No. 4), usually have tuff beds over them. These four beds extend westward from the Glencullen and Maum Valley fault for at least four miles, when they disappear beneath the waters of Killary Harbour. Farther west, in the country that has been described by Mr. Leonard, some of them again appear. In the four miles just mentioned the continuity of the felstones is continually broken by small faults.

To the east, where the felstones are cut off by the Glencullin fault, they seem to be shifted for three miles south-eastward to Munterowen, in the district to the south, where similar beds occur that can be traced to a focus of irruption on the hill of Rinavore. This shift is somewhat greater than that to the N.W. at the other margin of the trough, as near Doolough the displacement in the aggregate is two miles and a quarter.

Besides the bedded felstones, other igneous rocks that were observed hereabouts are two dykes of melaphyre, one running S.W. and N.E., and the other N.W. and S.E., about a mile S.W. of Bundorragha Hill, at the shore of Killary Harbour, the last occupying a line of fault. To the north of these melaphyres is a N. and S. dyke of similar rock that is cut and displaced by an E. and W. fault. Due south of the summit of Bundorragha is a N.W. and S.E. fault, containing a dyke of felstone, while a mile and three quarters to the E.N.E., on the east of the river, is a small portion of a N. and S. felstone dyke.

Fossils, said to be of Upper Silurian types, were found in green shales in the glen one and a half mile S.E. of the summit of Mweelrea.

To the east of the Glencullin and Maum Valley fault, as previously mentioned, a considerable part of the rocks forming the synclinal trough is cut out by the fault that extends up the N.E. portion of Killary Harbour into the Erriff Valley. All the rocks to the north of this fault dip southward, while immediately south of it many of them are repeated. To the N.W., adjoining the Glencullin and Maum Valley fault, on the hill south of Doolough, the late Mr. Warren recorded three beds of the Eurite, the lowest being over fifty feet above the base of the Mweelrea rocks. In the low ground S.E. of Doolough, a tongue and small triangular patch of the Doolough beds are brought up by a complication of faults, which renders their structure obscure. It seems remarkable, however, that in the Mweelrea beds over them the felstones could not be found. On the shoulder of the hill, immediately S.E. of Doolough, and east of the Doolough fault, the geology is very complicated on account of the numerous faults that cross one another. Five or six exposures of felstones were observed, some being undoubtedly portions of beds, and all probably so. These have been displaced and tilted by the different faults. Adjoining the nearly E. and W. fault is brecciated steatite.—G. H. K.

Erriff Valley and Formnamore Mountain District.

Country about Drummin and Srahlea, Erriff and Glenawough.—This area includes a large part of the Erriff River valley and the high tableland on the south-east of Drummin Chapel; the road runs close to the base of a rocky hill composed of schistose rocks, all more or less traversed by cleavage, which is often the most distinct structure, and may be easily mistaken for stratification. North of the "Scalp" are "grits, shales, and schists, more or less micacised; some are steatitic, while in places a peculiar bright green schistose rock occurs, that weathers with a coppery appearance."

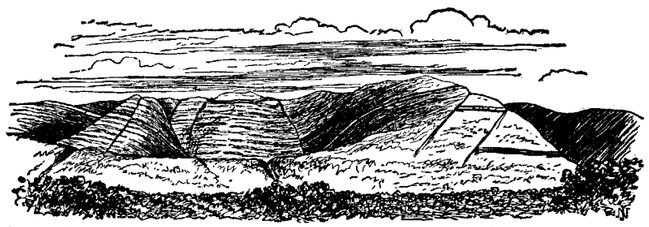
Farther southward, between the River Owenmore, its branch in Glenlaur, and the Erriff Valley, is a rather elevated tract forming on its northern side a low N.E. and S.W. ridge, while the southern portion is a boggy flat with numerous bosses of rock. The beds here are very similar to those near Drummin, being for the most part cleaved clay slates, glazed or micacised, although sometimes very slightly, on the planes of cleavage. Some also were noted to be slightly steatitic. Here coarse slates have been procured, a small quarry having been opened at Srahlea. North-east of Tawnyard Lough, near the north-west source of the Tullawee Stream, the schists become "conglomeritic, the pebbles being elongated in the direction of the strike," and north of this stream is a small exposure of hard greyish quartzitic felstone, with a saccharoid appearance. It is four feet wide, and can be traced only for a few yards. To the south-west near the source of the Tullawee Stream is the eastern continuation of the pale green felstone mentioned in the description of Mr. Warren's work (*page* 49); in this place it is twice shifted southwards by faults.

The boundary of the Upper Silurian rocks strikes the Erriff Valley where the Owenduff enters the flats, nearly a mile south-west of Erriff Bridge; but no good section is to be seen along this valley.

The older rocks (metamorphic series) are hard green, often pebbly grits, highly indurated, and might perhaps be called quartzite. Usually the lowest rock observed in the Upper Silurian series is a bedded felstone, however below it, near where the Owenduff enters the Erriff, there is an exposure of green conglomeritic grit, which seems to belong to the Upper Silurian series.

The three bedded felstones are shifted immediately south of Derrintin Lough by a fault which seems to run in a S.E. direction. In the valley this fault seems to be shifted by the "Erriff Valley fault." Eastward of the former the bedded felstones are very wide asunder, which is due to the low dip of the rocks, the angle seldom exceeding 15°. From the nearly N. and S. fault to Lough Glenawough the bedded felstones are very conspicuous on the escarpment which forms part of the northern boundary of the Formnamore tableland. They are seen to be shifted by numerous faults as represented in sketch (fig. 8).

Fig. No. 8.



Sketch of part of the N.W. escarped boundary of the Formnamore tableland, showing the bedded felstones shifted by faults.

Two of these faults on the shoulder of the hill north-east of Lugagowlan run parallel, having a northerly direction for about six hundred yards on the steep part of the hill, but change to about N. 50 W. for the remainder of their course, due to the intersection of the planes of the faults with the face of the hill.

The three beds of felstone are found as far east as the stream, valley, and fault a mile west of Glenawough; but between those two places one of the upper beds was not observed; however, east of the Glenawough Lake they all occur, and were found in places as far N.E. as the great fault at the barony boundary, about a mile and a half N.E of Loughanshee. These felstones are mostly of a purple color varying to bluish or greyish, and contain globules and crystals of quartz. Before the blowpipe they fuse slightly on the edges. In some places the beds are much more homogenous than in others, and weather with a remarkably smooth conspicuous white crust.

It should here be mentioned that the boundary between the Upper Silurian and the metamorphic rocks west of Glenawough, and between Glenawough and Loughanshee is very complicated, and on it the following note was made by Mr. Kinahan:—"South of Erriff Bridge, between the nearly parallel faults, the felstone is close to the base of the Upper Silurian rocks, there being only a thin conglomerate under it; east of these faults under this felstone bed are grits and sandstones, dipping southward at 70°, while the felstone seems to dip in nearly the same direction at 55°. These rocks can be found under this felstone as far N.E. as Loughanshee; but north-east of that lough the felstone evidently lies unconformably on the rocks with which it is associated, and yet they are very similar, if not identical with the rocks just now mentioned south-east of Erriff Bridge that apparently are conformable with it. On this account also, as the felstone is at, or close to, the base of the Upper Silurian series, to the N.E. and S.W., we are forced to believe that these rocks under the felstone in the country west and north-east of Glenawough, may be part of the older rocks; but if they are it is remarkable

that their strike, and that of the felstone should be so similar for such a long distance."

In the hills of Lough Glenawough particularly in the precipitous cliffs that margin the lake, the bedded felstones are also well shown. Here also the rocks are traversed by several faults.

East of one of the largest of these faults about half a mile N.N.E. of the trig. point 1290, the lowest bed of felstone is found apparently lying on the metamorphic rocks. Farther N.E. (in sheet 85), S.W. of Bohaun, this lowest felstone was also noted, but it seems to die out before that summit is reached.

The rocks interstratified with these felstones all along the S.S.E. escarpment of the Erriff valley, are similar to those south of Lough Derrintin, viz., pebbly grits and sandstones of a purple or green colour, sometimes very coarse and containing good sized pebbles and blocks, chiefly of red granite, felstone, mica-schist and jasper. Their stratification is exceedingly well marked, being distinctly seen at the distance of several miles.

The country lying between the Upper Silurian rocks and the Erriff river is for the most part occupied by metamorphic rocks, somewhat similar to those on the north-west of that river; part of a basin or trough of rocks of Carboniferous age, however, occupies a small area N.E. of the hamlet of Derrinkee. In the stream called the Cross river which flows from Lough Glenawough to Derrinkee, many sections of these rocks occur, being chiefly green sandstones, grits and shales very little altered. On the hill north of Lough Glenawough, 875 feet, there are also numerous exposures of rock, consisting of hard green grits and shales, the cleavage traversing the shales but not the grits. As we trace these beds on to the hill west of the Lough Glenawough bog a little north of where the trig. point 1277 is marked on the map, we find interstratified some finely cleaved conglomeritic beds. The matrix of these conglomeritic beds is a schistoid slate, containing pebbles chiefly of quartz.

In one of the streams descending from the coom to the Erriff there is a small dyke, of a bluish quartziferous felstone, about 300 yards from the Silurian boundary, the intermediate rocks being chiefly green argillous schist, in which are two "gausseny" courses. South-west of where the old road crosses this stream a working for slate was opened, but as the slates are of a very coarse texture, it was abandoned. In the neighbourhood of this quarry another felstone dyke occurs. West and north of this dyke the metamorphic rocks seem to be much twisted, and there are some peculiar quartzose grits with small pebbles. A peculiar dyke-like mass, bearing N.W., was also observed. It might be a brecciated felstone, or more probably it is fault rock.

The Formnamore Tableland.—The cliffs south-east of the Erriff Valley, the rocks of which have just been described, form the northern escarpment of the great Formnamore tableland. The latter is indented by various valleys, the two most remarkable being Glennacally on the west, and that of the Owenbrin on the east. The former opens into the Erriff Valley at Glennacally Bridge, and has branches to the east and south-east, that to the east being called Glenfree, and that to the south-east Glennagleragh. About half a mile west of Glennacally Bridge, nearly 200 yards south of the road, there is a small bed of felstone that could only be traced for a short distance. Faults have been proved in Glennacally and its two branches.

On the tableland, about half a mile N.E. of the upper end of this valley, are two patches of the Carboniferous conglomerate. These, with a large horizontal tract farther south, forming the summit level of Benwee, prove the great extension of that formation, which must origin-

ally have spread all over this district. Moreover, they seem to suggest that this tableland may have been originally the bottom of the Carboniferous sea.

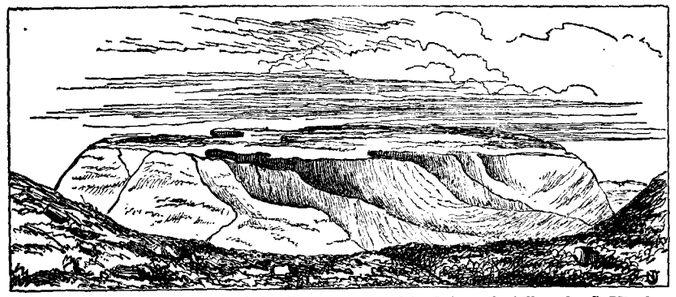
Fig. 9.

Section of Carboniferous Conglomerate outlyers, a little S.W. of Gowlan.

At Benwee, to the north of the tract, we find yellowish conglomerates, with subordinate beds of flags, resting on red pebbly sandstones, all lying nearly horizontal, but with a slight dip to the N.W. To the south the beds under the conglomerate are much thicker.

The south part of the Formnamore tableland is made up of silurian rocks. It presents singularly bold and striking features. (See fig. 10). The general appearance is that of a high, flat-topped mountain, indented by deep precipitous valleys, the most marked of these lying south of Leynabricka, and west of Dooletter. On the shoulder north of the latter hill a synclinal curve, which traverses the district, is well seen. The trough of this curve, as will be evident from the arrows on the map, extends nearly E. and W. (N. 80 W.), from Bengorriff, the summit, which lies a mile and a-half S.S.E. of Aasleagh, by Knocklaur and south of Leynabricka, to the valley called Dooletter (*black slope*). Through this valley a N.N.W. and S.S.E. fault seems to run, and east of it the direction of the synclinal curve changes to N. 30 E. From this the trough of the curve crosses the Sranalong Valley, and in the cliff to the west it is well marked, by Binnaw to the valley of the Owenbrin, where it meets the south-east continuation of the great fault that extends through Glenawough and the Owenbrin Valley. East of the Glenawough and Owenbrin fault the synclinal curve runs in a northerly direction to the country east of Glenmask, where it seems to be in faulty ground, and from thence it extends in a N.N.E. direction along the ridge of the Slieve Partry range.

Fig. 10.



View of the southern part of the Formnamore tableland from the hill at the S. W. of Lough Nafooey.—J. N.

The valley of Sranalong, east of Skeltia, is a long narrow glen, with precipitous sides, rising on an average to about 1,000 feet above the bottom of the glen. The rocks in the cliff consist of "conglomerates and coarse pebbly grits." Their stratification is most remarkable, the basset of the beds down the precipices being nearly at right angles to the strike,

giving the rocks the appearance of a pile of planks or slates in a timber yard. East and south of Sranalong these beds become coarser, passing into massive conglomerates, containing fragments and boulders of red granite and other rocks, often two or three feet in diameter.

Owenbrin Valley.—East of Derrypark, on the northern shore of the arm of Lough Mask, called Derry Bay, is a low hill formed of the massive conglomerates; two smaller exposures occur between this and the mouth of the Owenbrin.

The Owenbrin, the largest river in this part of the district, has for the most part a south-easterly direction, and its valley is one of the two principal cooms which, as before remarked, indent the Formnamore tableland. No rocks occur in the river, nor are there any seen in the bottom of the glen, the whole of which is thickly covered with drift, but the sides of the valley are formed of the pebbly and conglomeritic beds so often described. The western boundary of the glen is everywhere precipitous, forming a range of cliffs called "the Dirks," in which are two deep cooms, that to the south containing the lakes Nadirkmore and Nambrackkeagh, and that to the north Dirkbeg Lough. This spur from the Formnamore mountain or tableland terminates abruptly to the south east in the mountain called Binnaw, across which a fault is very distinctly seen immediately north of the trigonometrical point 1,703 feet. This fault bears N. 55 E., hades towards the south-east, and is cut off or shifted by the Owenbrin Valley fault.

Aghagower and Slieve Partry District.

North and north-east of the country just described lies the area next to be considered. Nearly across it, in an oblique direction, extends a tract occupied by rocks of Carboniferous age, while farther north, at the margin of the district contained within the limits of Sheet 84, is a small tract of similar rocks. The latter we may first describe.

*Country south of Aghagower.**—The country about and south of Aghagower seems to be occupied by Carboniferous rocks, but as much of it is covered with drift, there are not many exposures. These are of similar age to the previously-mentioned rocks on Benwee, and as the Carboniferous rocks there lie on Silurian rocks, and here on Metamorphic rocks, it is evident a vast amount of denudation must have taken place subsequent to the Upper Silurian and prior to the Carboniferous periods. Dark-blue Carboniferous limestones were observed at about 350 yards S.W. of the village of Aghagower, and nearly a mile to the S.S.W. are three or four quarries of limestone, sometimes earthy looking, and interstratified with beds of shale. As the geology hereabout is obscured by deep drift, the sandstones under the limestones were only observed in one place, at the road, about a mile S.E. of Aghagower; however, it is probable they occupy an irregular N.E. and S.W. strip of country, as indicated on the map.

South and south-east of the Aghagower Carboniferous rocks, and between them and the Carboniferous rocks of the Aille river valley, is a rough hilly country, occupied by rocks of Lower Silurian age. Most of these seem very little, if at all, changed; some, indeed, appear to be quite unaltered, except near the margin of the Carboniferous sandstone on the north-west, where they approach more nearly to genuine metamorphic rocks. Mr. Kinahan, who examined this part of the area, thus describes the rocks on Corveagh Hill:—"Grits, sandstones, and slates, that are probably more or less metamorphosed. In the sandstones the foliation follows the oblique lamination, and in the grits and slates

* The village of Aghagower lies on the junction of Sheets 74 and 84, the name being in the first.

the cleavage. In some of the sandstones there are small calcareous nodules that seem to be fossil casts."* North-east of Corveagh Hill there are small dykes of felstone, which, as they are shown on the Map, need not be specially described.

Country occupied by Lower Carboniferous Rocks along the Derrycraff and the Aille Rivers.—The rocks of this valley lie in a gentle synclinal trough, bounded on the S.E. by a fault, and extending S.W. and N.E. from Derrinkee past the north margin of the district, into the great central limestone plain. The first exposure towards the S.W. is about 300 yards S. of Derrinkee Bridge, in the river which flows from Lough Glenawough. These beds, which are close to metamorphic rocks, consist of purple quartzose sandstones and conglomerates, with pebbles of pink and white quartz. These sandstones, at the junction with the metamorphic rocks in the different sections along this southern boundary, have a rather high dip, which is supposed to be due to the fault that extends along this boundary; here they dip at 30°, but flatten out to 3° as they approach the centre of the basin. Farther N.E. the Derrycraff River exposes a good section of those rocks. The lowest were observed about half a mile S.W. of the village, and consist of red and yellow sandstones, but in the trough of the synclinal curve are some thin beds of limestone and shale. To the northward, under the sandstone, is a conglomerate, then sandstones, flags, and shales, when a fault occurs, with a downthrow to the north-west, which shifts the limestone to the W.N.W.

In the river, north-west of the limestone, are sandstones, grits, shales, and dolomite, with a peculiar rotten-looking conglomerate.

The limestone occupies the axis of the trough, and has been observed in a few places near the margin of the map, particularly at the village called Sraheen. At the village of Derrycraff, in "dark blue fossiliferous limestones," the following fossils were observed by Mr. Baily :—

ZOOPHYTA.
Zaphrentis cylindrica.
" " ; small species, undetermined.
Cyathophyllum; species undetermined.
Michelinea favosa.
Lithodendron junceum.
ECHINODERMATA. Crinoids.
Poteriocrinus crassus.
Archæocidaris vetusta.
(Crinoid joints abundant)."

Other sections are opened in the Aille River, near the boundary with the metamorphic rocks, and in a quarry with an ochreous spring near the east bank.

In the stream that flows east of the village of Sraheen, at about seventy yards north of the spot where the road meets the stream, Carboniferous sandstones are seen to rest unconformably on, or may possibly be faulted against, the schists of the metamorphic series. They have a high dip at their junction with the metamorphic rocks, but lower immediately after. The section here was measured, and the following are notes on it, made by Mr. Kinahan.

"Section at junction of Carboniferous and metamorphic rocks in the stream a little north-east of the village called Sraheen. Strike N. 20 E., dip at from 45° to 60°, to the north-west.

	Feet.
11. Reddish shale, over	5
10. Greenish grey grit, about	4
9. Reddish grit and shale,	15

* These rocks were carefully searched by the Fossil Collectors, but without finding any fossils.

	Feet.
8. Greenish grey grit,	6
7. Red shale, with calcareous nodules, about the size of hens' eggs,	15
6. Black shale, with greenish and reddish nodules,	0·5
5. Greenish and purplish soapy stuff, very like schist in appearance,	3·5
4. Purplish shale, with nodules, more especially in the upper part, from the size of a man's head to that of a marble,	12
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UNCONFORMABILITY?

3. Purple, greenish, blackish, and bluish shaly and schistose stuff, full of irregular nodules and layers of quartzose beds. This rock in places is very like a talcose schist,	20
2. Purple and variegated shaly beds, with irregular nodules and veins of quartz.	

Apparent break.

1. Steatite and steatitic schist, striking N. 10 E., and dipping N.N.E. at 60°.	

No. 4 seems to be the basal bed of the Carboniferous rocks, yet No. 5 is undistinguishable from a metamorphic rock."

The sandstones, and other Carboniferous rocks under the limestone to the S.E. of the synclinal trough, may have a mean thickness of about 130 feet, yet it is extremely difficult to calculate the thickness of the rocks in this basin on account of the insufficient data; at Derrinkee there are about seventy feet in thickness of the basal Carboniferous rocks exposed. In the Derrycraff River there is probably a thickness of 100 feet at the junction of the arenaceous and calcareous rocks, and in the stream east of Sraheen sixty-one feet of the lowest beds. In the Aille River, however, there is a section as follows, giving a thickness of 120 feet for the arenaceous rocks.

Carboniferous { 3 Limestone. 2 Sandstone. 1 Conglomerate.

Unconformability.

Metamorphic—Green schist.

The real thickness may not be seen, as possibly part of these may be cut out by a fault. On the north of the basin no section is exposed, but north-west of Sraheen, they were calculated to be 150 feet thick.

The sandstones which form the north-western side of the synclinal basin or curve, occupy a much larger area than those to the south-east, on account of their low dip; north-west of Sraheen, several exposures of these rocks are to be seen in the vicinity of Loughanadivsha, those west and north-west of that lake being "red and yellow maculated sandstones and flags," while nearly a mile north-west of Loughanadivsha, are conglomeritic sandstones and grits lying uncomformably at a low angle on nearly perpendicular green grits and shales (part of the rocks that in other places are metamorphosed). Good flags were procured at the village a little to the N.E. North-west of Loughanadivsha, are several exposures of sandstone, while at some distance farther north-east, or due west of the village of Arderry, are conglomerates.

The rest of this area, supposed to be occupied by Carboniferous rocks, is chiefly covered with drift and bog; there are, however, some few exposures.

The country from Glenmask, by Bohaun, to the Chapel of Kellavalla.—Glenmask is the uppermost portion of the Aille river valley lying to the north-east of the Formnamore tableland. Northward it is mostly occupied by drift and alluvium, little rock being seen; but southward,

or in the upper portion, are some considerable cliffs of conglomerates of the same kind as those previously described as making up the mass of the rocks in the Formnamore mountains.

In the part of the river north of the alluvial flat are rocks that evidently belong to the metamorphic series; they are green sandstones and shales, or schists, in which are calcareous nodules. In the latter rocks, the cleavage is generally the most conspicuous structure, the bedding being very difficult to determine; however, in places it seems to strike along the stream and to dip at a low angle to the west.

An E. and W. jasper dyke was observed cutting across these rocks. It seems to be vertical and is about six feet wide.

Immediately on the north lie the Carboniferous rocks last described.

S.S.E. of Croaghcrom lough rises the isolated hill of Croaghrimcarra (sheet 85), formed of metamorphic rocks of the same character as those described as occurring in the Aille river to the west. In the valley half a mile S.S.E. of the summit of the hill, the lowest of the beds of contemporaneous felstones described at page 53 reappears. Here evidently the lowest of the Upper Silurian beds is exposed, and has been shifted to its present position by a fault, as the rocks immediately west and S.S.W. of it are grits and fine conglomerates, part of the metamorphic group. Over this felstone is a bed of conglomeritic ash. These rocks have a general north-north-east direction for about a mile and a half, though their continuity is much broken by faults.

The rocks over this felstone and its associated ash in the valley east of Croaghrimcarra, and in many places on the hill to the S.E. are conglomerates of the same kind as those which have been described at Formnamore mountain and other places as forming the great mass of the Silurian series, the contained pebbles being of granite, schist, felstone, red jasper, &c. A section of these conglomerates lying on the metamorphic rocks is exposed in a stream half a mile south of Bohaun south; these metamorphic rocks are green schists. Cutting across them is a dyke of igneous rock, suggested by Mr. Kinahan to be probably a "melaphyre." To the east and north-east, capping the hill, the Silurian conglomerates form marked crags that dip to the S.E. About a quarter of a mile S.E. of Bohaun south, are conglomerates among the metamorphic rocks having a schistose matrix, containing pebbles principally of quartz. The Upper Silurian boundary here is obscure, but it seems to extend as indicated on the map from where it is well marked, immediately S.E. of the dyke of melaphyre. At the metamorphic conglomerates there is a fault that shifts the boundary nearly half a mile S.E., and the S.W. portion of the fault fissure is occupied by a massive quartz lode. This fault crosses Slieve Partry in a general north-easterly direction. North of this fault the boundary probably extends northward for a short distance, when it is shifted a little to the west by an E. and W. fault, a branch from the larger one just mentioned. The metamorphic rocks north of the fault were noted as "schistose-looking grits," while the overlying Silurians are obscured by the bog or drift, only one exposure being seen about 100 yards to the north.

In the country to the west and south-west, the metamorphic rocks are well seen. Those on the east side of the stream north-east of Croaghcrom lough, also due east of that lake, between the faults, are conglomeritic schists similar to those previously mentioned, and interstratified with them are argillous and micaceous schists, some being steatitic. A fault seems to run northward in this valley, as these conglomeritic beds seem to be cut off, but its exact position is obscure. West and south-west of where the dyke of melaphyre was noted, there are green micaceous schists; there are also large bosses of them in the

neighbourhood of Bohaun south, and for some distance north of that village. The foliation is often crumpled and nodular.

East and south-east of the village of Bohaun north, to the great E.N.E. fault which runs south of the summit of Bohaun, the Upper Silurian rocks are all more or less quartzose, silicified and indurated, while some of them, especially a bed near the base of the formation, are affected by cleavage. They, however, contain pebbles of red granite, schist, felstone, jasper, &c., similar to the other Upper Silurian conglomerates.

The country north and north-east of the summit of Bohaun is occupied by a peculiar quartzitic rock that graduates upwards into a conglomerate, but never itself appears to be conglomeritic. This siliceous rock evidently filled up the interstices and other vacancies in the underlying rocks, consequently the Silurian rocks here have no well defined basal line, but appear to graduate into those of the metamorphic group. This siliceous rock is somewhat similar to the lowest bed of the Upper Silurians at Doorus, Lough Corrib. (See ex. sheet 95, page 40.) Of it Mr. Kinahan writes—"Similar rocks to these remarkable basal beds, although peculiar, are not uncommon, as on many occasions similar rocks have been observed—not, however, always in the Silurians, as they also occur as the basal beds of the Old Red Sandstone. They have been observed by both Mr. Wynne and myself, in the Clare, Limerick, and Tipperary hills. (See memoirs explanatory of sheets, 124, 125, 134, 135, &c.)"

Farther eastward, S.W. of the hamlet called Tawnynagry, are large exposures of the Upper Silurian conglomerate, while in the stream south of that hamlet are metamorphic rocks, the stream running parallel to the boundary till it meets the Carboniferous rocks east of the village of Tawnynagry. The basal rock of the Upper Silurian is similar to the quartzose rock previously described, while the overlying conglomerates are exposed in many places to the south and in the stream south of the village of Derreennascooba. At this village they also occur, but north of it is a fault with offshoots that brings up small detached portions of the older rocks; they, however, can scarcely be represented on the map.

In the vicinity of the trig. point 746, half a mile S.S.W. of Maumeen, are green sandstones; but particularly to the N.E., N., and S.S.W. On the surface of one of these, about 200 yards N.E. of that point, a ripple mark was observed.

The beds S.W. of Kellavalla were noted as "grits and cleaved shales, with holes that look like fossil casts."

Kellavalla and neighbourhood.—The rocks of the country north of Kellavalla are Carboniferous limestones; they crop to the surface half a mile E.N.E. of that village; while farther N.E., at Polladoon, are dark blue limestones with shale partings.

This limestone is probably bounded on the S.E. by the fault which seems to extend along the S.E. boundary of the Carboniferous formation, and continues in a north-easterly direction into the district on the north.

The low country south of this limestone, between the Aille river and the eastern slopes of Slieve Partry, is occupied by Carboniferous sandstones, but as it is almost altogether covered with bog and drift, the rock *in situ* is rarely seen. One of the best exposures, consisting of red sandstones and shales, occurs on the road from Westport to Ballinrobe, about three quarters of a mile S.S.E. of Kellavalla. Rocks were not again observed *in situ* for several miles; but at half a mile S.E. of Clonee, in a new drain west of the road to Ballinrobe, an apparent opening in yellowish brown and green sandstone was observed, and nearly half a mile to the south, a little west of the Cloon river, are yellowish brown, highly quartzose sandstones, apparently horizontal.

Farther south, in the wood and on the west of the river, are yellowish green and pink well bedded sandstones.

The islets and rocks in the north-eastern part of Lough Mask, including Black Islands, Dawaur Islands, &c., are mostly formed of Carboniferous sandstone *débris;* but on some of them, and on the shores of the adjoining promontory called Derrymore, the rocks occur in place.

Of this promontory with the islands and rocks to the east thereof, Mr. Kinahan writes—"Some of these sandstones form nearly flat quâquâ-versal domes, while others are bent into sharp anticlinal and synclinal curves. The principal rocks are brown, yellow, and red sandstones; some flags also occur; and in one place a bed of green sandy clay rock was observed. Some of the sandstones are beautifully cut up by systems of parallel joints."

North-east of this part of Lough Mask, on the southern shore of Cloon Lough, are brown sandstones, while farther north, on the eastern shore of that lake, some very thin beds of sandstone were observed in the limestone, the most northern exposure being to the east of the Aille river, half a mile north of Cloon Lough, where there is a thin tongue of yellow sandstone extending into the limestone.

In the country immediately west of the road from Westport to Ballinrobe the rock *in situ*, as before remarked, is rarely seen; however, at a mile south-west of Cloonee, on the branch of the road leading to Toormakeady, coarse reddish sandstones are met with, and similar rocks are seen in a drain a short distance to the south.

To the S.S.E., immediately south of Srah Bridge, close to the road, are three or four exposures of pink and purple grits and sandstones, while pink flaggy sandstones and conglomerates are seen resting on igneous rocks of Upper Silurian age nearly half a mile to the west of Srah Bridge. The Carboniferous formation probably extends to a considerable distance southward along the western shore of Lough Mask, as that part of the country is thickly strewn with its *débris*; but no rocks were observed *in situ*, except some conglomerates a little south of the monastery.

Half a mile N.W. of Srah Bridge, in the river that flows south of Shangort, thin bedded coarse grey and red sandstones, often conglomeritic, with some shales, are seen in the south bank; while to the west and north-west of this, immediately south of the village of Shangort, are purple and pink sandstones and conglomerates resting for the most part nearly horizontally on igneous rocks of Upper Silurian age. Farther north in the stream, north of Derrassa, are red sandstones and conglomerates resting unconformably on thin bedded sandstones and shales, as shown in sketch. (See fig. 11.)

Farther up the stream, and in several other localities in this neighbourhood, Carboniferous sandstones can also be seen.

Fig. 11.

Carboniferous sandstones resting unconformably on Silurian rocks in the river north of Derrassa.

A. Hard grits and shales. B. Purple sandstones and conglomerates. C. Purple shale. D. Loose blocks.

Upper Silurian country west of Srah and in the neighbourhood of Toormakeady.—North, west and south of Srah, extending in a N.N.E. direction from the village of Derrindaffderg to some distance S.W. of Toormakeady Lodge, is an extensive tract of country occupied by igneous rocks with associated beds of ash and agglomerate. They for the most part are interstratified with rocks of Upper Silurian age. To the extreme north of this tract, at Derrindaffderg, there are two distinct beds of light green and purple quartziferous felstone, and between them is a massive bed of agglomerate. South of this village a section is exposed in the river north of Derrassa. Towards the east, at the junction of the Carboniferous sandstones with the Silurian shales, several beds of ash and agglomerate are seen to rest on the latter. These are made up of felspathic fragments; they not only occur in the bed of the river, but form a low cliff on its northern bank underlying the Carboniferous sandstones. To the west of these tuffs is a bed of concretionary felstone—the more easterly of the two beds noticed at Derrindaffderg; over this felstone is the agglomerate, succeeded by the other or more westerly bed of felstone. Lying on the latter is a large accumulation of ash, part of it being well stratified, while above it on the west is another, but smaller bed of felstone. Higher up the hill, or toward the west, the streams expose sections of the ordinary conglomerates of the district.*

Farther south the felstones occupy a wider space, and other beds seem to come in, they being also interstratified with ashes and agglomerates, while between the two more easterly felstones, two beds of limestone occur. In a few places under the lowest felstone are jasperized shales of Lower Silurian age, which are brought up to the surface by the numerous faults that traverse and break the continuity of the beds of felstone, limestone, and the associated rocks. These exposures of Lower Silurian rocks are so small, often only appearing as the lowest rocks in a small perpendicular cliff, that they could not even be marked on the six-inch or working maps. The faults although numerous are hard to follow on account of the small shift, or displacement, due to most of them, but the principal one runs in a north-west and south-east direction immediately south of the village of Derrassa. Besides the purple quartzose felstones before mentioned, there occurs at and north-east of Derrassa, a porphyritic rock often beautifully columnar. It is of a bluish colour and has a certain greenish mineral like an earthy chlorite disseminated through it.†

A little south-west of Derrassa is a granular tuff containing a large quantity of the greenish mineral. It has in places a crystalline appearance, but on tracing it to the south it was found to be well bedded and interstratified with shales, &c.

The limestones that occur between the two eastern beds of felstone are, towards the north, first seen in the little valley between these rocks about 200 yards west of Shangort, but they can be best examined to the S.W. of that village where a quarry was opened to procure the stone for agricultural purposes. The general appearance of the limestone here is a compact mass of a light gray or bluish colour, but in places it is a limestone breccia, as foreign pebbles and pieces, particularly the red siliceous angular pebbles so characteristic of the Upper Silurian rocks of this district, are contained in a lime matrix. Towards the south these limestones are cut off by the previously mentioned N.W.

* Nearly 200 yards west of the last mentioned felstone, there is a lode of hematite on which a trial was made without any satisfactory result.

† Mr. Kinahan suggests that this mineral may be either ripidolite or a magnesian mica, "Hydro-mica" of Dana.

and S.E. fault; and they could not be again found at the surface of the ground, till they reappear in the neighbourhood of the village of Gortbunacullin.

The felstone east of this limestone is well seen in the river which flows in a N.E. direction, south of the village of Shangort. It also forms a line of low cliff on the north bank of the river. In both places the rock was observed to be well bedded and to have a columnar structure. South of Shangort, where the path from that village crosses the river, several clusters of well developed columns were observed in the upper part of the cliff, while the lower portion for the most part is only bedded, but sometimes in the latter the columnar form is apparent.

If this stream be followed south from the place where the N.W. and S.E. fault occurs, alternations of purple quartziferous felstones with ashy conglomerates will be met, some of the latter being well stratified. North of the village of Gortbunacullin, where a small stream joins a larger, is a green quartziferous felstone with beds of tuffose grits; also a small exposure of indurated Silurian shales, the tuffose grits having as a superstratum a bed of green quartziferous felstone of a considerable width. This latter rock dips at a low angle to the N.W., and forms a remarkable escarpment on the north of the river about a quarter of a mile N.W. of Gortbunnacullin. In the bed of this river, a little farther N.W. of Gortbunnacullin, and apparently under this green felstone is a basic igneous rock which is probably a dolerite. Farther west, for more than half a mile the only rocks observed were conglomerates, generally massive.

In the neighbourhood of Gortbunacullin there is much tuff, most of it being calcareous. East of that village and north of the stream to the south of it are parts of the before described brecciated limestone beds. Here, however, they are variegated and would make a handsome marble if polished. In the surface portion of the more eastern bed, carbonate of copper is disseminated. They have a general direction parallel to the stream though shifted by numerous faults. In places these limestones graduate into a variety of calcareous ash; nodules and pieces of limestone being disseminated through an ashy rock, or blocks, fragments and particles of ash are cemented together by a calcareous matrix. It seems remarkable that these limestones should only be associated with the igneous rocks. Here we find them thus associated; as also in Glensaul and near Lough Nafooey.

The rocks in the bed of the stream south of Gortbunacullin are chiefly calcareous ash or ashy grits; on the N.W. is a green felstone, while to the south and east is a large tract more than half a mile wide, occupied by quartziferous felstone. East of the latter is a long narrow tract of more or less indurated Upper Silurian rocks (quartzites and hornstones), which are well exposed in the stream about half a mile S.W. of Srah Bridge, and north of Drumcoggy. To the south of that village is a mass of brecciated felspathic rock, lying on indurated Silurian rocks. This brecciated rock is evidently associated with the felstone, as half a mile S.W. of Drumcoggy, and in other places, it is found to graduate into it. The felstone in the mass is in places granitoid, apparently being an elvanite; part also seems to be intrusive; it, therefore, is not improbable that hereabouts might have been one of the vents through which igneous formations were erupted.

In a hollow, in the south-west extension from the main mass of the felstone, a little north-east of the hamlet called Gortanalderg, part of one of the limestone beds was observed, and immediately in its vicinity is apparently a pipe or boss of an igneous rock. This rock may be either an aggregate of felspar and hornblende (diorite), or of felspar, augite, and ripidolite (diabase), but its constituents are so minute that they could not be determined by an examination in the field.

Hereabouts, south of the main mass, the felstone beds are very much broken up by faults, so that their exact relations to one another are obscure, but there appear to be at least three separate beds. These felstones seem to be similar to those north of Gortbunacullin, being more or less quartzose in places, and varying in colour from red or purple to greyish or greenish, besides having often a columnar structure.

To the W.S.W. of Drumcoggy is a rock that may possibly be a felstone graduating into whinstone. It is amygdaloidal, the cavities containing chiefly calcite, which weathering out near the surface, restores the old vesicular nature of the rock. Before the blowpipe it fuses quite readily, and seems to be precisely similar to others that occur in great masses in the district to the south, on the western part of Kilbride, and south of Lough Nafooey. For the description of the latter rocks the reader is referred to the explanation to accompany sheet 94.

In a hollow between this hamlet and Gortanalderg the limestones previously met with in the stream south of Gortbunacullin reappear. It is probable they extend from that stream along the western boundary of the felstone, though only one exposure of them was seen between the stream and the village of Gortanalderg, which occurs on the east of the southern branch of the stream nearly a mile S.W. of Gortbunacullin. Here the limestone seems to be fossiliferous, though, from its weathered condition, none could be procured.

S.S.W. of Gortanalderg is a N. and S. fault, along which a stream flows, the latter having excavated a bed in the fault rock (steatitic shaly stuff).

The light grey limestone west of Gortanalderg is much quarried. It can be traced from that to the stream south-west of the village, where it seems to be shifted a little to the N.E. by a fault, from whence it has a southerly course along the bed of the stream for about 250 yards, where a small quarry was opened. South of the quarry the limestone does not again appear in the stream for a quarter of a mile; it seems to be shifted to the N.E. and E. by several faults, the stream running through ash and felstone. Where the limestone reappears in the stream a quarter of a mile S.W. of the last quarry it is variegated, a reddish colour predominating. Only a small portion of the bed seems to be here, as apparently it is again shifted to the S.E. by a fault, but reappears a few yards N.W. of where the road crosses the stream. Here the rock is fossiliferous, and can be traced for a short distance to the south-west before it again disappears.

North and north-west of Gortanalderg, overlying the limestone, is a bed (?) of basic igneous rock, of which Mr. Kinahan writes:—"In places it is like a diorite, in others like a diabase, while to the south-west it seems to graduate into a highly basic felstone."

There is a felspathic rock, apparently continuous with the above, of a dark green color, that before the blowpipe, fuses on the edges; but it is not amygdaloidal like the rock near Drumcoggy. It seems to be tuffose towards the surface of the bed, as in some parts, particularly in a low cliff on the east bank of the stream, the upper part of it has an aspect remarkably like a calcitic felspathic grit. In the E.S.E. part of the stream a good section of it is exposed, from whence it may be traced in a S.S.W. direction till it disappears in the stream N.E. of Toormakeady Lodge.

West of the green felstone just described there are other felstones and tuffs, the latter being well seen in the bed of the stream S.W. of Gortanalderg with the limestone, and extending from thence till it meets the

green felstone in the E.N.E. turn of that stream. It also forms a large portion of the ridge which extends S.S.W. from Gortanalderg to the road leading from Toormakeady across Slieve Partry. This tuff is usually conglomeritic, being formed of well rounded pebbles of the adjoining felspathic rocks; under it to the east is a dark purplish felstone, and over it, forming the highest part of the hill where trig. station 421 feet is marked on the map, are conglomerates. A little S.E. of this point is a thin bed-like course of grey quartziferous felstone capped with conglomerate, and over this latter is an oblong N.E and S.W. tract of felstone, about half a mile long, and more than two hundred yards across in its widest part. This rock is well exposed in many places, particularly at the road, where it was noted to be of a red color, variolitic, and abounding with blebs of glassy quartz. South of this rock, and separated from it by conglomerates, is a bed-like mass of red and grey quartzose felstone. It appears on the old road a quarter of a mile N.W. of Toormakeady Lodge; but is much better exposed in the stream a little on the south, while farther south-west it occurs in mass, and some small quarries have been opened in it. Another but thinner course of similar rock was noticed to the east of this.

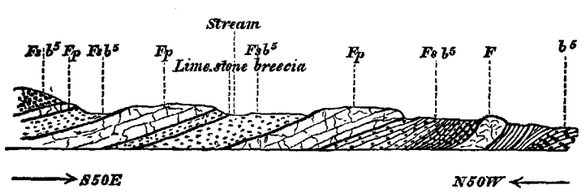
The largest and most important tract of felstone hereabout lies a little to the east. It is more than two and a-half miles in length, extending S.W. from the stream that flows into Lough Mask, to the north of Illaundawaur through Toormakeady demesne, nearly to the Glensaul river, S.S.E. of Derryveeny. This rock, like the others, is sometimes quartziferous, and seems to be interstratified with the sedimentary rocks. It varies in colour from red or purple to greyish, greenish, or bluish, and is often columnar, especially towards the north-east, where near the bye-road a quarter of a mile N.W. of the monastery, some well-marked columns were observed. A little west of these columns and south of the bye-road, is a small exposure of dolerite that appears to come up as a pipe through the felstone.

A section across this felstone and the associated rocks is seen in the stream west of the monastery. It is also well exposed on the mountain road about half a mile N.W. of Cappaduff Bridge, and in the streams that flow through Toormakeady demesne.

The following section gives an approximate thickness of all rocks associated with the felstones, as seen in the just mentioned stream, west of the monastery.

Fig. 12.

Section across the igneous rocks, &c., a mile N. of Cappaduff Bridge.



S. 50 E. N. 50 W.

F. and *Fp.* Felstone and quartz-porphyry. *Fs.* b^5. Felspatic tuff and agglomerate. b^6. Llandovery rocks, conglomerates, &c.

Scale, six inches to one mile.

At and immediately north of the bye-road, north of the monastery, is a basic rock apparently similar to that which occurs at Ardaun near Cong.*

* Geol. Survey Memoir, sheet 95, p. 38.

The base of this rock is of a dark green colour; it abounds in crystals of pink felspar, and there are peculiar greenish crystals with a metallic lustre, also some mica flakes and nests of sparry carbonates, weathering to a dirty yellowish green. Mr. Kinahan believes it to be a diabasic rock. Immediately to the south-west, south of the road, and extending to the house called Mount Partry, is a very peculiar greenish rock generally mottled with calcareous nests, and fusing easily before the blowpipe. Mr. Hull considers it a basic felstone, while Mr. Kinahan believes it to be allied to the rock last described. The upper portion is in parts tuffose. The best section is seen in the stream which cuts through it, about a quarter of a mile N.E. of Mount Partry.*

West of this bed-like mass of igneous rock, and apparently dipping under the red and grey quartzose felstone previously described are beds of tuff. In the stream S.W. of the monastery, and dipping under the igneous rock are sandstones and shales, some of which appear to be much altered and converted into hornstone.†

South of them, occupying the bed of the stream for some distance, are massive conglomerates. These latter are also well seen farther south in the Glensaul river, from the neighbourhood of Cappaduff Bridge, and towards the west in the demesne of Toormakeady Lodge. This conglomerate is almost altogether formed of large boulders often a couple of feet in diameter, consisting of schist, red granite, felstone, &c. About a quarter of a mile E.N.E of the waterfall, in the bed of the river, is a dark green variolitic rock with black specks that before the blowpipe fuses on the edges. The part exposed is very much weathered, but it seems to belong to the basic felstones, as it resembles the green rocks at Lough Nafooey and Kilbride; only a very small portion of it is here exposed.

At the waterfall in the tributary stream that flows into the Glensaul river, conglomerates are again seen, and immediately N.W. of them is the S.W. continuation of the previously mentioned great bed of felstone. In the vicinity of the road about half a mile N.W. of Cappaduff church is, "a mass of an irregular scraggy felspathic rock, that in places looks like a felstone and in others like a derivate rock, fragments of quartz, &c., being mixed with tuffoid stuff that may merge into a breccia. It is evidently similar to the basal part of the felstone previously mentioned when describing the northern part of this rock." South-east of Derryveeny may be seen the S.W. termination of this great felstone, while

* This rock is evidently very basic. It has been suggested in the general description that some of the basic felstones, the eurytes of Daubisson, seem to graduate into whinstone, this locality being one of the places therein referred to, also a somewhat similar rock that was noted exactly three quarters of a mile N.W. of this place. In the locality described above by Mr. Nolan the rock north of the road seems to be a typical diabase; south of the road it appears to be of a similar nature; at the stream it looks like a felstone, but highly basic, while in the neighbourhood of Mount Party I considered it to be a diabase graduating into a compact tuff. Of a specimen from the last locality Mr. D. Forbes thus writes:—"A diabase tuff or diabase. Its petrographic position would tell which. Probably a compact tuff." It seems to be exactly similar to some of the rocks in North Wales that are mapped as the passage rocks between felstones and whinstones.—G. H. K.

† These rocks, some indurated shales a little S.W of the house called Mount Partry, and some altered rocks that appear east of the band of felstone on the farm road through Toormakeady demesne, under where "Police Barrack" is engraved on the map, I am inclined to believe are Lower Silurian rocks, similar to those that in other places have been found under this lowest bed of felstone; more especially as the basal part of the felstone is identical with the peculiar rock before described S.W. of Gortbunacullin, as intervening between the indurated Lower Silurian rock and the typical felstone. If this suggestion be correct it would necessitate a N.E. and S.W. fault, an up-throw to the eastward to bring up the conglomerates found in the S.E. part of this stream, also those in the Toormakeady demesne, and at the village of Cappaduff.—G. H. K.

parallel to and south of it is a much smaller course of similar rock that seems to extend about half a mile to the south-west.

The Glensaul river, W. and S.W., of this small felstone, exposes conglomerates alternating with coarse pebbly grits.

The wild mountain country to the west and north-west extending from the felstones just described, to the N.W. escarpment of the hills or the boundary of the metamorphic rocks, is for the most part formed of conglomerates, more or less massive with subordinate beds and masses of sandstone and shale, as may be seen in stream sections and in hummocks, &c., on the hill sides. These rocks are similar to those described at Glenmask and other places, abounding with pebbles and boulders of red granite, schist, felstone, red jasper, &c. They appear to roll very much, as may be seen along the road from Glennagashleeny to Toormakeady and other places. In these conglomerates, nearly encircling the hill called Tonesaly, about three miles N.W. of Cappaduff, is a bed of melaphyre. This bed can be seen in the stream courses on the south-east slopes of the hill, as through it they have cut deep ravines along fault lines in the bed; it can also be seen in a quarry at the road S.W. of the summit of the hill, but it can be best seen in a stream immediately north of the road. Here the lower part is tuffoid, above that amygdaloidal, then tuffose, while the upper part is compact but shingly. Adjoining the conglomerate that overlies the melaphyre, there appears to be a small sheet of trap. The melaphyre is a nearly horizontal bedded mass and apparently is interstratified with the Upper Silurian rocks. It disintegrates easily into a coarse sand or fine gravel, and on its debris there is a belt of rich green pasture. At the N.W. it is cut off by a fault, a downthrow to the S.E. as shown on the map.

East of the summit of Tonesaly, on the slope about half way between the tract of felstone and the bed of melaphyre, either a bed or dyke of felspathic melaphyre, was observed at the base of a small cliff of conglomerate. It seems to be a bedded mass, but as so little of it is exposed this is uncertain—it was not remarked in the stream on the north and south.

North-west of Tonesaly, there is an exposure of Lower Silurian rocks brought up to the surface by faults, the north-west part of its boundary is either a fault or an old cliff line, probably the latter. These beds principally consist of green and greyish shales and slates, but in places grits occur, they are very little if at all altered—on them are four small outlying patches of Upper Silurian conglomerate.

To the south-east, adjoining Lough Mask, the conglomerates are replaced by grits, sandstones and shales, also of Upper Silurian age, but separated from the former by faults, downthrows to the south-east, between Cappaduff bridge and the mouth of the Owenbrin river. These rocks are much higher than the conglomerate, and also seem to be indentical with those at Kilbride, in the district to the south,* being chiefly purplish and greenish sandstones, often fossiliferous as at Toberkeelagh, they generally dip to the S.E.

West and south-west of the village of Trean, in the stream and in the road, are green sandstones, flags, and shales, many of them fossiliferous, a good locality being to the west of the point where the just mentioned stream enters Lough Mask, and another a little S.W. of Black Rocks, N.N.E. of Rinnagh Point. East of Trean, on the shore of Lough Mask, between the trig. point 84 and Annagh Point, are green sandstones, with shales; and at Annagh Point is a dark green igneous rock, which

* Memoir Ex. Sheet 95, page 44.

before the blowpipe fuses readily on the edges, and is probably a melaphyre.

Glensaul and Greenaun.—In Glensaul, which lies south-west of Toormakeady, beds of felstone, ash, and limestone, similar to those before described, appear, principally occupying the south-eastern part of that glen and the hill of Greenaun, while the rocks on the northern side of the valley are conglomerates. These igneous and ashy rocks seem to be representative of the Toormakeady series, but the connexion between the two could not be traced. As the country hereabouts is very much cut up by faults, it is not improbable that this part may have been upheaved, and thereby brought under the influence of denudation, by which the overlying conglomerates were removed, or the different exposures may belong to two different eruptions that protruded separate masses of igneous rocks. This latter supposition is rendered improbable on account of the remarkable similarity of the rocks of the two groups, as also from the consideration that they occupy apparently the same geological position; and in Glensaul, under the felstone, in a few places, are indurated shales and other rocks that appear to be of Lower Silurian age; while in the other hand we find that here evidently there was a pipe or volcanic vent from which these rocks were erupted in this neighbourhood, the rocks in part occurring as a protrusion, and not as bedded masses; while in the rocks west and north of Toormakeady there seem to have been other vents as at Drumcoggy, described at page 62, thereby suggesting that these igneous rocks, with their mechanical accompaniments, were not all erupted at one point, but in several, as is common in many volcanic districts at the present day.*

The largest exposure of felstone in the western group lies south of Garranagerra (Sheet 85), on the south side of the valley, from which it stretches S.W., till terminated by a large downcast fault, shown on the map; on the opposite side of this fault it is again found, at Tonaglanna (Sheet 84), forming a roundish mass. The rock is similar to those before described, being a more or less quartziferous felstone, of a blue or purple, green or grey colour, with in places a green mineral like chlorite. It is often columnar, some well-marked columns having been observed nearly half a mile W.S.W. of the trig. point 699 (Sheet 85). South-east of this felstone, and separated from it by thin beds of tuff, is another bed-like mass of the same character, while smaller bedded felstones, interstratified with tuffs and conglomerates, occur farther south-east. Under the lowest of this series of beds, south of the trig. point above named, are some of the indurated shales previously referred to.

Over the felstone first described there are tuffs and limestone, the former occurring in the greatest quantity south-west of the alluvial flat, south of Garranagerra. Some of those tuffose rocks that were observed on the south bank of the river contain very remarkable angular pieces of bluish hornstone or quartzite.

The limestones over the felstone coincide in aspect, composition, and number with the beds before described. Here they are bent into anticlinal curves, one of which occurs between the largest bed of felstone and its branch to the west, while the other is farther west, among the calcareous ashy rocks. This anticlinal curve slopes to the N.E., thereby causing the basset of the limestones to be V shaped. One of the best exposures of these rocks occurs a few yards to the south of the group of houses half a mile S.W. of Garranagerra, where a quarry was opened in

* If, as suggested by Richthofen, Whitney, and Le Conte, these great sheets of Plutonic rock are due not to crater but fissure eruptions, we should expect in various places to find portion appearing not as bedded masses but as protrusions.—G. H. K.

a limestone breccia, the included fragments being purer and more easily weathered than the matrix. This limestone is fossiliferous, and the following account of the fossils has been drawn up by Mr. Baily, F.G.S.

It will be observed that they are chiefly Lower Silurian forms, and are considered to be "derivative," and not of the age of the beds in which they are found.

List of Fossils from "Glensaul Limestone."

Locality No. 1.

Lower Silurian = Caradoc. County Galway ¾. Townland Greenaun.
Nos. in Register, L 2163 to 2169. Glensaul, three miles S.W. of Tourmakeady.

A Brecciated Limestone, formed of grey and red fragments, the red portions being the most fossiliferous. These fossils resemble very much those of the Chair of Kildare, and are, I believe, of contemporaneous age, being principally fragments of Trilobites, of which Illænus Bowmanni is the prevailing fossil.

Brachiopoda.

× Leptæna sericea.
× Orthis elegantula.

Crustacea.

× × × × Illænus Bowmanni, of various sizes, detached heads, tails, &c.

Locality No. 2.

County Mayo 19°. Townland Gortbunacullin, at side of stream forming S.E. boundary, 2½ miles N.E. of Tourmakeady. Similar Limestone and Fossils to locality No. 1, with a few additional species.

Echinodermata.

× × Crinoid joints ? Glyptocrinus.

Brachiopoda.

× Orthis elegantula.
„ insularis.
Leptæna sericea.
„ tenuicincta.

Mollusca.

Euomphalus? sp. Orthoceras? sp.

Crustacea

× × × × Illænus Bowmanni, various sizes, detached heads, tails, &c.
Cybele verrucosa.

November 15, 1875. W. H. Baily.

Some of these limestones are ashy, as previously described at p. 62; the pebbles are red, bright green, and blue, the matrix being greyish. South of this another quarry was opened on the same bed of limestone breccia. Like that at the stream south of Gortanalderg, this rock would make a pretty ornamental marble, if polished. At this last-mentioned quarry the limestone is shifted westwards by a fault.

The country south of this district to Killateeaun, and westwards to Barnahowna and the Owenbrin River is much covered with drift, the rocks where exposed are conglomerates, or coarse pebbly sandstones, graduating into conglomerates, except on the S.E. slope of the hill, called Lettereeneen (925 feet), where faults bring up to the surface a small tract of black fossiliferous Lower Silurian shales. The exact limits of this exposure are unknown. To the N.W. is the basset of the Upper Silurian conglomerates; on the N.E. it is cut off by a fault a downthrow to the N.E.; on the S.W. it is supposed to be cut off by the Owenbrin Valley fault, but its boundary to the S.E. is quite uncertain, the hillside being covered with deep drift; probably it may be cut off by the fault marked on the map, but it is not impossible that N.W. of that fault there may be Upper Silurian conglomerates, the boundary being an outcrop of these rocks. J. N.

Drift and other Superficial Accumulations.

South of the valley of the Culfin River, and in the neighbourhood of the hamlets of Cloonagh and Gowlaun, and from the coast line, stretching westward and southward, is a large sheet of undulating drift. This to the eastward is banked for a considerable height up along the hill slopes, while southwards, nearly to the Dawros River, and westwards to Tully Lough, it forms drumlins and undulating hillocks, some of which attain altitudes of 500 to 600 feet. Along the sea board many of the cliffs have vertical faces exceeding 100 feet in height. The drumlins have a general bearing of N.W. and S.E., thus agreeing with the ice striæ.

At Kanrawer, near Tully are high cliffs, where the drift lies on an ice-planed rock surface, but any ice markings which may have originally existed are now obliterated.

This drift is more or less stratified, and contains in its lower members, innumerable ice-dressed blocks. The cliffs range from 50 to upwards of 100 feet in height.

To the N.E. of Rinvyle House there occurs a bog below high water mark.*

In it are roots of trees *in situ* called "Corkers," and apparently of considerable age; the late Captain Edgar H. Blake, R.N., informed me that in one he had counted 256 rings of growth, and in another 190; in one of these I counted 260 rings, and it was only a portion of a stump, being denuded of many of its outer rings. The bog along the margin of the strand is now covered with at least three feet of fine sand. Further west in the neighbourhood of Rinvyle point, and on the islands, there are highly instructive drift cliffs (see Note, Ice Striæ table, page 78). A little E. of Rinvyle there is from 6 to 10 feet of a newer drift, over what seems to be boulder clay drift. About half a mile S. of Rinvyle Point is a high drift cliff, about 15 feet of which towards the top, is greenish or brownish, and contains angular or semi-angular blocks and fragments, while the lower portion is of a bluish colour, and having all its enclosed blocks more or less rounded.

On the hill called Letter More the formation of "rock basins" is well exemplified: two or more faults or breaks in the strata crossing each other, shattered the rocks at and in the vicinity of the junction leaving them loose and broken to be caught up and carried away by the ice, which subsequently was formed on the hill. In this way numerous oblong or bowl-shaped hollows have been formed, some now being lakes or loughauns, while others are deep hollows.†

On the south flank of Letter More are some small drumlins of drift, having a bearing with the trend of the valley of Ballynakill Harbour, the waters of which wash the southern slopes of the mountain. H. L.

* This extends to Crump Pland, as in the channel vessels at anchorage drag up the bog deposit with their anchors when moored there.

† In Yar-Connaught there are two classes of lakes, "Bog Lakes" and "Rock Basins;" these latter are always in lines of breaks or at the junction of breaks in the strata. A long lake running in length along a break, and widening out wherever other breaks cross it or join into it, while a roundish lake occurs at the crossing of one or more breaks. Rock basin lakes are found in rocks such as mica schist and the like, when the rock is capable of being ground up and forming amorphous "fault rock." In quartzite and hornblende rock, however, this is not always the case, consequently there is a rapid underground drainage through the "fault rock," and although the rock basins are as often, if not oftener, formed in these rocks as in others, yet only in some hollows will be found lakes. This is even more remarkable in a high tract of hornblende rock than of quartzite, bowl after bowl being met without a drop of water in them, even in very wet weather. Bog lakes on the other hand are formed by the growth of bog around a spring, banking up the water and eventually forming a lake.—G. H. K.

Mweelrea Mountains.—To the west on the sea board are extensive tracts of blown sand, partly quartzose and partly calcareous, with which are associated salt-marshes that more or less partake of the nature of lagoons. On the N.W., S., and E. of Doogan Hill are tracts of drift, principally moraine or stratified drifts. Then S. and E. of Doogan Hill, and from that to the valley of the Carrowiskey and Glencullin are more or less covered with bog. On the N.W. slopes of Mweelrea there is over 30 feet of drift under bog. From Glencullin East to Luggacolliwee, in the valley, and on the N. slopes of the hills N. and N.E. of Doolough, there is a thick sheet of stratified drift in places gravelly, or containing subordinate beds and portions of gravel, this is covered with a greater or less covering of peat. Over Glencullin Lough, on the steep hill slopes to the S.W., is a remarkable line, over a quarter mile long, of large blocks; they seem to be the remains of a lateral moraine. In Lugmore there seems to be traces of a very recent glacier. In Glenummera, and on the hills to the N., the major portion of the drift appears to be meteoric.

In the corry of Bellawaum, there is a large accumulation of moraine drift, probably the detritus left by a dying out glacier, and one of the hollows in it forms a small lake basin; while higher up the glen are remarkable abrupt hillocks of rocky drift that seem due to debicles or avalanches. In the coom, immediately S.S.E. of Mweelrea and S.E. of Lugaloughan lake, there is a remarkable esker-shaped bar of meteoric drift that seems to have been formed by the mountain torrent that occupies the break and ravine, in the ridge to the S. of the lake. In the large valley that extends from Mweelrea eastward to the Bundorragha River valley, there is drift obscuring the rocks; it seems to be partly moraine and partly meteoric. The flat bog in this valley is at a height of about 350 feet, and probably the flat was a strand at the time of the Esker Sea. About Lough Firr there is drift, while on the slopes of the valley of the Bundorragha River are the traces of the marginal terraces of the Esker Sea; they, however, have been much effaced by subsequent meteoric action. These terraces are much more prominent in the Maum Valley, and in the valley of the Erriff River; those in the latter locality will be mentioned by Mr. Nolan while describing that portion of the district. North of Tawnyard Lake, on the slope of the hill, is a well marked horizontal terrace at a height of 350 feet. G. H. K.

Erriff Valley with the Formnamore Mountains and Slieve Partry.—In this portion of the area there is very little boulder-clay exposed. It generally occurs in hills (*drumlins*), or is more or less undulating. The longer axes of the drumlins correspond in a remarkable manner with the direction of the glacial grooves and striæ, as pointed out by Messrs. Close and Kinahan in their Map and Description of the Glaciation of West Galway and Mayo. In the neighbourhood of Toormakeady, and along the comparatively low lands lying west of Lough Mask, many of these drift hills or drumlins are to be seen, but they are far more numerous to the N.W., in the neighbourhood of Maumeen, and along the valley of the Aille River, towards Derrycraff, where they are often covered with a thin coat of peat. Drift hills are also common in the district about Drummin; south of Drummin Chapel one of these hills is banked against a rocky height.

The valleys in the hills, especially those which indent the Formnamore Mountains, generally contain large deposits of moraine and glacialoid drifts. These drifts are usually local in character, the contained blocks and fragments being principally from the adjacent rocks, and

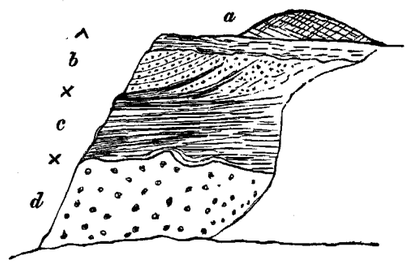
more or less angular, usually not striated, and sometimes large. The glacialoid drift is somewhat like the boulder-clay drift, except that it is always stratified, more or less. In places it seems to graduate into the moraine drift, while in others the latter overlies it. In some valleys, as in Glennacally, these drifts form long and extensive slopes, often having a thickness of 100 feet. At the eastern side of the glen last mentioned, on the west of the hill called Croaghadhuv, there is a series of blocks having a curious linear arrangement, which looks like the remains of a lateral moraine. The valley of the Owenbrin, on the opposite or eastern side of the Formnamore tableland, is also extensively covered with drift, especially the south-west slope, while the river sections show a thickness of 80 or 100 feet. It is principally glacialoid drift, being more or less stratified, as if deposited in water, and consists of the two varieties, part taking after boulder-clay and part after moraine drifts, both of which subsequently were re-arranged by water. To the south-east of this valley, at Shanvallycahill, the river exposes a cliff section about twenty feet high, the upper portion being moraine drift, and the lower apparently boulder-clay drift.

At the embouchure of the Owenbrin into Lough Mask, on the shores of the lake, is an accumulation of fine quartzose sand. This kind of deposit has frequently been observed in similar positions; and Mr. Kinahan, in his paper on "Æolian Drift,"* suggests that it may be of glacial origin, as the rivers flowing from glaciers are generally white and turbid from the quantity of silt, &c., in suspension.

Post Glacial Gravels.—In many places in this district terraces of gravel, &c., occur, some seemingly being ancient beaches. Those in the valley of the Erriff River are most conspicuous, and occur at elevations varying from 200 to 370 feet, the terraces gradually sloping from the north-eastern to the south-western part of the valley. There are also transverse spurs, in some places forming bars, the surfaces of two of the latter, three quarters of a mile west of Glennacally Bridge, slope from 140 to 100 feet. A sketch of part of the Erriff Valley showing these terraces is given in fig. 2, page 11.

In the north-east of the Erriff Valley, south of Derrinkee Bridge, there are two distinct terraces of sand and gravel, one at about 370 feet, and the other at about 440. In a tributary of the Cross River, one mile S.S.E. of Derrinkee Bridge, the following section was observed under the 440 feet terrace, showing the junction of the gravel with the underlying boulder-clay drift.

Fig. 13.



Junction of gravel and boulder clay drift in tributary of the Cross River.—G. H. K.
a Bog, 4 feet. *b* Coarse gravel, 8 feet. *c* Silt, 8 feet. *d* Boulder clay, 10 feet.

* Geological Magazine, Vol. VIII., No. 4.

South-west of the place where this section was noted, extending to Lough Glenawough, the country is chiefly occupied by slightly sloping bog, through which, however, gravel terraces occasionally appear.

"These terraces," writes Mr. Kinahan, "are more or less continuous from the village of Derrinkee, three and a half miles N.E. of Erriff Bridge to Glenanane, near the eastern end of Killary Harbour, occurring in a stretch of country about nine miles long. They gradually slope from the N.E. towards the S.W.; the surface of the terrace S. of Derrinkee Bridge being about 370 feet high, that at Glennacally 220 feet, while at Glenanane it cannot be 200 feet. From this it is evident that the terraces cannot be an old sea margin or raised beach. If, however, we examine the chart of Killary Harbour, we find that along each margin of that fiord there are gravel accumulations that have nearly level surfaces gradually sloping from low water mark at the east end of the fiord to a depth of 16 fathoms at its mouth, so that eventually if the land rose 300 feet, the present harbour would be a valley with sloping gravel terraces on both sides, those in the neighbourhood of Leenaun being 300 feet above the sea, while those at Inishbarna would have an altitude of less than 200, exactly similar to what we now find in the Erriff River, or upper portion of this valley. In support of this suggestion we find that the margin of the water in Killary Harbour is in only a few places (such as its eastern end at Dernasliggaun and at Bundorragha), marked by an accumulation of sands and gravels, while in other places it is generally indicated by a shelf cut in the adjoining higher ground; so, similarly with the ancient sea, we only find the marginal gravel accumulation at the termination, and in a few other places, while in general its limits were marked by a shelf cut into the hill slopes. The latter is, in most places, more or less obliterated by subsequent meteoric abrasion. It, however, is well marked N. of Tawnyard Lake, on the N. side of the Erriff Valley, opposite Glenanane (see Mr. Nolan's sketch, fig. 2.)

That these gravels are of marine origin seems proved by terraces of gravel and sand occurring in various places about the 350 contour line, not only in the neighbouring hills, but also in the counties Clare, Limerick, Kerry, Cork, &c., which could not have been formed by any but some universal agent like the sea."

In Glenmask, which lies farther to the E., remains of different terraces occur up to an elevation of 1,000 feet. In the northern part of that valley are some remarkable bars of drift, their summits being 500 feet in altitude; and on the W. side of Croaghrimbeg is a terrace at a height of 600 feet.

On the S. of the Formnamore Mountain, and a mile S. of Glenmask Bridge, a terrace occurs on the southern slope of Binnaw, at a height of 300 feet, and to the N.E. of the latter, on the western shore of Lough Mask, a well marked terrace can be traced along the eastern side of Tonesaly, about 800 feet above the level of the sea. Immediately E. of this terrace, on the shore of Lough Mask, at Drumcoggy, a low level terrace is found at an elevation of 80 feet. A gravel pit on the side of the road E. of the village of Drumcoggy, exhibits the following section.

Section of Gravel Pit East of Drumcoggy.

	Feet.
3. Gravelly and clayey sand, with vegetable mould at top,	5
2. Bright yellow clay,	1
1. Coarse gravel with middling-sized pebbles of local rocks,	5
	11

In connection with these terraces, it may not be inappropriate to notice the remarkable bowl-shaped depressions locally called *lugs* or *corries*, which so frequently occur in the sides of the mountains of this district. The almost uniform level of their floors seems to point to the prevalence of marine action, although as suggested by the Rev. M. H. Close, ice may have assisted in scooping out these hollows.* The general appearance of these corries will be understood from the sketch on page 12.

The long slopes of recent meteoric drift form a marked feature in many of the valleys. They are in general due to the weathering of the rocks of the country, the detritus being drifted away by wind, or rain and runlets. These slopes of this kind of drift are more frequent among the hills formed of the Upper Silurian rocks, especially when they are shales or slates, as such rocks have weathered more rapidly than the metamorphic rocks.

Bogs and alluvium.—The bogs may be divided into the flat or lowland bog, and the mountain bogs. Much of the country north of Lough Mask is occupied by lowland bogs, the largest of them, known as Srah bog, lying immediately north of the lake, has long been noted for the excellent character of its peat. Large flat bogs also occur in the neighbourhood of Derrycraff and Drummin. Many of the mountains are also covered in great part with a thick envelope of bog, some of which makes excellent turf, as at Tonesaly, the hill west of Toormakeady.

The alluvial flats in this part of the district are not very extensive, the chief being those of the Aille and Erriff rivers. The deposit mostly consists of sandy clay and gravel, and peaty stuff. At Glenmask, in the alluvium of the Aille river, pieces of Carboniferous conglomerate are of frequent occurrence, being probably derived from the cap of these rocks, which at one time extended over the Formnamore tableland, and of which some patches, as before mentioned, still remain.—J. N.

Drift in the Country around Westport.

Around Westport, but more especially to the N. and N.W., the drift is entirely boulder clay, varying in thickness, the greatest being probably about 120 feet.

The numerous islands in Clew Bay (the southern portion of which is described in this memoir) are saddle-backed hills of boulder clay resting on limestone, and are almost entirely composed of well striated blocks of dark blue and black limestone, cemented together in a matrix of gravelly stuff composed of the same rocks. These islands are peculiarly shaped, being generally oval with their longest axis running in an E. and W. direction, the most western of them having their face on the sea side cut away by the encroaches of the sea, and presenting vertical cliffs.†

South of Croaghpatrick the country for a considerable area is covered with a thick coating of boulder clay, which is derived apparently from the rock south of that, and presenting an undulating surface on which is a thick mantle of bog, and nowhere being delineated like that about Westport, which is in the drumlin form.

The hill country of the Croaghpatrick range has on all sides talus

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* "On some corries and their rock basins in Kerry, *Jour. Roy. Geol. Soc., Ire.*, new series, vol. ii., p. 236.

† See Report British Association, Edinburgh, 1871, "On the Boulder Drift and Esker Hills of Ireland," by Sir Richard Griffith, bart., F.R.S.

composed of the immediate rock, lying in places at angles as high as 35° which is well exemplified on the flanks of the central cone.

To the north of Croaghpatrick, and along shore of Clew Bay, are stratified sands and gravels, which appear to have been formed by the action of the sea on the debris brought down from the hills by the several brooks, and may be termed re-arranged drift.

West of Carrowmore (571 feet) which is to the W. of Louisburgh, there is a drift cliff 130 feet high, in which there is no sign of stratification; nor do blocks of granite, although very numerous along the shore, occur therein. The chief blocks composing the drift cliff are sandstones, and argillaceous shales (local), also well rounded blocks of limestone; the whole more or less cemented by some red arenaceous paste.

South of Louisburgh, the drift is unstratified, and is composed of debris from the country to the south, chiefly grits, &c., from the Mweelrea Mountains, and pebbles of felstone from Bundorragha.

Table of Ice Striæ in the South portion of

a. Primary Striæ. *b.* Striæ older than in *a.* *c.* Main Valley Striæ. *d.* Striæ

Inch Map.	Six-inch Map.	Townland.	Locality.	Striæ *a.*
85	Mayo, 98,	Tieveinish, East,	At the E. corner of the townland,	—
84	,,	,,	At the bifurcation of the roads,	—
85	,,	,,	A little S.S.E. of the last,	—
,,	,,	Tieveinish, West,	A little S.S.E. of the last,	—
84	,,	Corveagh, Upper,	Trig. point △ 772,	—
,,	,,	Corveagh, South,	—	—
85	,,	Bohaun, South,	At the north village,	—
,,	,,	,,	On the hill half a mile E.S.E. of last,	—
,,	Mayo, 99,	Kiltarsaghaun,	On the S. of the village,	—
,,	,,	,,	S. of last in many places,	—
,,	,,	,,	S.E. of the last,	—
,,	,,	,,	At the townland boundary,	—
,,	,,	,,	Do. at the east of the village of Tawnynagry.	—
,,	,,	Bohaun, North,	Half a mile N. of the summit of the hill.	—
,,	,,	,,	A little to the N.E. of the last,	—
,,	,,	,,	A little N. 8 W. of the summit,	—
,,	,,	Derrassa,	At the village,	—
83	Mayo, 94,	Caher island,	Portnacloy,	—
,,	,,	,,	Trig. point, △ 201,	—
,,	,,	,,	Caherpoint,	—
,,	,,	Inishturk,	Ooghduff,	—
,,	,,	,,	Gubagarlieve,	—
,,	,,	,,	N.E. of harbour,	—
,,	,,	,,	N.W. of harbour,	—
,,	,,	,,	Gubnagawney,	—
,,	Mayo, 104,	,,	South shore,	—
,,	,,	Inishdalla,	West shore,	—
,,	,,	,,	South-east shore,	—
,,	Mayo, 105,	Devlin, South,	Sea shore,	—
,,	,,	Kinnadooley,	Near old church,	—
,,	,,	Tallavabaun,	In several places,	—

Resting on the boulder clay we have the evidence of a newer drift, viz., erratics. In the neighbourhood of Westport the round-backed hills are covered with blocks of limestone, red and yellow sandstone, conglomerate, gneiss, mica schist, quartzite, and a few of dolerite, all well rounded; no evidence from where these blocks came.

In the neighbourhood of Louisburgh the country is strewn with numerous blocks of granite, from Knockaskeheen and Corvockbrock; about a mile to the south of the town they are deposited in enormous quantities, in some of the blocks pink felspar is very prominent; these are apparently from the hills where the Bunowen river cuts through them; the average diameter is about three feet.

In the neighbourhood of Aillemore Lodge are two large granite boulders, showing that whatever placed them there was moving in a westerly as much as a northerly direction.

R. G. S.

Murrisk, in Slieve Partry, and the Erriff Valley.

newer than those in the Main Valley. *e.* Local Striæ of small Glaciers.

Striæ *b.*	Striæ *c.*	Striæ *d.*	Striæ *e.*	Remarks.
N. 20 W.	N. 60 W.	—	—	On one rock surface.
—	N. 60 W.	—	—	
N. 10 W.	N. 60 W.	—	—	On one rock surface.
N. 10 W.	—	N. 5 E.	—	Drumlins bear from N. 5 E. to N. 20 E.
N. 25 W.	—	N. 10 E.	—	
—	—	N. 5 E.	—	
N. 10 W.	—	—	—	
—	—	N. 10 E.	—	
—	N. 30 W.	—	—	
—	N. 35 W.	—	—	
—	N. 40 W.	—	—	
N. 5 W.	—	N. 10 E.	—	
—	N. 35 W.	N. & S.	—	
N. 20 W.	N. 60 W.	N. & S.	—	All on one rock surface.
N. 20 W.	—	N. & S.	—	
N. 30 W.	—	—	—	
N. 20 W.	—	N. & S.	—	
—	N. 70 W.	—	—	On one rock surface.
—	N. 60 W.	—	—	
—	N. 70 W.	—	—	
—	N. 50 W.	—	—	
—	N. 65 W.	—	—	
—	N. 65 W.	—	—	
—	N. 60 W.	—	—	
—	N. 70 W.	—	—	
—	N. 70 W.	—	—	
—	N. 50 W.	—	—	
—	N. 65 W.	—	—	
—	N. 35 W.	N. 10 W.	—	
—	—	N. 20 W.	—	
—	—	N. 20 W. to N. 25 W.	—	

These striæ appear to have been engraved by ice that was going towards the N.W. and W.N.W. The rocks, on account of the small quantity of drift on these islands, are very much weathered, but in places there are dressed, grooved, and etched.

The ice striæ in column *d* seem to have been cut by ice going northward, and evidently are newer than the striæ N. 35 W.

The striæ N. 60 W. belonging to the ice going to Westport bay. Those N. 10 to 25 W. to older ice going from the hills into the same valley, and the striæ bearing N. 5 to 10 E. to the ice going N.N.E. down the Aille River valley.

In the column *c* all the striæ seem to belong to the ice of the Lough Mask glacier, while those in column *d* to ice going to Ballina, and those in column *b* to ice making for the Westport valley. Where two or more sets of striæ are recorded on "one rock surface," the age of each is apparent.

Table of Ice Striæ in the South portion of Murrisk

Inch Map.	Six-inch Map.	Townland.	Locality.	Striæ *a*.	Striæ *b*.	Striæ *c*.	Striæ *d*.	Striæ *e*.	Remarks.
83	Mayo, 105,	Conagaun, . . .	Near the coast, and on Tullavbaun,	—	—	N. 40 W.	N. 10 W.	—	
,,	,, .	,, . . .	At river, ...	—	—	N. 60 W.	N. 10 W.	—	
,,	,, .	Cleggaun, . . .	At the village, ...	—	—		N. 25 W.	—	
83 & 84	,, .	,, . . .	In many places, ...	—	—	N. 50 W.	N. 20 W.	—	On one rock surface.
84	,, .	,, . . .	At the S.E. of townland, . . .	—	—	N. 50 W.	N. 20 W.	—	The dressed hummock range, N. 50 W. The striæ, N. 20 W.
83	,, .	Carrigskeewaun, .	In many places, ...	—	—	N. 65 W.	—	—	In this townland most of the hummocks of rock are ice-dressed.
,,	,, .	Dooaghty, . . .	In many places, ...	—	—	N. 50 W.	N. 25 W.	—	The ice work in column *d* is evidently newer than that in column *c*, although in large tracts the latter is unobliterated.
84	,, .	Dadreen, . . .	Near the mountain-path, . . .	—	—	N. 40 W.	—	—	
,,	,, .	,, . . .	A little N.E. of the last, . . .	—	—	—	N. 5 W.	—	
,,	,, .	,, . . .	A little N.E. of the last, . . .	—	—	—	N. 10 W.	—	
83 & 84	,, .	Doobilra, . . .	In various places, ...	—	—	—	N. 5 E.	—	
83	,, .	Inishdegilmore, . .	Northern portion, ...	—	—	—	N. 20 W.	—	
,,	,, .	,, . . .	South-east point, ...	—	—	N. 35 W.	—	—	
,,	,, .	Inishdegilbeg, . .	—	—	—	N. 40 W.	—	—	
,,	,, .	Illaunglass, . . .	South portion, ...	—	—	—	N. 15 W.	—	
,,	,, .	,, . . .	East point, ...	—	—	N. 30 W. to N. 35 W.	—	—	
84	Mayo, 106,	Srahroosky, . .	At the Carrowisky, ...	—	—	—	N. 10 W.	—	
,,	,, .	Cushinger, . . .	At the mountain road, . . .	—	—	N. 15 W.	—	—	
,,	,, .	Glenkeen, . . .	At the alluvial flat, ...	—	—	N. 10 W.	—	—	These striæ seem to have been cut by the ice going up Glencullin to the N.W.
,,	,, .	Glenconnell, . .	N. of Lough Bellawaum, . .	—	—	N. 30 W.	—	—	
,,	,, .	Glenconnell, . .	North of the lake, ...	—	—	N. 20 W.	—	—	
,,	,, .	,, . . .	N.W. end of Doolough, . . .	—	—	N. 45 W.	—	—	Seems to have been cut by ice going N.W., north of Mweelrea.
,,	,, .	Clashcame, . . .	North of N.W. end of Doolough, .	—	—	N. 50 W.	—	—	
,,	,, .	,, . . .	Near last, ...	—	—	N. 60 W.	S. & N.	—	
,,	,, .	,, . . .	At the Felstone dyke, . . .	—	—	—	N. 10 W.	—	
,,	,, .	Glenconnell, . .	S. of lake, in various places, . .	—	—	—	N. & S.	—	
,,	,, .	Glenummera, . .	On the shore of the lake, . .	—	—	—	N. 30 W.	—	The striæ in column *c* belong to the ice of the Doolough Valley; those in column *d* are apparently a newer ice, while in column *e* are the records of the ice of Glenummera.
,,	,, .	Teevnabinnia, . .	At the parish boundary, . . .	—	—	N. 40 W. to N. 45 W.	—	—	
,,	,, .	,, . . .	At the S.E. end of Doolough, . .	—	—	N. 45 W.	N. 30 W.	—	
,,	,, .	Glenummera, . .	In the river valley, ...	—	—	—	—	—	
,,	Mayo, 107,	Muingatogher, . .	S.W. of Lugcolliwee Lake, . .	—	—	N. 45 W.	N. 35 W.	N. 80 E.	
,,	,, .	Shanvally, . . .	On the shoulder E. of Lugcolliwee, .	—	—	—	—	N. 75 W.	
,,	,, .	Cuilmore, . . .	At Caheraspie, ...	—	—	—	—	N. 5 W.	
,,	,, .	Tawneyer, . . .	At the lug S.E. of Lugcolliwee, .	—	—	N. 45 E.	—	N. 10 E.	Going north.
,,	,, .	,, . . .	,, ,, boundary,	—	—	—	—	—	
,,	,, .	,, . . .	A little N.W. of the last, . . .	—	—	—	—	N. 10 E.	On one rock surface the N. 10 E. striæ going S.
,,	,, .	Cuilmore, . . .	In many places on the cliff face, .	—	—	—	—	N. 5 W.	Going north.
,,	,, .	Derryherbert, . .	At the road S.E. of the R. C. Church,	—	—	—	—	N. 15 W.	On one rock surface both going to the N.N.W.
,,	,, .	Lettermaglinspin, .	Near the river flat, ...	—	—	N. 20 E.	—	N. 20 W.	
,,	,, .	Tawnyard, . . .	To the N.E. near the old road, .	—	—	—	—	—	Going N.N.E. To the north of this place the drumlins bear N. 10 W. while to the north-east they bear N. 5 to 10 E.
,,	,, .	,, . . .	S.E. of last at the lake, . . .	—	—	N. 45 E.	—	—	
,,	,, .	Barnaderg, . . .	E.S.E. of the last at the lake, .	—	—	N. 25 E.	—	—	
,,	,, .	,, . . .	A little E. of the last, . . .	—	—	N. 45 E.	—	—	
,,	,, .	,, . . .	S.E. of the village, ...	—	—	N. 45 E.	—	—	
,,	,, .	Lettermaglinshin, .	At the road, ...	—	—	N. 50 E.	—	—	
,,	,, .	,, . . .	A little to the N.W. of the last, .	—	—	N. 55 E.	—	—	Going N.E.
,,	,, .	Derrintin, . . .	South of the last at the road, .	—	—	N. 60 E.	—	—	
,,	,, .	,, . . .	South of the last, ...	—	—	N. 30 E.	—	—	
,,	,, .	,, . . .	At the east end of the lake, . .	—	N. 65 E.	—	—	—	Going N.E.
,,	,, .	,, . . .	A little south of the last, . .	—	N. 70 E.	—	—	—	
,,	,, .	Gowlan, . . .	At the road S.W. of the bridge, .	—	N. 70 E.	—	—	—	Going S.W. Two sets of striæ, one engraved by ice going N.E. and the other by ice going S.W., which is the oldest is not apparent.
,,	,, .	Derrinkee, . . .	S.E. of Keeranan lake, . . .	—	—	N. 50 E.	—	—	
,,	,, .	,, . . .	To the north of the townland, .	—	—	N. 30 E.	—	—	
,,	,, .	,, . . .	A little south of the last, . .	—	—	N. 60 E.	—	—	
,,	,, .	,, . . .	In the river, ...	—	—	N. 30 E.	—	—	
85	,, .	Croaghrimcarra, .	In the centre of the townland, .	—	N. 20 W.	—	—	—	The N. 20 to 30 W. striæ belongs to the ice that went to the Westport valley, and the N. 5 E. to the ice going to the Aille valley, the N. 20 E. seems to be cut by a local glacier.
,,	,, .	Glennagashleeny, .	At the road to the east, . . .	—	N. 30 W.	—	—	—	
84	,, .	Erriff, . . .	East of the trig. point △ 875, .	—	—	—	N. 5 E.	N. 20 E.	
85	Mayo, 109,	Tawnagh, . . .	At the village, ...	—	—	N. 5 E.	N. & S.	—	
,,	,, .	Shanvallyard, . .	North of the village, ...	—	N. 40 W.	N. 5 W.	N. 5 W.	—	Cut by the ice of the Aille valley.
					—	—	—	—	

in Slieve Partry, and the Erriff Valley—*continued*.

Table of ICE STRIÆ in the South portion of Murrisk,

Inch Map.	Six-inch Map.	Townland.	Locality.	Striæ *a*.
85	Mayo, 109,	Shanvallyard, . .	To the S.W. of the last, . . .	—
,,	,, .	Treanlaur, . .	On roadside, ...	—
,,	,, .	Drumcoggy Mountain,	At the south side, ...	N. 30 E.
,,	,, .	Derryveeny, . .	To S.W. of the village, . . .	N. 40 E.
,,	,, .	,, . .	To the E. of the last, . . .	—
,,	,, .	Cappaduff, West, .	To the S. of the last, . . .	—
,,	,, .	,, . .	At the road, ...	N. 45 E.
83	Mayo, 114,	Inishshark, . . .	Near Shark Head, ...	—
,,	,, .	,, . .	To the N.N.E. of the island, . .	—
,,	,, .	Inishgort, . . .	—	—
,,	,, .	Inishskinnymore, .	—	—
,,	,, .	Inishbofin, West Quar.	East coast, ...	—
,,	,, .	,, Fawnmore,	North coast, ...	—
,,	,, .	,, Mid. Quar.	N.W. coast, ...	—
,,	,, .	,, ,, .	Bunnamullen Bay, ...	—
,,	,, .	,, Cloonamore.	At the N.W. coast, ...	—
,,	,, .	,, ,, .	At the N. coast, ...	—
,,	,, .	,, ,, .	At the E. coast, ...	—
,,	,, .	,, ,, .	At the village, ...	—
,,	,, .	,, ,, .	At Church Lough, ...	—
,,	,, .	,, Knock, .	At the E. coast, ...	—
,,	,, .	,, ,, .	At the S.E. coast, ...	—
,,	,, .	,, ,, .	At the S.E. coast, ...	—
,,	,, .	Inishlyon, . . .	In many places, ...	—
,,	,, .	Davillaun, . . .	At the N. coast, ...	—
84	Mayo, 115,	Derreennanalbanagh, .	On the cliff, ...	—
,,	,, .	Glennaconnell, . .	S.W. of Lough Bellawaum, . .	—
,,	,, .	Bundorragha, . .	On the shore of Killary Harbour, .	—
,,	,, .	,, . .	S.E. of the last, ...	—
,,	,, .	,, . .	S.E. of the last, near Illanballa, .	—
83 & 84	South of 115,	Uggool, . . .	In many places, ...	—
84	,, .	Bundorragha, . .	Gubnamona, ...	—
,,	,, .	,, . .	Lacknanaunagh, a little E.N.E. of the last.	—
,,	,, .	Lettereeragh, . .	Gubateagil, ...	—
,,	South of 116,	Letterass, . . .	At the stream, ...	—
,,	,, .	Glennacally, .	At the road, half a mile west of the bridge.	—
,,	,, .	,, . .	At the river, to the N.N.E. of the bridge.	—
,,	,, .	,, . .	At the road, one mile N.E. of the bridge.	—
85	Galway, 13,	Gortmore, . . .	On the north shore of the lake, .	—
83	Galway, 9/1	Illaunananima, . .	—	—
,,	,, .	Inishbroon, . .	North-west end, ...	—
,,	,, .	Crump Island, . .	Northern and Western shores, .	—
,,	Galway, 9/2	,, . . .	Pollgarriffnahallymore, . . .	—
,,	,, .	Freaghillaun, North, .	South-west shore, ...	—
,,	,, .	Curragh, . . .	Rinvyle Point, ...	—

in Slieve Partry, and the Erriff Valley—*continued*.

Striæ *b*.	Striæ *c*.	Striæ *d*.	Striæ *e*.	Remarks.
—	N. 10 E.	—	—	
—	N. 10 E.	—	—	
—	—	—	—	
—	N. 10 E.	—	—	
—	N. 20 E.	—	—	On one rock surface. The N. 10 to 20 E. striæ are evidently due to the ice of the main valley, and the Drumlins have similar bearing. The striæ in column *a* have similar bearing to the primary striæ in the champaigne country on the east of Lough Mask.
—	N. 15 E.	—	—	
—	—	—	—	
—	N. 60 W.	—	—	The drift contains some rounded and etched blocks and fragments of rocks, but most of them are angular or subangular. On the eastern side of Inishgort, from which the drift has been recently removed, the rocks are well rounded, dressed, grooved, polished, and etched, by ice going to the N.W.
—	N. 40 W.	—	—	
—	N. 60 to 70 W.	—	—	
—	N. 50 W.	—	—	
—	N. 40 W. to N. 45 W.	—	—	
—	N. 50 W.	—	—	On these islands the N. 40 to 60 W. striæ are evidently cut by ice going north-westward. In one locality on the island of Bofin, and on another in Davillaun, were two systems observed on the same rock surfaces, and in these places the older striæ run nearly E. and W. The rocks are all more or less dressed, but usually are much weathered; in a few places, however, they are polished and etched. On Inishbofin a few large granite erratics were observed, while on Davillaun there are two remarkable assemblies of granite blocks, one consisting of six and the other of four large blocks.
—	N. 50 W.	—	—	
—	N. 40 W.	—	—	
—	N. 40 W.	—	—	
—	N. 40 W.	—	—	
—	N. 45 to 50 W.	—	—	
—	N. 50 W.	—	—	
—	N. 55 to 60 W.	—	—	
—	N. 45 to 55 W.	—	—	
—	N. 40 W.	—	—	
N. 70 W.	N. 40 W.	—	—	
—	N. 40 W.	—	—	
E. & W.	N. 55 to 60 W.	—	—	
—	E. & W.	N. 5 W.	—	On one rock surface.
—	—	N. 40 to 45 W.	—	Ice, probably going S.E., to the Bundorragha River valley.
N. 70 W.	N. 40 W.	—	—	On one rock surface.
N. 70 E.	—	—	—	Going west.
N. 70 E.	N. 80 W.	—	—	On one rock surface.
—	—	N. 10 W.	—	
—	N. 50 E.	—	—	Due to the ice going down the valley of Killary Harbour. The striæ N. 55 W. seems to have been deflected by the ice coming into the Main Valley from Maum Valley.
—	N. 70 E.	—	—	
—	—	N. 55 W.	—	
—	N. 70 E.	—	—	
—	N. 80 E.	—	—	
—	N. 85 E.	—	—	Engraved by ice going down the Erriff Valley.
—	N. 70 E.	—	—	
N. 5 E.	N. 25 E.	—	—	
N. 60 W.	—	—	—	On one rock surface, the N. 25 E. well marked and cutting the others.
N. 35 W. to N. 40 W,	—	—	—	A sandy drift containing rounded and sub-angular blocks, resting on a planed, polished, grooved, and etched rock surface. Knapps of rock crag N. westward, and the drift forms drumlins having a similar bearing.
N. 35 W. to N. 55 W.	—	—	—	The rocks to the north-west are well polished, grooved, and etched; the drift which covers the island is made up of small rounded pebbles, similar to the subjacent rocks, embedded in a sandy clayey matrix, while in the cliff on the south of the island it appears rudely stratified.
N. 40 W. to N. 45 W.	—	—	—	Striæ observed on the north, west, south, and south-eastern shores; on the western shore the rocks were planed, grooved, and etched.
—	N. 70 W.	—	—	
—	N. 70 W.	—	—	

Table of Ice Striæ in the South portion of Murrisk,

Inch Map.	Six-inch Map.	Townland.	Locality.	Striæ a.
83	Galway, 9/2	Tonadooravaun, . .	Barnaboy, ...	—
,,	,, .	Kanrawer, . . .	Seashore, ...	—
,,	,, .	Cloonlooaun, . .	South of Rusheenduff Lough, .	—
,,	,, .	Rushenduff, . .	Seashore, ...	—
,,	Galway, 9/4	Cloonlooaun, . .	—	—
,,	,, .	Derryinver, . .	At road, ...	—
,,	,, .	Tonadooravaun, . .	Seashore, ...	—
,,	,, .	Letterbeg, . . }	In various places, ...	—
,,	,, .	Lettermore, . . }		
,,	Galway, 10/1	Tullybeg, . . .	N.W. coast, ...	—
,,	,, .	,, . . .	N.E. coast, ...	—
,,	,, .	,, . . .	At road, ...	—
,,	,, .	Tullymore, . . .	W. of road, ...	—
,,	,, .	Mullaghglass, . .	On coast, ...	—
,,	,, .	Lettergesh, West, .	On coast, ...	—
,,	Galway, 10/2	,, . . .	—	—
,,	Galway, 10/4	Lettergesh, East, .	On S.S.E. face of low cliff, E. of Benehoona.	—
,,	,, .	Letterettrin, . .	S.E. end of Lough Muck, . .	—

in Slieve Partry, and the Erriff Valley—*continued.*

Striæ b.	Striæ c.	Striæ d.	Striæ e.	Remarks.
—	—	—	—	To the south of Curragh, at Barnaboy, there is a drift cliff which at the base is of a bluish colour, and contains rounded blocks embedded in a clayey matrix (boulder clay?) but for about 15 feet from the top it is of a brownish red or an olive green colour, the matrix being from sandy to clayey with angular and subangular blocks and fragments (Moraine drift?)
—	—	—	—	From Bunnahowna to Pollabanka, on the north-western shore of Kanrawer, the drift is in places upwards of 50 feet in depth, and appears to rest on an ice-planed horizontal rock floor. No striæ were observed. There is from 6 to 10 feet of a newer drift over the boulder clay drift.
N. 45 W.	N. 70 W.	—	—	In both localities striæ on one rock surface, The drift contains angular and subangular blocks and fragments.
N. 50 W.	N. 80 W.	—	—	
N. 45 W.	—	—	—	
—	—	N. 10 W.	—	The rocks on the north side of Ballynakill Harbour are in numerous places planed, grooved, etched, and polished by ice going N.W.-ward with the lie of the north shore. Drumlins of drift have a similar bearing. These evidently are due to an ice stream in Ballynakill Harbour. On the hill to the north is well exemplified the formation of rock basins.
N. 50 W.	—	—	—	
N. 45 W. to N. 50 W.	—	—	—	
—	N. 70 W.	—	—	
—	E. & W.	—	—	
N. 40 W.	—	—	—	
N. 25 W.	—	—	—	
N. 30 W.	N. 75 W.	—	—	In Mullaghglass the N. 30 W. are striæ, and N. 75 W. grooves which seems to point to the latter being the oldest, however, the drumlins of drift have a general bearing about N.W. and S.E. Some of the drift cliffs exceed 100 feet in height.
—	E. & W.	—	—	
—	—	—	—	
—	—	N. 10 W.	—	Cut by ice sliding down hill slope.
N. 50 W.	—	—	—	Cut by ice of the Culfin Valley.

Glacial Striæ noted in the Northern District.

County.	Quarter Sheet.	Townland and Situation.	Direction.	Remarks.
Mayo, .	75/3 . 4	Clare Island, Ballytoohymore, on sea-shore.	N. 60 W.	Flat surface.
,, .	84/1 . 2	Clare Island, Bunnamohaun, .	N. 65 W. N. 75 E.	Do.
,, .	85/1 . 2	Clare Island, Glen, S. of hill, . .	N. 40 E.	Roches moutonnees.
,, .	85/1 . 2	Clare Island, Lecarrow, sea-coast, .	N. 40 E.	Flat surface.
,, .	86/3	Carrowmore, hill-side, . . .	N. 75 W.	Roches moutonnees.
,, .	86/3	Derrylahan, sea-shore, . . .	N. 65 W.	Flat surface.
,, .	86/4	Falduff, close to roadway, . .	N. 30 W.	Do.
,, .	86/4	Kilsallagh, Lower, sea-shore, . .	E. & W.	Do.
,, .	86/4	Cuilleen, hill-side, ...	N. 25 W.	Roches moutonnees.
,, .	95/1 . 2	Emlagh, sea-shore, ...	N. 7 W.	Flat surface.
,, .	95/4	Killadoon, S. of Cross Lough, . .	N. 25 E.	Roches moutonnees.
,, .	95/4	Killadoon, on sea-shore, . . .	N. & S.	Rounded surface.
,, .	95/4	Killadoon, on sea-shore, . . .	N. 7 W.	Flat surface.
,, .	96/2	Mullagh, laneway to Louisburgh, .	N.W.	Do.
,, .	96/3	Derrygarvemore, on townland boundary.	N. 20 W.	Do.
,, .	96/4	Lactaeighter, on Corvockbrack, .	N. 30 W.	Rounded surface.
,, .	96/4	Lactaeighter, on Corvockbrack,	N. 60 W. N. 30 W.	Newer, rounded surface.
,, .	96/4	Lactaeighter, on Corvockbrack,	N. 30 W. N. 65 W.	Do.
,, .	96/4	Lactaeighter, on Knockaskeheen,	N. 45 W. N. 60 W.	Do.
,, .	97/2	Owenwee, ...	N. 5 W.	Roches moutonnees.
,, .	97/2	Owenwee, ...	N. 22 W.	Do.
,, .	97/2	Glinsk, at western mearing, . .	N. 30 W.	Do.
,, .	97/3	Pollaoughty, side of hill, . .	N. 35 W.	Do.
,, .	97/4	Pollaughty, on hill, . . .	N. 50 W. N. 40 W.	Newer, Roches moutonnees.
,, .	97/4	Oughty, in brook, ...	N. 15 W.	Flat surface.
,, .	97/4	Oughty, near eastern mearing, .	N. 25 W.	Do.
,, .	97/4	Letterbrock, on roadway, .	N. 5 E. N. 15 W.	Newer, rounded surface.
,, .	97/4	Carrowrevagh, top of hill, .	N. 10 E. N. 15 W	Newer, Roches moutonnees.
,, .	98/1	Lanmore, S. of slate quarry, . .	N. 5 E.	Flat surface.
,, .	98/1	Cordarragh, ...	N. 5 E. N. 27 W.	Newer, flat surface.
,, .	98/3	Roughaun, top of hill, . . .	N. 27 W.	Roches moutonnees.
,, .	98/3	Keelkill, hill-side, ...	N. 30 W.	Do.
,, .	98/3	Raigh, hill-side, ...	N. 35 W.	Do.

R. G. S.

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