Memoirs of the Geological Survey.

EXPLANATION

TO ACCOMPANY SHEET 95

OF THE MAP OF THE

GEOLOGICAL SURVEY OF IRELAND.

INCLUDING THE COUNTRY AROUND HEADFORD AND OUGHTERARD, ILLUSTRATING PARTS OF THE COUNTIES OF GALWAY AND MAYO.

By G. H. KINAHAN, M.R.I.A.,
(DISTRICT SURVEYOR,)

AND J. NOLAN, F.R.G.S.I.,
(ASSISTANT GEOLOGIST).

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

DUBLIN:

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE:

PUBLISHED BY

ALEXANDER THOM, 87 & 88, ABBEY-STREET;

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

LONDON:

LONGMANS, GREEN, READER, AND DYER.

1870.

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THE

GEOLOGICAL SURVEY OF THE UNITED KINGDOM

IS CONDUCTED UNDER THE POWERS OF THE

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

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

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

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

Condensed memoirs on particular districts will also eventually appear.

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

AGENTS FOR THE SALE OF THE MAPS AND PUBLICATIONS:
Messrs. LONGMANS, GREEN, & Co., London.
Messrs. HODGES, FOSTER, & Co., Grafton-street, Dublin.
ALEXANDER THOM, Printer and Publisher, Abbey-street, Dublin.

PREFACE.

THE tract described in this Memoir by Messrs. Kinahan and Nolan has been surveyed, chiefly by Mr. Kinahan himself, under the direction of the late Professor Jukes, who, on more than one occasion, examined into the geological structure of the district; and, as I understand, concurred generally in Mr. Kinahan's views.

For some of the statements and conclusions put forth in these pages, the authors are alone responsible; while those who examine the district, by the aid of the maps, will probably allow that no pains have been spared in elucidating its geological structure.

EDWARD HULL,
Director of the Geological Survey of Ireland.

51, St. Stephen's-green, Dublin,
October, 1869.

EXPLANATION

OF

SHEET 95, INCLUDING THE COUNTRY AROUND

HEADFORD AND OUGHTERARD,

OF THE MAP OF THE

GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

THIS sheet includes portions of the counties of Galway and Mayo. A considerable portion is occupied by Lough Corrib—the second largest sheet of fresh water in Ireland. It extends diagonally in a south-easterly direction; has a very indented outline; and is studded by numerous islands.

The southern portion of Lough Mask enters the map at the north-west; is also irregular in outline, and contains many islands, more especially towards its eastern shore.

North of Lough Corrib is the village of Cong, built on an island formed by the subterranean river that flows from Lough Mask coming to the surface, and breaking into two streams; one going eastward and the other westward.* North-west of Cong is the village of The Neale, and between these two villages is the plain on which the battle of South Moytura was fought between the Tuatha de Danann and the Firbolgs. A.M. 3303. †

Near the N.E. of this district is the village of Kilmaine, and farther southward the diminutive towns of Shrule and Headford, while west of Lough Corrib is the small market-town of Oughterard.

1. *Form of the Ground.*

East of Loughs Mask and Corrib, also S.E. of Oughterard, and immediately west of the latter lake, there is a low undulating country, which towards the south rarely exceeds 150 feet in height, but towards the north hills of 170 feet are not uncommon. The highest point is a hill about four miles eastward of Headford that reaches an altitude of 327 feet; while a hill, three miles N.W. of the same place, is 228 feet high. Lough Corrib, whose ordinary surface is only twenty-eight feet above the Ordnance datum level, or twenty feet above the

* This stream would naturally flow to the westward during low water; however, for milling purposes, a regulation wall now sends part of it eastward.

† Annals of the Four Masters, vol. i., p. 17.

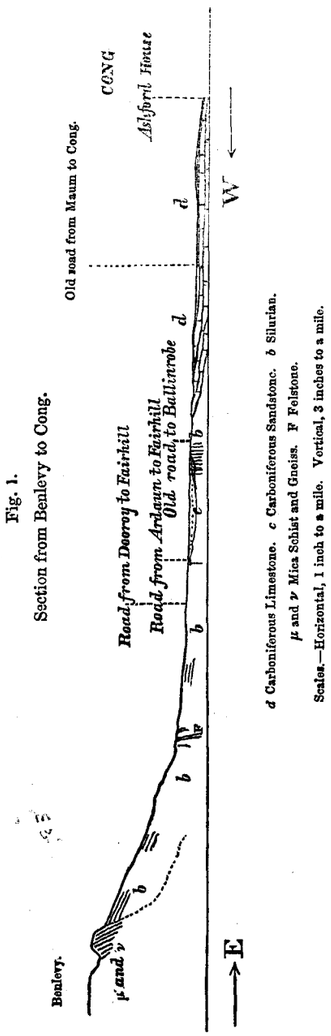
mean sea level in Galway bay,* is, in its southern part, shallow and studded over with islands; while its northern part, called by the fishermen on the lake "Shanlougha" (*Anglice*, the old lake), is usually deep, one spot about half-way between Inishmicatreer and Cong being 152 feet deep.

The surface of Lough Mask, whose waters are deeper than Lough Corrib, is sixty-four feet above the Ordnance datum line, that is, thirty-six feet higher than the surface of Lough Corrib, into which it flows by subterranean passages.†

It was proposed to join these lakes by a navigable canal, from the Black Rocks in Lough Mask along a natural hollow in the ground to Cong, on Lough Corrib, and after £30,000 had been spent on the work it was abandoned, as the rock was found to be so cavernous that it would have been nearly impossible to make the canal water-tight. If, previous to the commencement of this work, the geology of the country had been considered, it would have been seen that the proper place to cut the channel was from the gut a little east of Fairhill, on Lough Mask, to the Coal Quay on Lough Corrib; in which place the canal would have been nearly altogether through non-porous shales and grits, besides being much shorter.

The western part of the country between Loughs Mask and Corrib is hilly, rising gradually, in a distance of six miles, from 40 feet at Cong to 1,370 feet, the summit of Benlevy, close

Fig. 1.
Section from Benlevy to Cong.

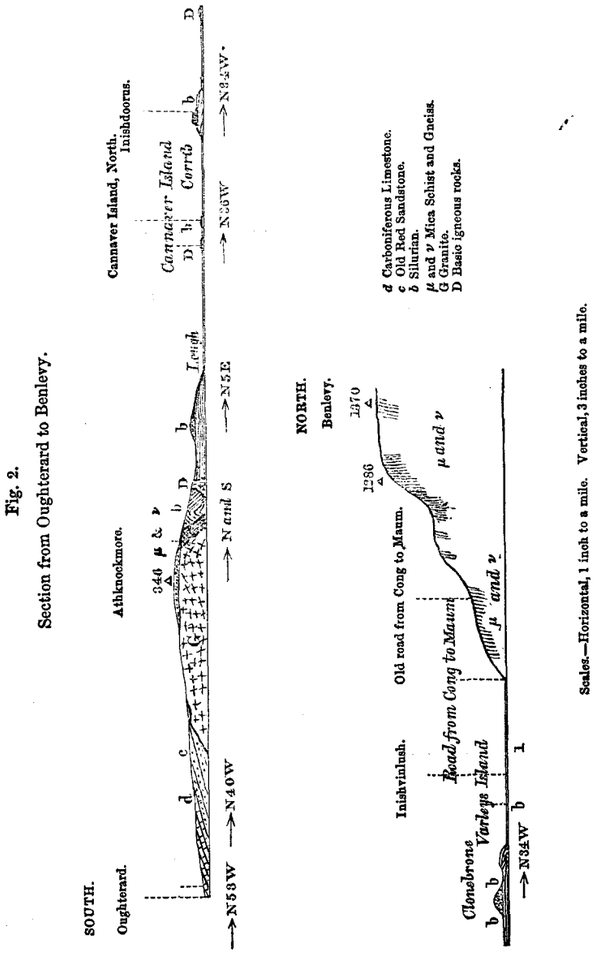


* The mean tide level in Galway Bay is 8·48 feet above the Ordnance datum line.

†The deepest hole in Lough Mask is one of 191 feet, a second hole being 188 feet. If we add thirty-six feet, the difference between the surface levels of Loughs Corrib and Mask, to 152—the depth of the deepest place in Lough Corrib—it will give 188 feet, the depth of one of the deep holes in Lough Mask, and within three

to the west margin of the map. The south slopes of Benlevy, although gradual, are much steeper than the eastern, as there the ground falls, in the space of two miles, to the level of Lough Corrib; while on the N.E. there is a nearly perpendicular cliff over the coom, or *cul-de-sac*, in which Coolin Lough is situated.

Fig. 2.
Section from Oughterard to Benlevy.



feet of the depth of the deepest; thus seemingly suggesting that these "rock basins" were excavated at the same time, and by similar denuding agents. (See paper by the author "On the formation of the Rock Basin of Lough Corrib." Geological Magazine for November, 1866.)

West of Lough Corrib, and N.W. of Oughterard, the country is also hilly, but no point reaches the altitude of Benlevy, the highest being Carn Seefin (1,009 feet). It is also more irregular, being made up of a number of peaks, the principal being—Knockletterfore (857 feet), Boleynabuddagh (774 feet), Knockaunanilra (627 feet), Gowlaun (609 feet), Keerauntoole (526 feet), Lettercraff (508 feet), and Boocaunmore (461 feet). The last, although so low, is conspicuous on account of its peculiar shape, and standing, as it does, nearly in the centre of the valley that extends westward from Oughterard.

The rivers in the low country east of the lakes were formerly, for a great part, subterranean; but some years since artificial cuts were opened that now carry off the greater part of the drainage, although in no case has the water ceased to flow in the subterranean channels.

2. *Formations or Groups of Rocks.*

Aqueous Rocks.

Name.	Colour on Map.
Alluvium, Bog, and other superficial covering.	*Pale Sepia.*
Drift, or Glacial deposits.	*Engraved dots.*
d. Carboniferous Limestone.	*Prussian Blue.*
d. Carboniferous Sandstone, &c.	*Prussian Blue and Indian ink, with dots of Yellow.*
b^5. Upper Silurian Rocks [Upper Llandovery].	*Purple.*

Igneous Rocks.

D. Any variety of Greenstone, Δ when supposed to be metamorphosed into Hornblende Rock.	*Rose lake.*
F. Any variety of Felstone.	*Vermilion.*
G. Granite (intrusive).	*Carmine.*

Metamorphic Rocks.

Q. Quartzite or Quartz Schist.	*Chrome yellow.*
μ. & ν. Gneiss and Schist.	*Crimson lake.*
λ. Crystalline Limestone and Limestone Schist.	*Cobalt.*
Σ. Serpentine.	*Carmine, with wavy Green lines.*

Igneous Rocks.

G. *Granite.*—In the country to the south and south-west there seem to be two distinct classes of granite, one supposed to be partly metamorphose—that is, part of the rock having been formed *in situ* from the metamorphism of the existing rocks (*See Geological Survey Memoir, Explanation of Sheet* 105, *pp.* 7 *et seq.*); while the other is undoubtedly intrusive. The Rev. Professor Haughton, M.D., F.R.S., has divided the Irish granite into two distinct classes; *intrusive* and *non-intrusive.** In the former he classes *the granites of Leinster;* quaternary granites, composed of—1, quartz; 2, orthoclase; 3, margarodite; 4, lepidomelane; and *the granites of Mourne and Carlingford;* quinary granites composed of—1, quartz; 2, orthoclase; 3, albite; 4, white mica (margarodite?); 5, black or green mica (lepidomelane?); while in the second class he puts the granites of *Donegal, Mayo, and Galway.* These latter are also quinary granites; but their mineralogical constituents are—1, quartz; 2, orthoclase; 3, oligoclase; 4, margarodite; and 5, lepidomelane; and of the latter he says—"They differ from the granites of Leinster and of Mourne and Carlingford in being stratified, and not intrusive, and therefore vary considerably in different localities, according to the beds from which they have been formed by metamorphic action." This description of Dr. Haughton's refers to the typical *Galway granite* in the country to the south and south-west, west and north-west of the town of Galway, but none of it comes into our present district. The granite here to be described, which may be called *the Oughterard granite,* from its being so largely developed in the neighbourhood of that town, seemingly is similar to the intrusive granite of Leinster, as will be seen by the general description immediately hereafter given.

The late Mr. Jukes, while inspecting this district, pointed out that these intrusive granites appear in mass occupying low parts, or valleys, in this country, while in the adjoining hills there are only veins, courses, and pipes; and as in other districts he remarked similar facts in relation to the intrusive granite, he was inclined to consider them as rather important. According to this view the deeper, and more extensive, the denudation, so much larger ought the tract of intrusive granite to be.

As just remarked, all the granites in this area seem to be undoubtedly intrusive. When these granites are in tracts† and wide courses, the constituents seem to be quartz, orthoclase, white mica, black mica, and usually iron pyrites; also, as Dr. Haughton mentions in reference to the Leinster granites—"Like the Cornish and Devonshire granites, they are occasionally traversed by mineral lodes, particularly lead lodes." When the rock occurs in veins† or dykes, and pipes, it seems to be a compound of quartz, orthoclase, and minute flakes of a greenish mineral, that occur generally in small nests. This latter mineral may be a green mica, or perhaps some sort of earthy chlorite.

Sometimes the granite appears to lose its felspar, and to merge into "a crystalline granular compound of quartz and mica,"‡ from which it seems to change, by the loss of its mica, into *Quartzite,* while,

* See the Presidential address for 1868 of W. W. Smyth, M.A., F.R.S., to the Geol. Socy., London, p. 74 of their Quarterly Journal, vol. xxiv.

† The terms *dykes* and *veins* are used synonymously. The term *course* has been used when the dykes or veins are very wide, or when the intrusive rock has the same, or a nearly similar strike as the associated rocks, and the term *pipe* to signify a small roundish, oblong, or irregular outburst of intrusive rock, which does not form a vein or dyke. The latter are too small to be represented on the one-inch map, and generally so small that they cannot even be inserted on the six-inch maps.

‡ This is Cotta's definition for a rock he calls "Greisen," page 207.

on the other hand, in some cases it appears to lose its quartz and mica, and become "a rock of compact texture, about the hardness of felspar, with dull or smooth conchoidal, or fissile fracture, colour yellowish, reddish, gray, greenish or bluish, weathering white."* In places there are fine compact veins traversing the mass, which, to the naked eye, seem to be composed of quartz and felspar; however, with a lens, minute flakes of mica can be detected.

Its principal accessories are pyrite, marcasite (*iron pyrites*), galenite, chalcopyrite (*copper pyrites*), barite, calcite, flourite, &c. These often occur in geodes, nodules, or lenticular patches, in which are found vugs that are lined with crystals of quartz. Some of these minerals locally may perhaps be also essentials.

F. ***Felspathic Rocks*** (***Felstones***).—These may be compact or granular, and of a greenish, bluish, yellowish, or gray colour. In some parts the felspar appears in distinct crystals, changing the rock into ***Porphyry***. In some there are also small globules of quartz disseminated throughout the mass (***Quartziferous Felstone***). The Felspathic rocks may possibly be of two or more ages; the more ancient being splintery with an uneven to a hackly fracture, while those which may be newer are compact with a conchoidal to an even fracture; in the former, globules of quartz are nearly sure to occur, while in the latter, they seem to be rare.

Besides these there are rocks which are supposed to be *Metamorphic Felspathic rocks*. These are of various textures and composition; however, they seem petrologically to be the same, although lithologically they are different.† In this district they seem to occur in courses, dykes, and pipes, among the metamorphic sedimentary rocks.

Krantz, in his collection of European igneous rocks at the Geological Survey Museum, Stephen's-green, Dublin, has named rocks quite similar to those, now to be described as Felspar Porphyries, while others he calls Quartziferous Porphyries. These rocks, however, are petrologically the same, for in one part of a dyke, course, or tract, there may be a felspathic rock, compact, without any of its constituents being crystallized out, while another part may be similar to what Krantz calls a Felspar Porphyry, and more of it to one of his Quartziferous Porphyries. Cotta‡ has also divided these rocks in distinct classes, calling some "Granitic Porphyry," others "Quartziferous Porphyry," or "Elvanite," and others "Felstone or Felsite-rock." However, as above observed, in this and the adjoining districts *the rocks, although differing in aspect and composition, seem to be naturally parts of one and the same rocks.* One variety of this rock is when it is compact or splintery, but not having any mineral

* Cotta's definition for Felsite rock.

† If these are metamorphic felspathic igneous rocks, would it seem improbable that in places they should be scarcely, if at all, altered, while in other places they might be almost changed into a granite. In the first case they would be scarcely, if at all, distinguishable from an unaltered felspathic igneous rock, while in the latter they are practically undistinguishable from a granite. In the district now immediately under consideration all these changes have not been observed, but in the adjoining country various gradations have been noted which apparently seem to show all the changes between a seemingly unaltered felstone or porphyry, up to a granite. See Memoir Geological Survey; Explanation of sheets 104 and 105.

‡ Rocks classified and described by Cotta.

conspicuously crystallized out.* In places the felstone will contain more or less small globules of quartz, sometimes so numerous as to give the rock a pisolitic appearance.† The matrix of some of these is semi-compact, for although each small particle may be of a horny appearance and impalpable structure, and individually breaking with an even fracture, yet the rock is so full of minute veins, sometimes irregular, at others rudely tesseral, that the mass of the rock has a fracture from uneven to hackly.‡ The matrix of others has a coarsely granular structure, while in others it is lamellar or riband. Some of the free quartz is in regularly coated minute balls, while on others, with a lens, the faces of crystallization can be detected. These rocks might perhaps be called *Quartziferous Felstones*. Some of these may, possibly, be unaltered rocks; however, rocks answering to *all* the above descriptions, have been proved to be older than the Intrusive Granite.

In some of these felstones one or more felspars may crystallize out, changing the rock into a porphyry; and associated with them there is always more or less free globular quartz, but sometimes the globules are so minute as not to be detected by the naked eye, while in others they are widely disseminated through the mass.§ Often with the felspars and quartz are more or less flakes of mica, chlorite, &c., or crystals of hornblende, or epidote; the last-named usually occurring in minute nests of crystals that have a radiated or divergent, rarely a stellated structure. When three or more minerals appear as essentials of the rocks, they usually have a greater or less granitic aspect. These rocks might also perhaps be included under the general name of *Quartziferous Porphyries*.‖ Many of these rocks, although petrologically Felstones, are lithologically granites. In all of them, however, part of the quartz has crystallized out previous to the other minerals, which seems to exclude them from the *true granite groupe;* for Scheerer, along with others, considers, that in all true granites the quartz crystallized out last. A short epitome of this eminent Swedish geologist's opinion, is as follows:—"The crystals of felspar, and others not containing water, would crystallize out first; the mica, which contains much water, probably next; and the silex, which the heated water would longest hold in solution, last. This silicate in its liquid state, moreover, would fill the shrinkage rents, or other crevices, formed in the granite, as it consolidated, giving rise to quartz veins, &c."¶ In these rocks, besides part of the silex crystallizing out first, another difference between them and true granites, is, that generally much of the felspar does not crystallize, but remains as a pasty matrix, thereby causing them to weather similar to the felstone groupe, with a regular slightly undulating even surface, of a dirty whitish colour, and never having the roughish, uneven, surface, so characteristic of the true granites.

* This seems to be what Krantz would call Claystone.

† Similar to Krantz's Claystone Porphyry.

‡ Somewhat similar rocks Krantz calls "*Hornstone Porphyry*," while others he calls "*Globular Porphyry*," and if it is a riband rock "*Striped Porphyry*."

§ These are similar to the rocks called by Krantz "Felspar Porphyry."

‖ These rocks, with a granitic aspect, are similar to what Krantz has named Quartzose Porphyries.

¶ Scrope's "Volcanoes," pp. 282, 283.

D. *Basic or Hornblendic Rocks.*—Of the basic rocks there seem to be three classes belonging to different ages—viz., *Doleritic Dioritic*, and *Diabasic.* The first is a heavy compact rock, varying in colour from dark green to nearly black. Some are flaggy, more especially near the walls of the dykes, and in these there is usually a rude columnar structure vertical to the walls. The dioritic rocks usually are not of as compact a nature as the doleritic. They are from a green to a dark green or purplish colour, some being mottled, and all break from an uneven to a hackly fracture. A few are inclined, in parts, to be flaggy; and others to have a rude columnar structure. The diabasic rocks are light greenish, and from that to a reddish colour. They are coarse-grained, fine-grained, to semi-compact; also sometimes flaky, and before the blowpipe melt freely. In places they contain flakes of a mineral, with a pearly lustre, or flakes of a grayish green mineral, with a metallic-pearly lustre (diallage?). Small quantities of sparry carbonates are often also contained in the compound; not visible, but recognisably through effervescence with acid. Sometimes there are flesh-coloured crystals of felspar; titaniferous iron ore (?) and iron pyrites are also accessories. Calcite and quartz occur in nests and veins.

Δ. Besides those just mentioned there are rocks supposed to be *metamorphic basic, or hornblendic rocks.* These occur among the metamorphic sedimentary rocks, in tracts, courses, pipes, elongated nodules, and lenticular patches between the beds. There are different varieties, but the most common is *Hornblende rock,* a compound of hornblende and felspar (*labradorite?*), titaniferous iron, epidote, and iron pyrites; the two latter also occur in nests and strings, while crystals of felspar and quartz, also flakes of mica, appear as accessories.* Sometimes the rock is coarsely crystalline, when the hornblende crystals are the most conspicuous; at other times the crystals are so small that the rock is quite compact, except when it has a schistose structure, which is not uncommon in the finely crystalline varieties. When it is schistose, and changes into *hornblende schist,* it is usually "thickly foliated, and at the same time fibrous, this texture being occasioned by the parallel position of hornblende of various thickness."† This variety seems rarely to contain quartz as an essential, but quartz and felspar occur in nests, strings, and veins. In some varieties the felspar crystallizes out, and the rock becomes a crystalline granular compound of felspar and hornblende. (*Porphyritic Hornblende rock*).—The porphyritic hornblende rock often takes up quartz and changes into a rock similar to Dana's description for *Syenite*;‡ a crystalline granular compound of felspar, hornblende, and quartz.§ These varieties of the supposed metamorphic hornblendic rocks usually merge into one another, the schistose variety generally occurring near the margin of the tracts, but not always, as it has been observed near

* This rock is similar to No. 308 in Krantz's collection, and called by him "Hornblende rock." Dana calls this rock "Amphibolyte" (*Mineralogy by Dana and Brush*, p. 240).

† Cotta's definition for "Hornblende schist;" also Dana, p. 240.

‡ This rock apparently is the same as No. 211 in Krantz's collection, and called by him Sinaite.

§ Cotta's definition for Syenite contains no quartz.

what apparently is the centre, and at other times in lenticular masses.

A variety of the hornblende rock consists of an aggregate of minute radiated crystals; another has, in a hornblendic felspathic base, fibrous portions made up of long acicular green crystals (*Actinolite?*), that lie in convex rays,* or it has innumerable small hyaline crystals (*Tremolite?*) scattered irregularly through the mass; while another is a compact, dark, cherty-looking rock, a variety of serpentine. This, in places, has small drusy cavities, or strings, full of acicular hyaline crystals (*Tremolite?*). There is also a pale green rock, that occurs sometimes in dykes, but more often in veins and lenticular patches, in the metamorphic, hornblendic, irruptive, and sedimentary rocks. It seems to be a mixture of felspar and epidote, the last often occurring in minute acicular hyaline crystals. This seems to be identical, or nearly so, with the rock called by Krantz *Epidote rock.*†

Metamorphic Rocks.

It has been mentioned that some of the irruptive rocks are supposed to be metamorphosed; but besides these there are rocks that seem to be metamorphose sedimentary rocks. Of the latter there are numerous varieties of gneiss and schist, including quartzite and crystalline limestone, the latter always being more or less schistose in character.

Gneiss and Schist.—Among the gneiss were observed numerous structural varieties, such as "*gray gneiss,*" when the rock is of a gray colour;‡ "*porphyritic gneiss,*" containing large distinct crystals of felspar; "*strangel gneiss,*" full of oblong minute pebbles of quartz; "*slate gneiss;*" "*very fine grained, nearly compact gneiss;*" and "*granitic gneiss;*" also *oblique gneiss,* with the foliated texture lying oblique to the planes of stratification; and *nodular gneiss,* with the foliated texture curling, or bending round, contained nodules of gneiss, felsite, hornblende rock, or quartz; the nodules varying from the size of a man's fist to two or three feet in diameter. When the contained nodules are hornblende rock, this gneiss is usually found associated with tracts or courses of one of the varieties of the hornblende rock.

Of varieties in composition the following were observed—"*Micaceous gneiss,*" "*Quartzose gneiss,*" "*Hornblendic gneiss,*" "*Protogene gneiss,*" "*Two mica gneiss,*" and a gneiss in which epidote seems to take the place of the mica. There are also different grades between the above varieties, in which various minerals appear locally, either as essentials or as accessories.

Of the schists there are—"*Mica schist,*" "*Fine mica schist,*" "*Wavy or crumpled mica schist,*" *Curled or spheroidal mica schist,* in which the different particles curl round in separate ovals; a variety of this kind of schist is, when nodules of gneiss or quartz occur in the mass round which the foliation curls. "*Knotty mica*

* This rock is identical with No. 320 in Krantz's, and called by him *Glassy Actinolite rock.*

† No. 361 in collection.

‡ Cotta gives descriptions for the varieties of gneiss and schist, which are here marked in inverted commas.

schist," "*Gneissic mica schist,*" "*Chloritic mica schist,*" with chlorite in addition to the mica, "*Two mica schist,*" "*Hornblendic mica schist,*" "*Talcose mica schist,*" "*Quartz schist or Quartzite,*" "*Granular quartz schist,*" "*Felsite schist,*" or *Leptinite* of Krantz,* "*Chlorite schist,*" "*Hornblende schist,*" *Talc schist, Epidote schist,* consisting chiefly of epidote, with a little mica and quartz, "*Phylite or Argillaceous schist,*" or *Argillite,* and *Pyrrhotite schist,* consisting of quartz, pyrrhotite (*magnetic pyrite*), pyrite, marcasite, with chalcopyrite and mica as accessories. There are also what seem to be metamorphic conglomerates and breccias.†

Of the limestone four marked varieties were observed—namely, *Crystalline limestone,* containing a little mica, and very often nodules and veins of felsite, quartz, &c.; *wavy schistose limestone,* with wavy or crumpled lines of felsite, mica, or quartz; *spheroidal schistose limestone,* in which the foliated texture curls or bends round nodules or lentils of felsite, quartz, &c., &c.; and *limestone schist,* in which half or more of the constituents of the rock are non-calcareous. The last seems to be the rock called by Krantz *Spilite.*‡

The foliation in the metamorphic sedimentary rocks seems to have been predisposed to follow the most marked structure in the original rocks; and as simple or parallel lamination, apparently, was the principal structure in the ancient rocks of this district, so generally we find the foliation parallel to the bedding. The next most prevailing structure would seem to have been curled or spheroidal lamination, which has produced curled or spheroidal foliation. This foliation would also, in some cases, seem to have been caused by the original rock containing nodules which in the metamorphic rocks were altered differently to the rest of the rock, and round which the foliation now curls; next a wavy or crumpled lamination, which has caused a wavy or crumpled foliation—this is very conspicuous in some varieties of the limestone. The oblique lamination would seem to have predisposed the rocks in which it occurred to now have an oblique foliation, and in a very few instances the foliation may have followed the cleavage planes, but as this structure seems to have been nearly altogether absent in the original rocks, the few cases in which it has been supposed to have been observed may possibly have been caused by an oblique lamination. The foliation in the contained nodules, in some of the rock with nodular foliation, is very remarkable, as it is quite oblique. The joints in the original rocks, in some cases, would seem also to have been the cause of a remarkable structure in the metamorphic rocks, more especially in the schistose varieties, being, perhaps, even more visible if the rocks are of a hornblendic nature. Among this class of rocks it is not unusual, in weathered portions, to find the old joints marked by compact conspicuous lines standing up above the rest of the mass, seemingly as if during the metamorphic action the rocks

* See No. 87 in collection.

† These would nearly agree with Cotta's description of "Conglomeritic Itacolumite," but no slabs were remarked that would bend backwards and forwards. However, some of the micaceous quartzite seems identical with No. 67 in Krantz's collection, and called by him "Itacolumit."

‡ "Altered clay slate with carb. lime." *See No. 55 in his collection.*

had been partially fused along the old joints, and thereby hardened. Old joints are also very conspicuous in most of the finely crystalline hornblendic rocks. In the felspathic rocks the action would seem to have been slightly different, for in some the old joint lines still remain open, but alongside these, often for over an inch on each side, the rock seems to have been hardened and made capable of resisting "meteoric abrasion" better than the mass of the rock. Since the metamorphic action ceased other systems of joints have invaded the rocks, cutting them up in all directions: The "fault rock" in the old dislocations or faults, although now a solid rock, can also, in many cases, be observed forming curious crumpled and irregularly jumbled foliation.

Upper Silurian Rocks—b.[5] *Upper Llandovery (Beds).*—These are supposed to be the equivalents of the Llandovery beds, and consist of green and gray grits, sandstones, and shales, many of which are fossiliferous; with, near the base of the formation, red and purple shales, sandstones, and conglomerates. In some places these massive red sandstones, or grits, are found lying uncomformably against the gneiss, or schist, showing that the Llandovery beds have been deposited against a cliff of the metamorphic rocks.

It is proposed to give detailed lists of all the fossils in a future memoir, when the whole of the Silurian rocks have been examined. In the meantime Mr. Baily is able to give the following as the most characteristic and abundant fossils from these Llandovery rocks west of Cong:—

Favosites fibrosus.
* * *Cyathophyllum (Petraia) elongatum.*
Tentaculites ornatus.
* * * *Encrinurus punctatus.*
Illœnus Bowmanni.
* * *Orthis reversa.*
Rhynchonella Llandoveriana.
* * * *Atrypa hemisphœrica.*
* * * *Trochus multitorquatus.*
Orthoceras subgregarium.

The asterisks prefixed to the names of fossils indicate the comparative abundance in which they occur.

Carboniferous Rocks.—These consist of dark blue and gray limestones, sometimes obliquely laminated; interstratified with which are calcareous conglomerates, or conglomeritic limestones. This latter rock has a gray limestone base, which is full of rounded and semi-angular particles of white quartz, usually varying from the size of small shot to that of a pea, but in a few cases being much larger. Moreover, in some few instances, the quartz fragments make up nearly the mass of the rock; while more usually there are about equal proportions of quartz-pebbles, and limestone; but in others, the quartz fragments are only disseminated throughout. In places, at the boundary of the Carboniferous rocks, there are red and yellow sandstones, and conglomerates, with a few gray and red shales, some of which dovetail into the limestones. These latter rocks have some resemblance to those which in other places are called *Old Red Sand-*

stone. Near the juncture of these sandstones with the limestones, but seemingly always in the latter, are iron-gray or dull brownish-gray, hard, vesicular rocks, that Professor King, of Galway, finds on examination to be dolomites.

Drift Deposits.—The drift deposits of this district seem to belong to three distinct classes; the first being the true *Boulder-Clay*, consisting of a clay, or a slightly sandy clay, in which are embedded beautifully polished, scratched, and rounded blocks and fragments of rock; the second, *Boulder*, or *Moraine-Drift*, consisting of broken and sub-angular fragments and blocks of local rocks, mixed with sandy clay: that are rarely polished or rounded;* and the third, *Esker-Drift*, or *Post-Drift-gravels and sands.* The first and third occur on the low country west of the lakes, and the last seems to be the Boulder-clay washed and sifted, as we find it merging into a *Rocky-drift*, or half washed Boulder-clay, and from that into the Boulder-clay itself. The second occurs principally in the valleys, or on the slopes of the mountainous district. A similar Drift in Wales is supposed by Professor Ramsey to have been formed by the glaciers that once existed in its mountain valleys. That such glaciers did also exist here appears probable, as will be seen in the table of ice stria given in the detailed description.

3. *Relations between the form of the Ground and its Internal Structure, with some Account of the latter.*

The low undulating ground on the east of Loughs Mask and Corrib has everywhere, except in a small tract S.E. of the village of Cong, Carboniferous limestones, or their accompanying sandstones and shales, for its subjacent rock, as also has the low country S.E. of Oughterard; while under the small tract S.E. of Cong, and in the hill district, the rocks either belong to the Silurian, or are metamorphic or granitic rocks of much greater age.

Denudation.—At least three great periods of disturbance and denudation seem to have affected this country from early geologic times down into the glacial epoch. The most ancient of these was that which affected the metamorphic and granitic rocks; as we find on the east of Benlevy that the Silurian rocks were deposited in places against a cliff over 200 feet in height. The second was that during which was carried away a great part of the Silurian rocks, as also parts of the metamorphic and granitic rocks. This is evident, for previous to the deposition of the Carboniferous rocks, at least in the hill country N.W. of Oughterard, the metamorphic rocks could scarcely have much exceeded their present limit; for in various places, lying on these rocks, patches of what was the local base of the Carboniferous series have been observed, and in the neighbourhood of Oughterard the Carboniferous rocks appear to have overlapped the Silurian, and are now found to lie directly on the granite. The third period of denudation was that in which was excavated and carried away so much of the Carboniferous rocks, so as to leave the

* From the examples of this so-called "Boulder Drift" shown to me by Mr. Kinahan, I am led to concur in his opinion that it is in reality "moraine matter" left behind at the retreat of the more recent glaciers of Galway.—EDWARD HULL.

features of the country to a great extent as we now find them. This may have been partly marine; but the last great engine at work would seem to have been ice, as all the rock surfaces which are protected from the meteoric abrasion, now in progress, are beautifully polished, planed, and striated; moreover, on the exposed surface of the country we find the rounded flowing outlines which are now universally recognised as the result of ice agency. Since the ice has disappeared the existing agencies have been and are daily at work, gradually, although very slowly, changing the features of the country.* Adjoining the lakes the weathering seems to be much more rapid than elsewhere.

DETAILED DESCRIPTION.

5. *Position and Lie of the Rocks.*

[For convenience during description, the area now to be described may be divided into four districts. First—The country west of Lough Corrib, or the *Oughterard District.* Second—The country east of Loughs Corrib and Mask, or the *Headford and Cong District.* Third—*The island in Lough Corrib.* Fourth, and last—The country west and south of Lough Mask, or the *Benlevy and Kilbride District. The drift and other superficial deposits* it is proposed to describe in a separate section, and after them the *mines and mineral localities.*]

OUGHTERARD DISTRICT.

Limestone Country at and to the S.E. of Oughterard.—Ard is the promontory extending northward into Lough Corrib, about three miles east of Oughterard. At its eastern extremity there are dark gray limestones that dip S.E. at 3°, and at the north margin of the boggy flat which separated it from the mainland, are other limestones. S.E. of Ardnasillagh are dark gray limestones, and north of it, forming the boundary of the lake, are cherty limestones, all of which dip S. at 3°. East and west of Aughnanure are dark gray limestones that, in the former place, dip at 3° to the south, and in the latter to the S.E. At Corribview the rocks dip SS.E. at 3°. At Portacarron, which lies a little to the N.W., are dark gray or blue limestones, that are nearly horizontal or dip at 3° to the NN.W.; here there is a mineral vein (*see Mines and Minerals*). A quarter of a mile south-west of Portacarron are dark gray or blue limestones, that dip S.W. at 30°, they are very much jointed, the principal systems being perpendicular, and bearing N. and S. Among these limestones were observed small beds, or portions of beds, full of small fragments of quartz, changing the rock into a fine conglomerate. Those beds containing the conglomerates form a small feature along the by-road that leads to the coach road; and from that, on the east of the glebe-house, southward to the bog. The conglomeritic beds seem to become better developed as they are traced south-westward towards the overlie of the

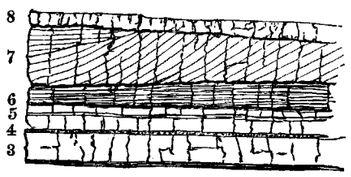
* On the granite near Oughterard the decay since the Glacial period would seem to be from half an inch to an inch and a half, as that is the height the unweathered veins that traverse the granite stand up above the mass of the rock; and the weathering of the carboniferous limestone to be from three to five inches, as that is the height of the unweathered rock pedestals that support the perched blocks.

carboniferous rocks on the granitic and metamorphic rocks, as immediately south of the sheet line at the margin of the bog, there are thick calcareous conglomerates.

Oblique lamination is found in many of these limestones, and south of the glebe-house, in a quarry a little west of the by-road, it can be well seen.

Fig. 3.

Oblique lamination in Limestone Quarry, south of Glebe.



Section of Quarry South of Glebe.

	Feet.
8. Bluish gray limestone,	1·00
7. Obliquely laminated limestone,	4·66
6. Bluish limestone, flaggy and shaly,	1·33
5. Bluish gray limestone, with a few shale partings,	3·00
4. Shaly calcareous conglomerate,	0·5
3. Bluish gray limestone,	2·75
2. Shale parting,	0·25
1. Bluish gray limestone with shale partings,	*over* 10·00
	23·5

East of the glebe-house in Gortrevagh, is a calcite vein. (*See Mines and Minerals.*) North of the glebe-house by the roadside, there are black limestones that formerly were quarried for marble.* Among others, a block 18 feet long by 3 feet wide, lies on the bank quarried and scabbled. Associated with the gray limestones over the black beds, are two or three thin beds of shale.

Farther north-west, between the Union Workhouse and Ardvarna, is a crag of rock composed principally of dark gray and blue limestones; however, many of them are fine calcareous conglomerates, these latter beds being more numerous and the contained quartz fragments larger towards the S.W., near the junction of the limestones with the granitic and metamorphic rocks, than further N.E.; for at the road cutting at Ardvarna, the quartz fragments are small, few and far between, while farther N.E. along the shore of Lough Corrib, not one bed containing them could be detected. The rocks all dip SS.E. and S.E. at about 5°. In the rocks on the shore of Lough Corrib some of the beds are full of beautiful preserved fossils, the most remarkable varieties being named in the accompanying list, by Mr. Baily.

List of Fossils from Lemonfield, shore of Lough Corrib.

Aviculopecten granosus.
Euomphalus pentagonalis
Syringopora geniculata.
" reticulata.
Cyathophyllum ceratites.
" flexuosum.
Michelinia favosa.

* No information about these quarries could be obtained from the manager of the Law Life Insurance Society's Estate, on whose property it is situated.

In the vicinity of Lemonfield and Oughterard are various mineral veins, and for the detailed description, see *Mines and Minerals.*

South of Oughterard, in the townland of Cregg, black limestones that might be worked for marble were formerly quarried. A slab from this quarry 10×5·5×·75 feet, forms the top step at the entrance door to Lemonfield House, and larger slabs were raised out of it.

At Oughterard, and seemingly underlying the limestones that contain the previously mentioned beds of limestone-conglomerate, are black, blue, and gray limestones, that dip SS.E. and S.E., at angles varying from 1° to 10°. In many of these are geodes and drusy cavities some of which contain crystals of quartz, fluorite calcite, &c., while others native sulphur. North of these, and underlying them, are other limestones and eventually sandstones and grits, with a few shales; all having a low dip towards the southward. In the river section at Clareville, the dip changes from southerly to easterly; and under the limestones are black shales, yellow sandstones, and a coarse conglomerate. The last named, at first sight, might be mistaken for granite, as it is made up, almost entirely, of the debris of that kind of rock. Here the thickness of the sandstones, shales, &c., cannot be calculated, as a N. 14 W. fault, (which may also be a mineral vein,) a downthrow to the east, occurs at the base of the Salmon Leap. The dip of the beds on the east of this fault is high, as it varies from 25° to 30°. The coarse granitic looking conglomerate can be traced for about half a mile toward the N.W., after which it seems to change into an ordinary conglomerate. Moreover, a few small outlying patches of it were observed on the granite, in the vicinity of the boundary. No continuous section across these carboniferous sandstones was observed, but at a farm road, about 400 yards N.W. of Clareville, where the rocks dip N.E. at 40°, there is room for a thickness of about 150 feet including the conglomerate. The basal conglomeritic bed along the N.W. boundary was noted in detached places, and found to be a reddish or yellow rock, the principal contained fragments being quartz and quartzite, with a few of granite. Over the conglomerate, as seen in the stream alongside the old road from Oughterard to Currarevagh, there are red sandy clay-rock and sandstones, some being slightly conglomeritic. These are succeeded by yellow sandstones, of which parts weather with a honeycomb appearance, and an unweathered newly broken piece of these peculiar beds, shows that the rock is full of small round pockets, containing much calcareous matter. Associated with these beds, half a mile N.N.W. of Clareville, flaggy beds and black shales were observed. Farther east, at the old road from Oughterard to Currarevagh, flaggy grits seem to lie on blue limestone and shales; to the east of these in the vicinity of the new road are yellow sandstones and a calcareous conglomerate that seems to dovetail into the limestones. The conglomerate is somewhat similar to those previously mentioned as occurring interstratified with the limestone south of Oughterard. To the N.E. of the last locality, on the east of the new road, Mr. Hodgson of Currarevagh has opened a quarry and procured a good stone for tool work, but as, unfortunately, many parts of it are impregnated with iron pyrites, it seems liable, in places, to become stained on exposure to atmospheric influences. In a rock exposure south of this quarry, a fine calcareous conglomerate was observed interstratified with yellow sandstone. On the shore of Lough Corrib, having dark blue limestone under and over it, is a vesicular rock of a dove colour, seemingly a dolomite. This rock was not analyzed; apparently, however, it is identical with a rock found in the limestone at Rinville, on the east of Galway Bay. This latter rock was examined by Professors Rowney and King of Galway; and I am informed by the latter gentleman that they found it to be a dolomite.

Oughterard Granitic District.—Bounding the carboniferous rocks and appearing from under them on N.W., W., and S.W., is a tract of granite of the

variety described as *Intrusive granite*. It is of an irregular shape, being nearly two miles wide N.W. of Oughterard, while S.W. it may be half a mile across ;* and due west of that village it extends in an irregular narrow strip for about a quarter of a mile west of the hill called Boocaunmore, where it widens out and forms a tract that extends to, and beyond the margin of the area contained in this sheet of the map.

Beginning at the north, at Lough Corrib, the granite is found in the island called Drumminnakill Rock. S.W. of that rock there is a drift hill which obscures the boundary, but S.W. of the hill, and from that to the road near Newvillage Bridge, the granite boundary forms a well-marked, low escarpment. At the road the granite extends for a short way northward of the escarpment, but south-west-ward of the road for nearly half a mile, the escarpment and the boundary seem to coincide, except due north of the hill, called Athknockmore, where a course of the granite extends for a short distance in a N.E. direction, into the metamorphic rocks. N.W. of Athknockmore there is a hill of drift on the boundary for a short distance, but from that it is well marked, an escarpment extending in a slightly irregular N.E. and S.W. line by Lough Seecon to the bridge on the old road, half a mile S.W. of the summit of Lettercraff (△ 508). West of this bridge at the margin of the granite, is a rock that has all the appearances of a conglomerate. It may be a bed of conglomerate in the metamorphic rocks which by chance here occurs at the junction of the two kinds of rocks ; but what seems not to be at all improbable, is its being an outlying patch of the basal conglomerate of the carboniferous rocks which was deposited in an old hollow at the junction of the two rocks, and thereby preserved, while the rest of the carboniferous rocks were denuded away. In favour of this latter supposition it may be mentioned, that half a mile farther W.N.W. similar conglomerates were observed, which, in places, seem to be lying on the metamorphic rock, while in others they undoubtedly lie on the granite. Moreover, the conglomerate has the same appearance as the rock previously mentioned as forming the Salmon Leap at Oughterard ; also, it seems to be of a calcareous nature, for the lime ferns, such as Asplenium, trichomanes, A., ruta-muraria, &c., were observed growing on it ; this, however, may only be due to calcareous matter taken up from some of the metamorphic limestones in its vicinity. From the bridge of Lettercraff the boundary extends in a W.N.W. direction for about half a mile, afterwards it runs in a westerly direction till it nearly reaches Lough Adrehid, when it turns towards the north and then towards the N.E., until it reaches the old road from Oughterard to Clifden, where it again has a westing and extends up the slope of Knockletterfore nearly to its summit ; however, before that point is reached it turns, and bears nearly south for a quarter of a mile, when it again goes west, to, and beyond the margin of the district.

The southern boundary of the granite on the S.W. of Oughterard, is under a flat bog ; but in this bog, near Glengowla Bridge, it was found mixed up with the metamorphic sedimentary rocks. West of the bridge the boundary cannot be seen as it is obscured by a drift hill. However, at the village called the Garibaldi, there is a tract of granite extending south to the river, and west of that village the boundary runs in an irregular line to the summit of Boocaunmore, in the neighbourhood of which, the granite and the metamorphic rocks are very much interlaced, and also from that to Lough Adrehid. On the S.W. of Lake Adrehid the boundary between these two classes of rock is most irregular, as the granite sends veins and courses into the metamorphic rocks.

In the granite, due south of the south-west extremity of Lough Adrehid,

* A large bog bounds it on the S.W., but the granite may not extend under the bog, for in the vicinity of Lough Mall some metamorphic sedimentary rocks were observed.

there are two caught pieces of white crystalline limestone. Immediately north of the summit of Boocaunmore there is a pear-shaped mass of metamorphic rocks caught up in the granite. A little west of the before-mentioned bridge, that was built half a mile S.W. of the summit of Lettercraff, a mass of rudely foliated felsite was observed, caught up in the granite.

In many places on Lettercraff, and from that to Clareville, there is a structure that may be systems of parallel joints, giving the granite a bedded appearance ; this on the south slope of Lettercraff has a dip E. at 70° ; farther E. it has a dip W. of 75°, and within half a mile of Clareville has an east dip of 80°, while in the stream that flows from Lough Seecon to Lough Corrib, it varies in its dip from 20° to 70° towards the east. In many places there is also a structure that has the appearance of a rude foliation ; but on breaking the rock its constituents do not seem to be arranged in leaves or plates. Near Newvillage it was noted "The granite very felspathic and lumpy with a structure like rude foliation ;" and south of this, the following note was made, "White or pinkish-white granite very felspathic." In many places there are small flying strings containing lead, copper, and iron pyrites, on some of which small trials have been made. Half a mile N.W. of Clareville, at the junction between the granite and the basal conglomerate of the carboniferous rocks, there is a compact greenish felstone, but when followed S.W. into the granite it immediately becomes granitic in appearance and eventually seems to become incorporated with the mass. West of the Oughterard Salmon Leap there are numerous specks of galena, copper pyrites, and iron pyrites in the granite, with some small veins ; and in this neighbourhood various mining operations have been carried on.—(*See Mines and Minerals.*) South of Oughterard, in the vicinity of Lough Mall, the granite seems to lose all its felspar and to become a foliated silicious rock or *Greisen*.

Country about Lough Agraffard and Glengowla.—In the vicinity of Glengowla Bridge gray crystalline limestone and schists occur in various places, having dips to the N.E. and S.E., at angles usually varying from 50° to 70°, although in one place it was observed to be as low as 20°. They all seem to be parts of the same set of beds that have been ruptured and broken by the intrusion granite which comes up through them in patches, courses, and veins, pushing them hither and thither, and thereby ruining their continuity. Farther south in the vicinity of Glengowla mine no tract of granite was observed ; however, there are numerous veins with faults and mineral lodes, all of which rupture the beds, moreover, as they seem to be in anticlinal and synclinal curves, it is extremely difficult to trace the different sets of strata ; nevertheless, it is possible, if not probable, that only one set of limestones occurs, not only here, but also farther west in the neighbourhood of Lough Agraffard, as the beds of limestone west of that lake may represent the northward and southward outcrops on a synclinal curve that extends (ruptures and displacement being for the present disregarded) south-eastward to Glengowla, where the limestone turns over one or two folds and goes back to the north-west, till it is finally cut off by the granite in the neighbourhood of Boocaunmore. At Glengowla mine there are various granite veins, faults, shift, and cross courses, that will be mentioned when describing the mines in detail. The rocks dip every way, but they seem to form two irregular synclinal curves. West of the mine there is a remarkable white granite vein, in which the constituents are so amalgamated together that they cannot be distinguished by the naked eye, under which, or even with a lens, the rock seems to be more like a sugary felsite than any other kind of rock; however, on a careful examination, places in it were found that proved it to be a dyke of granite. On the west of this granite vein, there is a fault that bears nearly N. and S. (N. 20 E.), and farther west, is another fault that bears N. 20 W., and shifts the limestone beds on the west towards the south.

On the east of this fault there is a small vertical dyke of an olive green flaggy irruptive rock (Dolerite?) that bears N. 25 E. and is about two feet wide. N.W. of the last mentioned fault in the vicinity of the road are small patches and veins of granite. At the same locality, among the metamorphic sedimentary rocks that lie on an anticlinal curve, dipping N.E. at 75 and south at 80, are masses and veins of a compact although crystalline hornblende rock, which appears to be a metamorphic basic irruptive rock; and a little east of them is a granite vein, in which there are lenticular caught up, and enclosed, pieces of white crystalline limestone.

At the river on the west of the spur of granite that extends southward from the main mass in the vicinity of The Garibaldi, the rocks are all twisted and broken by granite veins, to such a degree that in one place a mass of gneiss seems to lie unconformable on the limestone. North of this near the mass of the granite, there is a regular net-work of small granite veins and strings traversing the metamorphic rocks.

South of the summit of Boocaunmore, beside the numerous granite veins, one dyke of a metamorphic rock, and another of a more modern irruptive rock were observed. The first, although irruptive, is foliated, and bears nearly E. and W. It is thus described—"A granite-looking rock cutting across the associated metamorphic rocks, but having foliation in the same plane with them." It might possibly be a metamorphic felspathic igneous rock. Running oblique to this dyke, and bearing about N. 15 E. is a thin dyke (about 2·5 feet wide) of a Dioritic-looking irruptive rock. Under a cliff of granite, a little N.W. of the summit of Boocaunmore a peculiar green rock was noted; it may possibly be either a felspathic igneous rock, or a peculiar metamorphic sedimentary rock.

At the road, S.W. of Boocaunmore, and due east of the eastern extremity of Lough Adrehid; the limestones, which dip northward at 50°, seem not to be much altered, and in the neighbourhood are beds of argillite or argillacious schist. On the hill side, immediately south of Lough Adrehid, there were a great many beds of limestone observed; all of which dip S.S.W. by W., however, it is possible there may be an inverted fold on the north side of this hill, which would cause the same set of beds apparently to lie over one another. That this supposition is not improbable would seem to be suggested by some of the limestones west of Lough Agraffard, which seemingly are the continuation of these beds dipping S.S.W. at 80°, while others, those to the south, dip N.N.E. at 60°.

At the south-west corner of the district contained within the limits of this map, there is a tract of intrusive granite, in places very felspathic, and north-west of it is a mass of the supposed metamorphic basic irruptive rocks, that in places is schistose; in others, a well crystalline compact hornblende rock, while in part of it well developed crystals of the felspar appear. This porphyritic variety sometimes also contains quartz as an essential, thereby changing the rock into a syenite. A patch of similar irruptive rocks was observed a little farther east, close to the margin of Lough Agraffard. South-east of Lough Agraffard is a small tract of granite.

Country south of the N.W. arm of Lough Corrib.—The country that lies south of the north-west arm of Lough Corrib, and north and north-west of the large irregular tract of intrusive granite, north-west of Oughterard, is principally occupied by metamorphic sedimentary rocks that are very much cut up, and their continuity broken, by faults, veins of granite, small tracts of granite, and other irruptive rocks. Moreover, overlying these rocks in the neighbourhood of Currarevagh is a tract of upper silurian rocks, associated with which are some igneous rocks. The metamorphic sedimentary rocks seem to lie on an anticlinal curve, the axis of which extends about S.W. and N.E., a little south of the summit of Carn Seefin, and in the trough of a synclinal curve that runs about N.E. and S.W. through, or a little south

of Lough Seecon. The rocks to the northward of the anticlinal curve dip N.N.E. at angles varying from 40 to 80, to the southward of the anticlinal curve S.E., at angles varying from 50 to 80, and to the southward of the synclinal curve N.W., at angles varying from 30 to 85.

At the south extremity of this tract of metamorphic rocks and a mile and a quarter south-west of Lough Seecon, are gneiss and schist that have a general N.E. and S.W. strike, with usually, a N.W. dip varying from 30 to 85; however, in the immediate vicinity of the large tract of granite there are various local twists that sometimes reverse the dip. In other places numerous veins of granite traverse the rock, and in one instance they are so numerous as to cut up the metamorphic rocks into small patches. Crossing the old road nearly a mile west of the summit of Lettercraff, is an irregular N.E. and S.W. tract of hornblendic metamorphic irruptive rock; part being a coarsely crystalline hornblende rock, part finely crystalline and schistose, and in part some of the felspar appears in well-developed crystals. South of the S.W. end of this tract, and close to the boundary of the granite is a small patch of hornblende rock, and farther west at the bifurcation of the stream, is a small outburst of granite. In the valley of the stream, between the last-mentioned patch of hornblende rock and the outburst of granite, there is the previously mentioned conglomerate, that seems to lie unconformably on the metamorphic rock, and is supposed to be an outlying patch of the basal bed of the carboniferous rocks, being somewhat similar to the rock at the Oughterard Salmon Leap. South of this stream in the gneiss and schist, a bed of very schistose limestone or limestone schist, was observed.

West of Lough Seecon the beds dip south at from 70 to 80, and about half a mile west of that lake in a bed between two others, a peculiar crumpled foliation was noted. Immediately west of Lough Seecon is a bed of limestone schist, probably the continuation of the bed that was noted as occurring a mile and a half further S.W.; immediately north of Lough Seecon, in a bed between two beds of gneiss, there is oblique foliation, and in another curled foliation. A little further north-east close to the margin of the large tract of granite, a bed of limestone schist was observed. West of Lough Seecon and south-west of Knockaunanilra is a small patch of granite, and further south-west, close to the summit of Boleynabuddagh, is a tract of hornblendic rocks very similar to those previously described. These, however, are remarkable for having alongside them an outburst of granite. About a quarter of a mile north of the last mentioned summit is a narrow east and west tract of hornblende rock, in which is a vein of granite, and a little farther north is another small tract of hornblende rock. In this neighbourhood, on the N.E. slope of Knockletterfore, are a few small tracts of granite and innumerable dykes, the latter running in all directions.

On the south-east of this slope, in the townland of Lettercraff, an excellent illustration of crumpled foliation was observed. The crumpling is so intricate that it would be impossible to copy it correctly except by a photogram.

Upper Silurian Rocks in the neighbourhood of Currarevagh.—These rocks are fossiliferous, and associated with them are igneous rocks; the promontory N.E. of Currarevagh being formed of the latter. These igneous rocks seem to be composed of a micaceous looking mineral [diallage?] in a green or reddish base, and the latter before the blowpipe melts easily. Sometimes there are flesh-coloured crystals of felspar, and occurring in nests and veins, quartz and calcite. This rock seems to agree with Cotta's description of diallage rock.* Associated with these igneous rocks are altered grits and shales, the latter being changed into a rock like hornstone, and the former becoming slightly mineralized. West of these igneous rocks, on the shore of the lake, are green fossiliferous grits and shales, with calcareous bands, and under them

* See "Rocks Classified and Described," page 150.

are red and purple sandstones, that seem here to be the basal beds of the silurian rocks. These rocks dip about N.E. at 20. In the stream south of St. Cuthbert's Well there are green grits and shales, in which a few fossils were observed. The beds dip E. at 35°. In Shanballymore townland, and extending out of that across the road into Newvillage, is an irregular tract of igneous rocks similar to those described as forming the promontory N.E. of Currarevagh House. Here in some places the irruption rocks have the appearance of being bedded among the sedimentary rocks; however, in others they cut across the beds, and alter the latter rocks in a similar manner as observed N.E. of Currarevagh. In two places in Newvillage, seemingly associated with these igneous rocks, are curious ashy-looking breccias, and in some of the contained pebbles of the breccia, near the west end of the igneous rock, fossils were observed.

South-west of this tract of igneous rock are blue sandstones that weather purple, the basal beds of the silurian, and immediately south of them the rocks are very much twisted; but further south they have a steady strike southward, and dip east at angles varying from 25 to 60. This strike carries the sedimentary rocks against the underlying granite and metamorphic rocks, from which it would appear that these silurian rocks must be either bounded on the S.E. by a dislocation or fault, a downthrow to the N.N.W., or have been deposited against a cliff.

The silurians of Newvillage are very fossiliferous. Between Newvillage and the lake in the south part of the hill, there are fine conglomerates and green sandstones, that dip N.N.E. at 40; however, if this section is followed along the brow of the hill, the strike of the rocks will be found to gradually change, and at the margin of the lake the rocks dip E.N.E. at 65. Immediately S.E. of this section there is a N. and S. fault, and east of this fault the rocks (flags and green sandstones) strike N. and S., and dip east at angles varying from 25 to 15. Seemingly on the line of this fault there is an outburst of a similar igneous rock to that described on the N.E. of Currarevagh House. It may be here remarked that the outburst of igneous rock N.E. of Currarevagh House may also be on the continuation of the line of the fault just mentioned. West of the S. part of the fault is a patch of breccia that seems to be igneous.

South-east of Currarevagh House, in the west end of the promontory called Annaghwood, are green sandstones, grits, and shales, with fossiliferous bands. They dip E. at 15. At the N.W. extremity of this promontory is a dyke of whitish blue compact felstone, of a splintery nature but with a conchoidal fracture. In it are a few small globules of quartz disseminated through the mass. This dyke at the north shore of the island is perpendicular, and two feet wide, but when traced southwards it is found to widen to five feet, and there suddenly end.

On the north shore, filling up the fissures and cracks in some of the silurian rocks, there are patches of conglomerate that seem to be the residue of the basal bed of the carboniferous limestone. If this surmise be correct, it would seem to prove that, comparatively speaking, very recently the carboniferous limestone covered this part of the district.

Immediately south-east of the suggested line of fault that bounds the silurian rocks on the south-east, except where the road crosses it, are gneiss, schist, and quartzite, and under them is the previously described tract of intrusive granite. Here this is usually a white or pinkish granite, containing orthoclase, a greenish mineral, supposed to be mica or chlorite, and quartz, with in many places iron pyrites. In one place, on the shore of the lake, it seems to have lost nearly all its mica or chlorite, and quartz, and to have become felsite rock.

Country West and South-west of the Currarevagh Silurians.—West of the tract occupied by the upper silurian rocks are gneiss and schist that seem

to roll in sharp flextures, curves, and contortions. Moreover, as before mentioned, they are very much broken up by granite dykes and patches, mineral lodes, and lines of fault. South of the stream that divides the townlands of Ballygally and Barnagorteeny, in the last named townland, and a mile S.E. of Currarevagh House, a considerable tract of granite was observed, from which extends five or six veins; while small patches occur six hundred yards on the N.E., three hundred and fifty and six hundred yards W.N.W. of this tract; and in their respective neighbourhoods, veins were observed, as also to the west. Veins are very numerous in the townland of Gowlaun and Curraghduff east, and further north, near the shore of Lough Corrib, a nearly N. and S. vein was observed in the stream that divides the townlands of Gortnashingaun and Farravaun. The gneiss and schists are of various composition and texture. On the shore of Lough Corrib, townland of Gortnashingaun, and S.W. of Inishlannaun is a coarse gneiss, with oblong contained particles of quartz, apparently such a rock as a fine quartz conglomerate might be when metamorphosed. Near the centre of Farravaun townland a curious curled foliation was observed that seems to be caused by the lamination of the original rock having been cut up by small faults. Near the south of the same townland there is oblique foliation in a bed that tails out, while in the overlying beds there is a curled foliation round contained nodules. In the south of the townland of Curraghduff east there is a very quartzose gneiss containing small flattened particles of quartz, round which the foliation of the other constituents curl. At the S.W. corner of Gorteenwalla there is a curled foliation round contained nodules of quartz, and in its neighbourhood, in the townland of Gowlaun, there is hornblendic gneiss, the foliation in parts of it being curled or spheroidal.

In the part of the stream which flows into the bog N.W. of Currarevagh House, and lies between the townlands of Gorteenwalla and Ballygally, 500 yards west of the road there is a massive conglomeritic gneiss. Toward the east of the last mentioned townland there is curled foliation round nodules. In the stream that divides Ballygally and Barnagorteen, and about 600 yards west of the road, nodules of white crystalline limestone were observed in schist. South of this, immediately east of the hamlet, there is a small break in the continuity of the beds, and alongside it is a curious breccia, which seems to be metamorphic "fault rock."

North, east, and north-east of the highest part of Derroura, called Carn Seefin, is a most irregular tract occupied by intrusive granite, which extends westward to and beyond the margin of this district, and further S.E. there are a few small patches and innumerable veins that break up through and disconnect the associated rocks. Hereabouts there are thick beds of crystalline limestone and limestone schist that have a general strike of about N.E. and S.W., but, as before mentioned, their continuity is broken by numerous veins of granite, mineral veins, and faults. However, although the beds apparently are very much broken up, yet they do not seem to be much shifted, except those in the vicinity of the Leamnaheltia mine, where they appear to have jumped considerably towards the south. To the S.W., in the vicinity of a small bog lake that lies about half a mile due west of Gowlaun, there is a fault that shifts the limestone about 300 yards towards the S.E., and south of this, is another fault, that shifts them about the same distance towards the west, while farther south is a fault that jumps them westward about 50 yards, and north of the hamlet that lies N.W. of Knockletterfore, is a fault that seems to run N.W. and S.E., and to throw the limestone further towards the west. South and east of these well marked beds of limestone, and west of the summit of Gowlaun are small exposures of limestone, but so much dislocated and in such obscure ground, they occurring in detached bosses or short cliffs, and everywhere evidently displaced by faults and veins, that their relations to the well marked beds is not apparent; nevertheless they seem to overlie

them, and may possibly be part of the beds that previously were mentioned as having been noted west and N.E. of Lough Seecon, and north of Athknockmore.

The well-marked limestones north of Leamnaheltia Mine seem to turn towards the N.W. round Carn Seefin, as thick limestone occur thereabouts, and both they and those north of Leamnaheltia dip away from the hill, the latter at about 75° to the S.E., while the beds on the east of Carn Seefin dip N.E. at about 70°, and those north of the hill northward at angles varying from 50° to 85°. On the N. and N.E. of this summit the beds are very much broken up, and in no place was a continuous bed traced over 100 yards; however, notwithstanding all these ruptures, it is probable that they may all be parts of the same set of beds. Even the limestone beds in the enclosed patch of metamorphic sedimentary rock, a little north of the summit of Carn Seefin, may also belong to them. This, however, does not seem quite so probable, for to the S.W. of this summit, and extending S.S.W. from that into the district on the west, there are limestones that have a very similar strike and a dip E.N.E. at from 50° to 80°, to which they may belong; and if they do, they probably are part of the beds on the S.E. slope of the anticlinal curve, and not part of the beds forming its northern slope.

Three hundred yards due east of Carn Seefin, among the metamorphic sedimentary rocks, is a tract of a greenish, hard, crystalline hornblende rock, such as we might suppose a greenstone or other allied basic igneous rock to have been changed into by the action that metamorphosed the grits, shales, &c., into gneiss, schist, &c.

North of Carn Seefin small detached masses of white quartzite were observed that seem to be detached parts of one set of beds, but disconnected by faults. The gneiss and schist hereabouts are usually more micaceous than hornblendic, and, as a general rule, the foliation is parallel to the strike of the beds; however, in some places it is oblique, in many places it is curled, in others crumpled. In the stream, N.E. of Carn Seefin, there is a bed of gneiss about five feet thick that has an oblique foliation, and south of the small lake or pond, nearly a mile W.S.W. of Gowlaun, there are thick beds of obliquely foliated gneiss.

The Headford and Cong District.

That part of the County of Galway west, south, south-east, east, and north-east of Headford.—Adjoining Lough Corrib N.W. of Shrub Islands, are dark blue limestones that dip S.E. at 3°, those at the southern point of the promontory being very cherty, and having in them a N. 18° E. calcite vein with a trace of galenite and mundic. Hereabouts were remarked blocks of the fine quartzose limestone conglomerate similar to those south of Oughterard; however, the rock was not observed in situ. Further S.E., north, and north-east of Rabbit Island are dark blue and gray limestones that dip S.E. at from 3° to 5°, some of these being cherty, and one bed being noted as full of pipes of chert. West and south of Clydagh House are limestones that dip southward; and N.E. of the same place, in the vicinity of Ballynacregga, is a rather extensive crag of limestone, some of the beds being full of chert nodules. The beds hereabouts dip S.S.E. at 3°. Less than a mile N.W. of this crag, dipping south, are gray and blue limestones; while a little on its N.E., near Ballynalacka Lodge, is a nearly N. and S. cliff of limestone, many beds in which are cherty; and half a mile east of the cliff, at the bifurcation of the road, are cherty limestones, some being very fossiliferous, while farther east, at Ballymanagh, and further south, between Ballyhale and the lake, are gray limestones. In all these places the rocks have a southerly dip of about 3°.

A little west of Clooneen are gray limestones that have a slight dip towards the south, and more than a mile east of that village, in the neighbourhood of Caltragh, Kilcoona, and Rafwee, are detached quarries, or small crags of limestone, nearly all of which have a slight southerly dip. Southwest of Turloughcor, between that and the south margin of the district, dark gray and blue limestones, that have a slight south dip, appear in places through the rocky drift, and further east, in the neighbourhood of Ballinduff Lodge, are similar rocks with a similar dip; while still further east and southwest of Cahermorris House, the rocks are horizontal. North-west of Cahermorris House the limestones have a slight dip toward the east. East of Kilcoona the rocks have a slight south dip; further north-east, about Manuslynn and Turlough Monaghan, they have a slight dip to the S.E., while a mile S.E. and E. of Crossursa they are horizontal, or nearly so, and southeast of the Halfway House are detached quarries in which the rocks are either horizontal or dip S.E. at about 5°.

North of Lough Hacket, close to the trigonometrical point 162, there are compact gray limestones that dip E.N.E. at 3°. Further north and S.W. of Lough Dooaun are blackish limestones and shales, that dip E. at 2°. A mile S.E. of this lake are nearly horizontal limestones, and east of it at Ummoon are rocks that have a slight dip to the S.E.

North of Lough Dooaun, near Gortnabishaun, are nearly horizontal limestones, and further northward, in the neighbourhood of Rockwell, Ratesh, and Millburn House, are rocks that are either horizontal or undulate, at a very low angle.

In the river at Shrule are dark blue limestones that dip N.E. at 3°. West of Mirehill House, along the road that leads from Shrule to Headford, nearly horizontal gray limestones appear in two places. At Mirehill are blackish limestones and shales that dip N.N.E. at 3°. Further west, south of Moyne Hill, there is a quarry in black limestone and shales, which exposes a slight overlap of the uppermost beds in the quarry. The general dip of the beds is about 5° towards the S.S.E.

Fig. 4.

Overlap in Shaly Limestone at Moyne Hill Quarry.

Dark blue limestones that dip N.E. at 3° are quarried a little S.W. of the Rectory, and immediately N.E. of Headford are dark gray limestones that lie nearly horizontal. East of Headford demesne, at the old Roman Catholic chapel, also near Dalysfort House, are dark gray limestones that lie nearly horizontal, or have a slight dip to the S.E. South of Headford, where the road turns off to the Ferry of Kilbeg, there are nearly horizontal dark blue limestones, and south of Headford demesne by the roadside are cherty limestones that dip S.E. at 3°.

Immediately west of Headford the rocks are undulating, but so slightly as to be nearly horizontal; but farther west, in the vicinity of Kildaree, the dip suddenly rises, as the rocks north of the road are dipping S.E. at 30°, while those south of the road E. at 40°. A mile S.W. of Kildaree are nearly horizontal dark blue earthy limestones, and similar rocks were noted halfway between that hamlet and Ower.

N.W. and north of Ower, and S.W. of Clover Hill, dark gray and blue limestones were observed, all of which dip S.E. at angles varying from two to five. West of Carreens are cherty limestones; moreover, in this vicinity were observed many blocks of the fine quartzose limestone conglomerate,

similar to those that previously were mentioned as occurring near Oughterard, but here it could not be observed *in situ*. Farther N.W. at Lake Corrib are blackish and flaggy limestones.

South extremity of the County Mayo, or the country lying adjacent to Ballycurrin and the village of Shrule.—Along the shores of Lough Corrib, in the neighbourhood of Ballycurrin, are dark blue limestones that dip S. at 3°; some west of the Castle are magnesian, and farther west, at and near Ballycurrin Point is a dove-coloured hard vesicular dolomite. In it were observed geodes lined with bitter spar (?) and enclosing crystals of quartz. On the shore of the lake, and N.W. of the Castle, are patches of mundic, one being very large; however, it is not evident whether they are only surface deposits, or that they are connected with underlying mineral veins.

About a mile S.E. of Ballycurrin are blue limestones that have a slight dip to the S.E., and in them, close to the N.W. corner of the townland of Gortbrack, bunches of lead and mundic were found in the broken surface of the rock. Further eastward, and about a mile and a quarter westward of Moyne Lodge, in the Black river, are similar limestones. At and to the S.E. of Cahermore are gray and blue limestones that dip S.E. at 5°; while south of Ballisnahyny Castle they dip in the same direction at 3°, and at the S.W. and to the east of Pollaghkeeraun similar limestones lie nearly horizontal. A little to the west, and half a mile to the N.W. of Shrule, are cherty limestones that have a slight dip to the S.E., and a mile S.W. of the same village are blue limestones that dip S.E. at 3°, while similar rocks in the river at Shrule Bridge dip N.E. at 3°. N.W., W. and S. of Lough Lee*, are gray and blue limestones, those on the W. being also cherty. Those to the N.W. are horizontal, or dip N. at 3°. Those on the W. dip E. at 3°, while those on the south are nearly horizontal, but have a slight dip to the south. N.W., S.W., and S.E. of Dalgan House are detached quarries in dark blue limestone, in all of which, except those to the S.E., the dip is easterly at about 3°; in the last-named place the dip is S.W. at 3°.

Country about Ballymacgibbon Bay.—North of Ballycurrin Castle, on the north-west shore of Castletown Bay, are gray limestones that dip S.E. at 5°, while on the S.E. shore of the bay and east of Red Island they dip N. at 5°; further N.E. and west of Glencorrib are gray and blue nearly horizontal limestones. Along the shore of Lough Corrib, in the neighbourhood of Castletown, are dark blue earthy limestones, some of which are magnesian; and, in at least one place, a dolomite. East of Ballymacgibbon Bay at Billypark are yellow sandstones and gray shales underlying dark gray limestones that dip S.E. at 3°, and further N.E. a little east of the village of Cordroon are yellow sandstones interstratified with blue limestones that dip S.E. at 3°. Further N.N.E. close to the hamlet called Tonagh, in a country covered with an angular sandstone drift, there is a limestone quarry in which the beds dip W.S.W., at 15°. Close to this locality on a block of yellow sandstone in a wall, but like some of those just mentioned, a plant stem was observed which Mr. Jukes considered like stigmaria. South-east of Cong in the promontories and islands, there is a change in the subjacent rock, as under and interstratified with the limestones, are a few sandstone and conglomerate beds that lie unconformable on silurian, metamorphic and igneous rocks. Along the shores of the islands and promontories at the west of Ballymacgibbon Bay, are the debris of conglomerates, with silurian and irruptive rocks. The latter which is a variety of whinstone, containing pink felspar and diallage (?) (but more fully described previously, see p. 23) occur in situ on Easter, Green, and Holy Islands, also on the adjoining mainland. S.W. and S.E. of Sir W. Wilde's new house, as also in the island just mentioned. These irruptive rocks protrude through the upper silurian rocks, but are older than the sandstones, &c., that here are found associated with the carboniferous rocks. Close to the village of Gortacurra there is said to be carboniferous limestone.

* In Lough Lee are two islands that seem to be crannoges, but when the place was examined they could not be explored, on account of the height of water in the lake.

Although large angular conglomerate blocks are numerous in places, yet it was not observed in situ. Silurian rocks occur a little south of the village of Gortacurra, consisting of gray and ribboned grits and shales with small flying calcite veins in which are traces of galenite. On the mainland due west of Blackderry rock, are gneiss and mica-schist that dip N.E. at 80°, and on the small promontories N. and E. of Blackderry rock is a fine yellowish white granite, seemingly an outburst of the intrusive granite. On Green Island are green fossiliferous silurian sandstones, that at the south of the island, where in contact with the whinstone, are altered into a sort of quartz schist. In Betragh island and on the mainland to the N.E., is the same variety of whinstone as previously described, and immediately N.E. of these irruptive rocks, but supposed to be in the carboniferous rocks, are grayish hard vesicular dolomite (*see General Description*) and under the latter are sandstones. North of these, but separated from them by a small N.W. and S.E. fault, a downthrow to the W., are blue limestones that also lie on sandstones. These latter dip W. at 30°, while those south of the fault dip at about the same angle to the W.N.W. East of the small bay that lies S.E. of Strandhill House, are blue, gray, and green silurian grits, sandstones and shales, and west of the bay are rocks of which Mr. Jukes writes:—"Pale yellowish sandstones and flagstones, may be in the carboniferous limestone." Over these are dark gray limestones, all dipping W., at angles varying from 15° to 60°.

Country about Kilmaine.—A mile S.E. of Turin House are blue limestones with chert layers and nodules, that dip E. at 3°, and half a mile N.E. of the last locality are blue limestones that dip S.E. at 3°, while farther N.E. on the margin of the bog are similar rocks with a similar dip. Half a mile N.N.W. of Turin House are nearly horizontal limestones, and similar rocks also were observed about the same distance on the S.W. of that house. Alongside the road on the west of Cloghan House are black limestones that dip S.W. at a very low angle, and contain geodes in which are crystals of fluorite. At Kilmaine dark gray limestones lie nearly horizontal, two miles to the W.N.W. in the neighbourhood of Ballylassa are blue and gray limestones that have a dip of 3° to the south, at the south end of Turloughagurkall similar rocks dip S.E.; at Cregduff they are nearly horizontal. South of Knockanaplawy they are nearly horizontal, while west of it they dip E.N.E. at 5°. West of Turloghmore the limestones dip north at angles varying from 5° to 10°, and half a mile north-east of Garracloon Lodge are dark gray limestones that have a slight dip to the N.W.

Country about The Neale.—West, north-east and south of the village of Neale there are numerous exposures of blue and dull gray limestone. A quarter of a mile north of the church they dip N. at 3°, as also on the N.E. and E. of Neale House, while further north they dip south at angles varying from 3° to 10°, and two miles N.W. of Neale at the Carn they dip east at 3°. At and to the west of Neale church they dip south at 3°. Immediately S.W. of the village they dip N.W. at 3°; east of Neale they dip S.W. at 3°; and south of the village W. at 3°; while further south they dip N.W. at 5°; and south of Kildun north, but at so low an angle as to be nearly horizontal.

Neighbourhood of Lough Mask and Cong.—On Inishard and the adjoining mainland are crags of limestone, in parts of which there are chert layers and nodules. They all dip E. or S.E. at from 3° to 5°, and a similar dip is prevalent in the extensive crag bounding Lough Mask as far S.W. as Ballykine wood, but S.W. of that place there is a N.E. dip of from 5° to 15°, and N. and N.E. of Cong there is also a change in the direction of the dip, as the

beds slope northwards at angles varying from 2° to 10°. Adjoining this part of the district in Lough Mask are islands called Carrigeen Islands, Saints Island, Inishgleasty, Inisbogbt, &c., all of which have a general bearing of about N. 20° E. They have limestone for their subjacent rock; and on most of them there is more or less drift.

Islands in Lough Corrib.

Beginning at the south margin of the district there are as follows:—

Lees and neighbouring islands.—Undulating drift, or drift mounds.

Illaunaveal.—A long east and west rocky or craggy island now joined to the mainland by a causeway.

Islets in Clydagh Bay.—Principally drift mounds.

Potatoe Islands.—Drift mounds.

Freeheen Island.—A N.E. and S.W. ridge of drift.

Inishflynn.—A N.W. and S.E. ridge of drift.

Eagle Islands.—Crags and gravelly drift.

Illaunfadda-beg Illaunfadda-more, Moor Island, with the rock islands in their vicinity.—These are low long islands, the names of the two first indicating the latter peculiarity. They may have been formed by the waters of the lough when agitated by the winds, driving up sand and gravel on the nearly N.E. and S.W. reefs of rock, or possibly they might be the remains of ridges of boulder-drift that formerly existed on those reefs. The limestone in these islands is cherty, and on account of it being so much water worn, the chert is very conspicuous. The following notes were made on the rocks in Illaunfadda-beg, "Dark gray limestones full of spheroids of chert." "Cherty-limestones, chert in layers and nodules; very peculiar nodules on the N.W. of the island." South-west of these islands, and also north-east, there are small N.E. and S.W. reefs of limestone. Moreover, the lake is shallow hereabouts in a N.E. and S.W. line across from the south point of Annaghkeen, half a mile S.S.E. of Annaghkeen Castle on the east shore through the islands just described, to the point a quarter of a mile south of Ard, on the west shore of the lake. This shallow may hereafter be economically useful, in the event of either a road or railway, being made across Lough Corrib. All the rocks mentioned have a S.E. dip of about 3°.

Devinish Island.—Drift hill with cherty-limestone debris at the south-east point.

Illaunnagower.—Drift with cherty-limestone debris on the south shore. To the S.E. are two rock islets called *Kid Island.*

Rabbit Island.—Drift hill; with a shoal formed of cherty-limestone debris lying off it, on the north-west.

Shrub Islands.—Drift mounds.

Inishgarraun-more and *beg.*—Undulating drift. On the large island are hillocks and patches of gravels and sand (*post-drift-gravels*) over the boulder-clay-drift. From the west points of both the islands, extending towards the S.W., are reefs of dark gray limestone that dip S.E. at 3°.

Illaunnagappul with rocky islets in its neighbourhood.—These are N.E. and S.W. reefs of limestone rock that dip S.E. at about 3°. On the reefs in places is boulder-clay-drift.

Snahadaun or Needle Island.—A long narrow N.E. and S.W. reef of limestone that dips S.E. at 3°. On it are a few boulders of granite, also pieces of the fine quartzose calcareous conglomerate similar to that noted in situ, a little south of Oughterard.

Inishcash.—A hill of limestone drift. On the south shore of the island there is a remarkable assembly of large granite blocks.

Illaunaconaun.—A N.E. and S.W. mound of boulder-clay-drift, the principal blocks and fragments being limestone, some of which contain geodes of native sulphur. Besides the limestone there were noted a few silurian-grits and carboniferous-sandstone blocks.

Inishool and *Cussafoor.*—Drift hills; principally containing limetone debris; however, there are also many blocks of silurian-grits and carboniferous-sandstones.

Illauncarbry.—A limestone rock with a slight coating of drift. The limestones dip S.E. at about 3°. They are much jointed, the principal system of joints bears N. 10° E. There is another conspicuous system that bears N. 45° W.

Illaunnacreeva.—A N.E. and S.W. reef of gray limestone and dolomite, that dips S.E. at 3°. The dolomite has geodes of bitter spar, and in some of the nearly north and south joints there is calcite with galenite.

Inishdauwee and *Roeillaun.*—Roundish hills of sandstone drift.

Inishshanboe.—A N.E. and S.W. mound of drift, the principal contained blocks being carboniferous sandstone, dolomite, silurian grits with a few of granite and gneiss. Near the N.E. point of the island there is a calcareous spring, and in one place, on the N.W. shore, a rock that looks like dolomite, may be in situ.

Bronteen Islands.—Carboniferous-sandstone drift. Among the blocks are the two peculiar kinds of sandstone; one of which weathers in round circular holes, giving it a honeycomb appearance; while on the other, during the process of weathering, round excrescences grow out on it from the size of a pea to that of a gooseberry.

Illaunanarroor.—Carboniferous-sandstone and silurian drift.

Foorannagh.—Drift. Silurian and sandstone blocks.

Annagh Island.—Gravelly drift.

Drumminnakill rock.—Reef of granite.

Illaunwauranny.—Drift. Silurian blocks principally, with a few of granite.

Morgan's Island.—Drift. Red carboniferous-conglomerate and silurian blocks.

Illaunnacleha.—Carboniferous and silurian drift.

Bilberry Island and *Urkaun-more.*—On these islands there is a drift nearly altogether made up of blocks and fragments of carboniferous-sandstone and silurian rocks.

Urkaun-beg and *Inishbeagh.*—Drift hills, in which are silurian, carboniferous-sandstone, and limestone, blocks and fragments.

Inchiquin.—The largest island in Lough Corrib.* The interior of it, excepting a crag near the centre and another at the S.W., is covered with drift; moreover all the rocks exposed are dark gray limestones that have a S.E. dip of 3°. At the west side, south of Inchiquin rock, white geodes occur in the limestone.

N.W. of Inchiquin is a shoal formed by a reef of limestone; and further N.W. is another consisting of silurian and carboniferous-sandstone blocks.

Curryskehan Island.—Dark gray limestone that has a slight dip to the S.E.

Comillaun Island and *Islands in Ballycurrin Bay.*—Rocky islets or mounds of rocky drift composed of sandstone and dolomite blocks and fragments.

Inishbiana.—A N.E. and S.W. hill of drift containing carboniferous-sand-

* Inchiquin contains 229A. 2R. 25P., while Inishmicatreer contains 203A. 1R. 27P., and yet, although there is a difference of over 26 acres between them, nine out of every ten boatmen on the lake will tell you that the latter is the largest, or they will say that both contain exactly the same quantity of land.

stone, silurian and limestone blocks and fragments. About 3,000 feet S.E. of Inishbiana there is a N.E. and S.W. reef of dark blue limestone that appears above water during the summer months. The rocks have a slight dip to the S.E. May it not be conjectured that the islands hereabouts have rock nuclü, as their largest axis nearly always has a similar bearing to this reef?

Mucklagh.—Gravelly drift.

Coad Island.—A N.E. and S.W. mound of carboniferous-sandstone drift.

Inishknagh.—Limestone drift; with limestone debris forming shoals to the S.W.

Illaunleenagh.—North and south low ridge of drift principally containing sandstone blocks and fragments.

Goats Islands.—Limestone drift.

Carrickaslin.—Debris of dolomite.

Inishmicatreer.—Round the margin of the east part of this island rocks occur in places. At the N.E. and S.E. are dolomites with a few dark gray limestones, and in some of the dolomites are geodes of bitter (?) spar containing crystals of quartz. All these rocks lie nearly horizontal. Round the west shore are dark gray and blue limestones, that, although undulating slightly, are nearly horizontal. One bed was noted as flaggy, another as containing geodes of pearl spar and calcite, and another as dolomitic. The interior is covered with undulating stony-drift containing, along with limestone, sandstone fragments and blocks. Toward the south-west the principal contained blocks and fragments are silurian and carboniferous sandstone, and on the west shore is a large block of granite.

About 1,600 feet south of Inishmicatreer there is a large stone that on April 30th, 1865, stood four feet above the water. It is called "Clogh-a-currigee," *i.e.*, "the stone moved by the great storm," as it first appeared above the waters "during a great storm that occurred on a Christmas eve about twenty years previous to the above date."

Inchagoill, Burr Island, and *Inishshannagh.*—The west part of Inchagoill is a flat-topped hill of sandstone drift, under which Sir R. Griffith, bart., according to his geological map of Ireland, supposes sandstone to exist, but to us there appears no good reason for this supposition. Under the rest of the island and the two adjacent ones there can be little doubt that there is limestone. West of the ancient churches on Inchagoill there are dark blue limestones that dip easterly, but at so low an angle as to be nearly horizontal; they are very much jointed, the principal joints running N. 10 W., while other systems bear E. and W. and N. 50 W. One bed on the north of the island was observed to be arenaceous and flaggy, and to weather of a yellow brown colour.

East of the churches the limestones dip easterly at about 3°; one bed was noted as slightly magnesian, and another as full of productæ. At the south extremity of the island there is also a magnesian limestone. On the S.E. part of this island, as previously mentioned, the hill of drift principally contains silurian and sandstone blocks and fragments.

Burr Island is occupied by drift, as also is Inishannagh, the principal fragments being those of silurian rocks and carboniferous sandstones. On the S.W. point of Inishannagh and on the S.E. side of Burr Island there is limestone debris.

Illaundaulaur is occupied by drift. On the north side there are silurian and a few red conglomerate blocks. At the S.W. extremity is a large block of igneous rock, and to the S.E. are a quantity of large flat blocks of red conglomerate.

Illaundauvrack, South.—Rocky drift.

Illaundauvrack.—A drift mound containing blocks of silurian grits, sandstones, &c. On the N.W. of the island is a red conglomerate that seems to be in situ and to dip N.N.W. at 3°.

White Strand Island.—Principally composed of gravel and sand, the waste of the rocks surrounding this part of Lough Corrib; however, on the west of the island are some red silurian sandstones that seem to be in situ.

Doonavilla.—Composed altogether of drift.

Cannaver Islands, (South).—At the S.W. extremity of this island there are a few beds of gneiss and hornblendic schist that strike N.W. and S.E. and dip N.E. at 70°, and at the north of the island are some beds of mica and talcose schist that strike nearly E. and W. and dip southward at 70°, the uppermost bed being a talc schist curiously mineralised and full of stellated nests of hyaline acicular crystals.* The rest of the island is occupied by metamorphic irruptive rocks, which seem originally to have been some variety of hornblendic or basic irruptive rocks, that were altered by the same action as changed the grits, shales, &c., into gneiss, schist, &c. At the south of the island is hornblende rock, an aggregate of hornblende crystals associated with epidote, iron pyrites, and felspar. At the east of the island is actinolite and tremolite rock, being a hornblendic epidotic rock in which are long acicular olive green crystals of actinolite arranged in half cones, or numerous minute nests of glassy tremolite crystals in a hornblendic base. At the north of the island, lying on the mica schist, is a black compact serpentine rock, that in places contains small bunches of minute acicular and at the same time hyaline crystals of chrysotile, giving it a mottled appearance. The rocks on this island show the gradual change of (apparently magnesian) hornblendic rocks into serpentine. A peaked rock in Lough Corrib, situated a short distance S.W. of this island, is a mass of hornblende rock.

Cannaver Island, (North).—This island is covered with drift, but on the north and N.E. coasts are red sandstones, some of the basal beds of the upper silurian that dip N. and N.N.E. at angles varying from 20° to 30°. Some of these sandstones are cut up with irregular systems of joints, and in the rocky islet at its S.E. extremity a fissure in this sandstone was noted as being filled with a conglomerate which seems to be part of the basal bed of the carboniferous rocks.

Inishdoorus with the islets called Roeillaundoo, Roeillaunbaun.—These islands are nearly altogether covered with drift or bog, however enough rocks are exposed to teach us that the northern and western parts of Inishdoorus, the whole of Roeillaunbaun, and the western part of Roeillaundoo are composed of rocks of upper silurian age, while the southern part of Inishdoorus and the eastern part of Roeillaundoo have metamorphic rocks under them.

The metamorphic rocks consist of mica and talc schist and gneiss that dip S.S.W. at 80°; and in them, at the S.W. of Inishdoorus and south of Roeillaundoo, are strong quartz lodes containing large pockets of white mica, that weathers rusty.

The silurian rocks consist nearly altogether of the red sandstone similar to that on Cannaver islands (north), but those at Roeillaunbaun have a peculiar spheroidal structure. Associated with these silurian rocks are irruptive rocks similar to the rocks previously described at Currarevagh, and supposed to be a variety of diallage rock; but at the north of Inishdoorus they are rather peculiar, being a dark blue rock with white almond crystals, and light green with dark green almonds, the latter seemingly coming up in a pipe through the former.

G. H. K.

* This appears very similar to a rock found in Norway by D. Forbes, F.R.S., &c., and called by him "Rhœtizite schist," or "magnesian schist."—Quar. Jour. Geol. Soc., Lond., Aug., 1858.

Cloonbrone.—This, although not an island, but the promontory stretching out toward Inishdoorus may next be described, on account of the similarity between the rocks therein found, and those on that island.

Along the northern and south-eastern shores many exposures of silurian rocks occur, chiefly red and green sandstones, which have a general dip to the N.W. and N.N.W., at angles varying from 30° to 50°, except south of Inishthee, where the dip is N.E. at 30°. In the last-mentioned place there is a peculiar hard shale like hornstone, which seems to be the basal bed of the silurian. Associated with these is a conglomerate. Further east is a shore rock, called on the six-inch map Derryrock, which is a hard quartzose green rock that seems to be an altered grit, perhaps caused by igneous rocks, however, the latter are not visible.

Associated with the silurian are igneous rocks, which occupy a great part of the peninsula; a part also of the south shore, N.W. of Roeillaunbaun; these seem to be diabasic. At the latter locality, on the southern shore, this intrusive rock apparently has the character given by Cotta for diallage rock,* and concerning it Mr. Kinahan notes—"Part of this rock seems to be a regular ash, but it appears to be unconformable with the silurian rocks. That it does not belong to the metamorphic rocks would seem proved as it does not appear to be altered." It is very similar to the intrusive rocks east of Cong, and those at Currarevagh; the latter previously described. [See page 23.]

West of the silurian rocks, and unconformable under them are metamorphic rocks, which will be described when treating of the adjoining townland of Doorus.

East of Cloonbrone are a group of islands and rocks called *Roeillaun, Roeillaun East, Bertragh rock,* and *Kelly's Islands, &c.,* which are composed of green sandstones, having a dip to the north varying from 20° to 25°. In the rocks fossils are very abundant, especially the *Orthis reversa,* the best localities being Kelly's Islands, and Roeillaun.

Illaunagawna.—Low drift hill with fossiliferous silurian blocks.

Illaunamang and *Needle Island.*—On the S.W. of the former an irruptive purplish rock may be seen coming up through green grits and shales, which latter are slightly altered in its vicinity. This intrusive rock is in part quite compact, and part apparently consisting of an aggregate of minute crystals of gray and pink felspar with pyroxene and chlorite, also in parts limy, as apparent by a slight effervescence with acid in some places. It seems to be a fine diabase.

On Needle Island there is also a purplish igneous rock similar to that just described as apparently diabasic.

Smith's Island.—Low hill of drift.

Inishthee and *Inishthee Rocks.*—The former is a hill of yellowish, sandy, clayey drift. The latter are composed of a rock apparently igneous. It seems to be a fine crystalline aggregate of pyroxene and felspar. In it were observed distinct crystals of a pale green felspar (Oligoclase?) Mr. Kinahan is of opinion that it is a diabasic rock. Before the blowpipe it fuses on the edge readily into a glass.

Illaundonoghrevy is a hill of sandy gravelly drift. Like most of the

* Cotta says of Diallage rock—"The diallage occurs in white individual crystals of half metallic lustre, gray to green. The smaragdite is grass-green, and has a mother-of-pearl lustre. Small quantities of sparry carbonates are often also contained in the compound frequently; not visible, but recognisable through effervescence with acid. They are probably of secondary origin. The visible accessory ingredients are mica, talc, hornblende (especially at the margins of the diallage) actinolite, garnet, iron pyrites, magnetic iron-ore, titaniferous iron-ore, specular iron and apatite. Many of these also may be secondary formations. Calcspar and quartz occur in nests or veins." (Rocks classified and described by Cotta, p. 151.)

islands in the neighbourhood, its shores are covered with the debris of silurian and the associated igneous rocks.

Illaunribbeen.—This island is a hill of drift similar to the preceding, but under it on the N.E. shore are seen green grits that dip N.E. at 30.° At the N.E. corner a brecciated dyke-like rock comes in, that perhaps may be part of the basal bed of the carboniferous rocks.* Alongside the breccia is a very peculiar rock. It is of a greenish colour, apparently consisting of minute crystals of felspar and hornblende with some iron pyrites and small shining crystals of a brownish mineral, and is everywhere traversed by flesh-coloured veins that before the blowpipe partially fuse on the edges; they are soft and easily scratched but do not show any effervescence with acid. Along the northern shore of the island this rock apparently alternates with the dyke-like carboniferous (?) breccia and the green grits. The latter become very quartzose at the north-western point of the island.

Illaunanarrew.—Low drift hill.

Inishvinlush.—Low stony-drift hill.

Illaunglass Islands.—These islands are composed of gneiss and schists that dip N. at 70°.

Illaunaknick, and rocky islands to the south and south-east including *Cormorant Rock* and *Lawrence's Isle.*—These islands are made up of a rock similar to that on the shore to the north, and of it Mr. Kinahan says: "It may be a diorite as apparently it is a crystalline aggregation of hornblende and felspar, however on a close examination it seems to be composed of mineralized grains, not crystals. If this be the case it must be a metamorphosed sedimentary rock. It makes very like an igneous rock, but as it is not unusual, especially among the older Palæozoic rocks, to meet with massive grits, that on a casual inspection might be mistaken, on account of their appearance, for igneous rocks, perhaps this may be a metamorphosed massive grit of that class."†

At the east end of Illaunaknick, pink felspar was observed in this rock. On Cormorant rock the following note was made:—"Apparently an aggregate of crystals of hornblende and felspar. The matrix seems to be a dark grayish felspar, containing what may be crystals of light green felspar."

Inishnanean.—Hill of yellowish sandy clayey drift, with rounded and subangular fragments of the neighbouring rocks. The axis of the hill bears N.E. and S.W.

Inishdauwee.—High hill of yellowish, sandy clayey drift.

Booey and *Inishdauwee shallows.*—The former is a low hill of yellowish, sandy clayey drift, containing angular pieces of silurian rocks, and the latter are covered with loose blocks of similar rocks.

Booeybeg.—Low stony-drift, with fossiliferous silurian blocks.

Sheegan.—This is a peculiar looking island, as it has in the centre a small tuft-like mass of drift, the remains probably of a hill; but it is now for the most part a low stony shore.

* Parts of the basal bed of the carboniferous rocks, as previously described on Cannaver and Annagh islands, would seem to have been deposited in open fissures in the older rocks, which gives them an appearance as if dykes. These, before being carefully examined, seem to be interstratified with the associated rocks.—G. H. K.

† The rocks mentioned above by Mr. Nolan are very peculiar and to determine them properly they ought to be microscopically examined. Good examples of the massive grits above referred to by me are mentioned by Mr. A. B. Wynne as occurring among the silurian rocks in the Slieve Bloom mountains, co. Tipperary, and I have found them in the Cratloe hills, co. Clare, a little north of the city of Limerick. On a mass in the latter hills I made the following note:—"There occurs a remarkable mass of green grit apparently unstratified and occupying a surface area of 1,000 feet long by 250 feet wide. This grit weathers and forms crags very like an igneous rock, but on careful examination small pebbles will be found in it."—(*See Memoir of Geological Survey Explanation of Sheet* 133, *p.* 26.)—G. H. K.

Carrickana.—Silurian debris.

Conor's Island.—Small hill of yellowish, sandy clayey drift, full of blocks of silurian rocks.

Cleenillaun, as its name signifies, is a low island. It is composed of Silurian drift, and some of the loose blocks which cover the shore abound with fossils.

Blackrock.—A shallow of loose blocks.

Ardillaun.—A high N.E. hill of drift, from whence its name. *Ardillaun rock*, off the east coast, is a mass of purple grit.

Scollop Island.—Low hill of drift.

Coad.—A low drift hill, full of silurian blocks.

The islands in the bay, on which Cong is situated, comprising *Illaunabuckedia, Soul Island, Inishconga, Leaf Island, Illaundarragh, Illaunree*, and *Bush Island*, are covered with young wood, but they seem to be composed of drift, full of Silurian blocks. Their shores, like the others just described, are covered with blocks of silurian rocks, many of them fossiliferous, but no rock *in situ* was observed.

IV. Benlevy and Kilbride District.

Limestone country west of Cong: part of the county of Galway in the neighbourhood of Fairhill, with the adjacent islands.—West of the village of Cong, for about two miles, much of the country is formed of bare crags of limestone, that dips northward at from 5° to 10°. This rock is cut up by parallel joints, the principal systems running about N. 5° E., while subordinate ones bear nearly east and west. Thus the rocks at the surface often present the appearance of detached slabs; but their tops and sides are rounded and furrowed from the effects of weathering. Fissures and caverns are common, they generally occur along the N. 5° E. joints. Near the north-western boundary of the demesne of Ashford three distinct caves were observed to lie along the same line of fissure. A few yards west of this, or nearly a mile west of Cong, is the celebrated "Pigeon Hole," which by reason of its extent and picturesque character is better known and more generally visited than the rest. At the bottom of it flows one of the subterranean rivers by which the waters of Lough Mask find their way to Lough Corrib. Water indeed is usually found at the bottom of all these caves. Another cave, the Horse Discovery, near the Quay at Cong, is remarkable for the number of stalactites that hang from the roof. To this cavernous nature of the limestone may be attributed, as before remarked, the failure of the Cong canal. In general the rock is very crystalline, and abounds with encrinites, corals, and other fossils. Very large *productæ gigantea* were observed outside of Ashford demesne, and a *chiton* was found in a loose block. In the neighbourhood of the Pigeon Hole, Mr. Baily observed the following fossils:—

Zoophyta.—Lithostrotion striatum (stools).
Chætetes tumidus, large hemispherical masses.
Crinoid stems and joints.
Mollusca.
Polyzoa.—Fenestella antiqua (plebeia).
Brachiopoda.—Spirifera pinguis,
Orthis resupinata,
Strophomena analoga,
Producta semireticulata,
„ punctata,
„ aculeata.

At the shore of Lough Corrib on the south of Ashford demesne, the boundary between the limestones and the silurians occurs, and from there may

be traced in an irregular north-westerly line, passing close to the village of Fairhill, a mile west of which it turns more north by Benlevy Lodge to Lough Mask. This line bounds the limestone; however south of Fairhill there is a bay of carboniferous rocks extending into the silurian and nearly surrounded by it, consisting of sandstones and conglomerates; these presently will be described. The limestone country about Fairhill is mostly covered with drift, but where the exposures of limestone occur, the rock is of the same character as near Cong. Immediately west of Ashford the beds dip N. at 5°, at Toberbiroge they are mostly horizontal, while at Culleenalena they are rolling, some dipping N.W. at 5°, and others dipping S.W. at 10°. In a stream about half a mile west of Culleenalena lough, are dark gray limestones, with a small vein of calcite containing iron pyrites. Half a mile west of Toberbiroge are dark gray, nearly horizontal limestones, and further north-west, north of the hamlet of Rusheen, is an extensive tract of more than half a mile long of bare limestone that forms marked crags, and dips N.E. at 5°. West of Rusheen are rocks dipping W. and N.W. at 15°, and half a mile west of Fairhill are two places where streams are seen to sink under dark gray limestones. Further west, in a stream near Cahergal, are very peculiar rocks, that seem to be dolomite with limestones. These rocks appear to be near the base of the carboniferous system, as at a short distance from them are seen the green and purple grits of the silurian age.* On the shore of Lough Mask, hereabouts, very small exposures of rock occur, but loose blocks are common; however, it was observed at Rosshill Abbey; and on the shore of the southern inlet of the lake east of that demesne, are dark gray nearly horizontal limestones. These rocks, like those everywhere near the shores of the lake, are pitted, and in many places bored through with circular holes similar to those on the shore of Lough Corrib, described hereafter by Mr. Kinahan in the section on "Drift and other Superficial Deposits." The islands north of this shore are Red Island, Big Island, and White Island, being hills of drift, with parallel axes which run in a N.E. direction.

A mile S.E. of Fairhill is the tract of country in the silurian rocks supposed to be occupied by carboniferous-sandstones and conglomerates; large blocks of the latter being scattered about in various places, but the rocks were only observed, in situ, in the vicinity of the new road from Cong to Maum; one exposure being in the south ditch, due south of Carrowbaun, where a purple sandstone was observed, that lies nearly horizontal, and another is about 100 yards more east, where, in the stream forming the townland boundary, there are conglomerates under 12 feet of drift. These rocks seem to have been deposited in a hollow in the silurian, and do not, elsewhere, seem (except they are extremely thin), to intervene between the carboniferous-limestone and the silurian; for a little S.E. of Rusheen, at a hamlet called Carrowhekeen, these two kinds of rock are nearly in juxtaposition, however, as the former dip N.E. at 5°, there would be room for 10 or 15 feet of sandstone.

Silurian country from Cong to Cornamona Bay.—South-west of Ashford demesne, near the shore of Lough Corrib, is a crag of gray sandstone, the dip of which is not very clear, but farther west at Ardnageeha Tower are considerable exposures of purple grits dipping N.E. at from 5° to 10°. Continuing along the shore of the lake we find green grits, with fossils, where the asterisk is marked on the map, and dipping S., S.W. and N.W. These, a little east of the trigonometrical point △ 292, terminate abruptly against metamorphic rocks, as if they had been brought there by a fault. The metamorphic rocks, gneiss, schist, and quartzite, seem to be an outlying ex-

* A similar dolomite is found east of Cong Bay, at the base of the carboniferous rocks.

posure of the rocks that occupy the summit and the northern slope of Benlevy. They dip N. and N.W. at from 45° to 60°. Lying unconformably over them to the west, are purple, gray and green grits and sandstones dipping W. at 30°.

At about half a mile N.E. of Ardnageeha, a little south of the road from Cong to Maum, is an igneous rock believed to be some sort of diabasic rock. It is somewhat similar to those associated with the silurians at Curra-revagh, and previously described; however, in it are silvery flakes apparently diallage, from which it might be called diallage rock. It is from greenish to purplish in colour, and has also crystals of pale pink or flesh-coloured felspar with nests and veins of a calcareous mineral, also some mica (?). This rock before the blowpipe easily fuses to a dark green glass.

North-west of this mass of intrusive rock, at the hamlet called Carrow-baun, there is a tongue of silurian rocks extending for half a mile toward the N.W., and dividing the previously mentioned carboniferous-sandstone from the carboniferous-limestone. These silurian rocks are mostly green grits and shales; near Carrowbaun they dip N. at 40°, and at their N.W. extremity N. at 45°.

South-west of the tract supposed to be occupied by the carboniferous-sandstone, in the neighbourhood of Tumneenaun, are considerable exposures of rocks, chiefly green grits and shales, dipping N. and N.W., at angles varying from 15° to 30°. Towards the north these rocks terminate in crags which bend round from a southern dip of 20° to a western one of from 20° to 30°.

About a mile S.W. of Tumneenaun, on the shore of Lough Corrib, north-west of Illaunaknick, are three exposures of a massive rock similar to those on that island, and described previously. [See page 35.]

North of Tumneenaun, on the eastern shoulder of Benlevy, considerable exposures of silurian rocks are also seen, the beds turning about very much, but having a general dip to the east. The amount of dip varies considerably, being from 45° to 50° or 60° near the top of the hill, while farther down it lowers to 10°. A remarkable departure from this low dip is seen in a cliff about half a mile N.W. of Gortnarup House. In this cliff the rocks at the east end curve from an eastern to a western dip of 50°, while towards the western end the dip rises to 80°, the rocks in the centre being much contorted. In this neighbourhood the rocks are very fossiliferous, the *Atrypa hemispherica* being found in immense quantities among the beds on the slope of the hill.

About half a mile west of Gortnarup is a dyke of diorite (?) running nearly N. and S., and between it and that village, parallel to, and a little west of the old road, is a massive yellowish felstone-dyke; that can be traced northward to the hamlet called Cahergal, a distance of about a mile and a half. Of this rock, Mr. Kinahan has made the following note:—"A yellowish greenish, irruptive rock that breaks with an uneven to a sub-hackly fracture. It contains globules of quartz, in some of which under a lens, the crystal faces are perceptible; in it also are nests of a purplish mineral, that weather to a rusty ochreous powder." And of it Mr. Jukes says:—"Globules of quartz occur occasionally, in all felstones, because felstone has an overplus of silica diffused as paste in the rock, which sometimes segregates itself in crystalline blebs or globules, but rarely appears as regular quartz crystals, unless the felstone be metamorphosed."

North of this, and southward of the village called Kilbeg, is an outlying exposure of metamorphic rocks, chiefly mica schist. They are met toward the S.E. in a stream called Ballyweeaun river, where they dip S.S.W. at 20°, rising to 60°, and S.S.E. at 80°. These latter beds crumple up and twist round to the N.N.E., with an E.N.E. dip of 70°. In the same stream, on the other side of the new road, apparently lying unconformable on the mica schist, are silurian green grits and shales dipping E. at 60°. The latter

rocks as they are followed down the stream, change their dip to the N.N.E., at angles varying from 45° to 20°. Following the road northwards, the silurian rocks appear in a stream near Kilbeg, where are purple grits that dip E.N.E. at 65°. Immediately west of them is the yellowish greenish felstone just described. Here it was observed to have a platy structure that apparently underlies towards the silurian rocks. Above it or to the west are gneiss and mica schist, some of which appears to be very little altered. They dip N.E. at 70°. About a quarter of a mile further north the silurian rocks, green grits and shales, with a dip of 20° to the S.W. reappear. At the stream flowing through Cahergal, half a mile north of Kilbeg, the felstone is again seen, and to the east of it are greenish and gray Silurian grits and shales. These rocks dip nearly E. at 30°. Immediately east, down the stream are purplish and greenish grits, with a dip of 5° to the north that may probably be classed among the silurian rocks; however they very much resemble rocks seen in a stream a few yards to the S.W., which underlie carboniferous dolomite and limestone, and are believed to be at the base of the carboniferous rocks.

*Doorus Promontory.**—This promontory extends in a south-easterly direction into Lough Corrib, bounding Cornamona Bay to the southward. It is mostly composed of metamorphic rocks, chiefly gneiss and schist, having a general dip to the south at angles varying from 50° to 80°. In many places these rocks are found to be traversed by quartz veins and strings, one that in places is five feet wide, seems to extend from the mouth of the Cornamona river to the west boundary of the district. On the south-western shore, near the west margin of the district, the rocks are described as "gneiss and schist very flaggy, and having regular foliation. Some beds are full of pieces of quartz that weather in small circular plates." In the same place is also noted, "nodules of limestone weathering out of the schist." At the margin of this district are two quartz veins, one bearing N. 40° E., the other N. and S. A trial cast was made on the former, which will be mentioned in the "Mines and Minerals section." Another quartz vein that bears N. 20° W. was observed on the same coast nearly a mile and a half to the S.E., and flows of gaussen were observed among the neighbouring rocks. Due north of this, a little east of Doorus, is another quartz vein.

A large irregular S-shaped mass of intrusive rock was observed on the south-western shore, and extending northward for nearly a quarter of a mile. It is described by Mr. Kinahan as a "greenish gray felstone, in places full of quartz globules with minute crystals of iron pyrites disseminated through the mass. It weathers to a dirty rusty white; towards the centre of the dyke it seems to be calcareous and weathers in pockmarks. This rock is full of minute dark green specks. In parts there is a most remarkable structure, as thick lines cross the mass apparently perpendicular or nearly so, to the walls of the dyke; while between those thick lines are irregular perpendicular lines giving the rock a sort of platy structure." Cutting across this felstone and for some distance inland, a N. 30 W. fault was traced. It hades slightly to the eastward and runs gaussen. Near the northern end of the felstone and separated from it by a few small beds of mica schist, is a mass of what seems to be an intrusive serpentine rock, of a blackish colour. It is similar to some of the rocks on Cannaver Island (South), and has small silvery-looking crystals disseminated through it [chrysotile]; also nests of a greenish mineral like precious serpentine [smaragdite?].

To the northward and W.N.W. of Doorus there are courses in the gneiss and schist, very pyritous, on which small trials have been made.

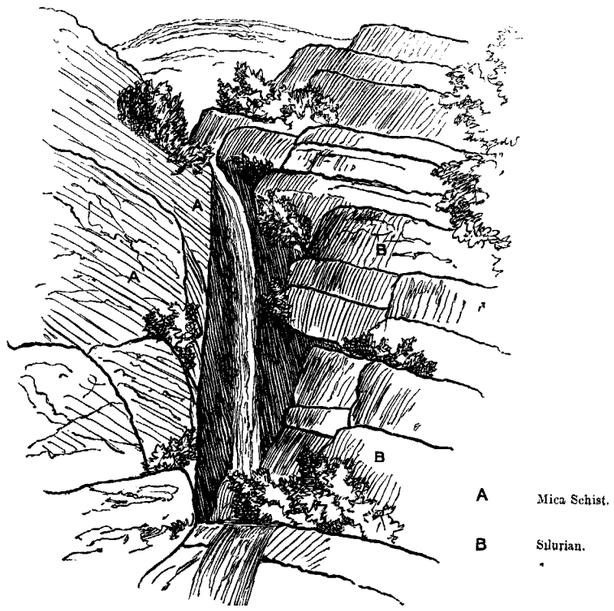
Eastward of Doorus is an outlier of silurian rocks made up apparently of

* The extreme south-east end of this promontory was previously described, and part of that now described was examined by Mr. Kinahan.

the basal beds of that formation and consisting principally of conglomeritic sandstone, which lies on a hard rock like hornstone ; while forming rocks in the lake to the north are some grits and shales that dip N.E. at 30°. Breaking up through these is a mass of a greenish glittering, finely crystalline rock, (diabase?) very pyritous and calcareous in places ; and south-east of Doorus in the metamorphic rocks, is a nearly E. and W. dyke of similar rock.

East, S.E., and S. of the silurian rocks are schists, some of which are highly talcose and all dip S. at from 30° to 70°. East of these metamorphic rocks are the silurian rocks previously described.

Fig 5.



Junction of silurian grits and shales with mica schist, seen at waterfall near Skelglash bridge, on the southern slope of Benlevy, showing the former deposited against an ancient cliff of the schist.

Country South, East, and North of Benlevy.—The southern slope of Benlevy, the hill north of Doorus, shows numerous exposures of metamorphic rocks, chiefly mica schist and gneiss. They seem to have the same general characteristics as those just described at Doorus, and in them are many quartz strings and veins, three of the latter being observed near the old road from Cong to Maum. The foliation in the rocks on the lower part of the hill is generally parallel to the bedding, but higher up it is often crumpled or wavy. The top of the hill, which is a table-land of about a mile long, is composed of the same class of rocks. The dip of the rocks changes from northward to southward, and if a line be drawn from the summit (1,370) in a S.E. direction to the point of the road a little west of Illaunaknick Islands. all the rocks east of this line, except at the extreme north alongside the silurian rocks, will be found to stand nearly vertical, or have a slight dip to the south

(70° to 88°), while those on the western side of the same line dip north at angles varying from 50° to 80°, with one or two exceptions. East of the summit, alongside the silurian rocks, the strike and dip is curiously twisted, perhaps by landslips in the pre-silurian cliffs. Close by, to the east of the trigonometrical point △ 1,235 is a dyke six feet wide that hades N.W. at 70°, and is traceable for over half a mile. This is described as "a saccharoidal, greenish gray felstone, with minute particles of free quartz disseminated through it, and breaking with an uneven fracture inclining to a hackly." As the dyke was traced to the S.W. it was noted as being very jointy and having mica in places, giving it a schistose appearance.

On the south-east slope of the hill, a little north-west of Skylglash, a felstone dyke was observed. It is a greenish gray rock, that breaks with an uneven fracture, and has nests of pale silvery iron pyrites disseminated through the mass. Crystals of a light greenish mineral, with a satin-like lustre, were also observed, and the rock in places effervesces freely with acid. This dyke bears about N. 30 E., and seems to underlie at 60° to the west.

At a waterfall, a little north of Skylglash, green silurian grits are seen banked against a cliff of gneiss and schist, as shown in the accompanying sketch (Fig. No. 5).

These silurian rocks dip N.E. at 10°, while the gneiss and schist are nearly vertical. Further up the hill, in a stream northward of the hamlet of Ballard, we find the silurian rocks dipping away from the gneiss and schist at a low angle, the latter being, as in the former instance, nearly vertical, and in a stream, a few yards further to the north-east, another section is exposed. In the latter locality the silurian rocks dip E. at 20°, but the gneiss and schist are nearly horizontal, and in them is a N. 45 E. quartz lode three feet wide. Here the metamorphic rocks occupy a small bay in the silurian, north of which the basal bed of the latter is a thick conglomerate. This conglomerate lies against nearly vertical gneiss and schist, and can be traced for about 400 yards in a westerly direction, when it turns round to the N.E., apparently being replaced by red and purple grits, which have an easterly dip of from 50° to 60°. The latter lie against gneiss and schist, which dip south at 85°. On the crest of the hill, about a quarter of a mile N.E. of the trigonometrical point △ 1,235, the conglomerate reappears, and close by it is the continuation of the felstone dyke previously described. North-west of this felstone greenish silurian grits and shales are seen in a stream, having a dip varying from 10° to 20° to the N.N.E., or away from the gneiss and schist. West of the felstone dyke no trace of the basal conglomerate was observed, if we except an outlying patch south of the boundary, and about 200 yards N.E. of the trigonometrical point △ 1,235. From here to the west of the district, the silurian boundary seems to run in a westerly direction, apparently parallel to a steep, well-marked, although slightly irregular escarpment of gneiss and schist. These latter rocks generally dip S. at high angles ; however, at the eastern end they dip at 75° or 80° to the S.E. In the stream which flows into the south-east part of Coolin Lough, a bed of gneiss and schist was observed, with a peculiar screw-like twist, lying nearly flat to the north, and nearly vertical to the south. At the eastern end of the escarpment purple silurian grits, dip N. at 50, away from the metamorphic rocks, but a little further west is a cliff, the upper beds of which dip S. at 20°, or towards the gneiss and schist, while the lower beds seem to dip at a low angle to the north. A little westward of the stream just referred to, are green fossiliferous grits, which dip N.E. at 50°, while some beds a few yards farther west are nearly horizontal, but dip slightly to the S., or toward the metamorphic rocks. In the stream west of this, and south of the west end of Coolin Lough, are green fossiliferous grits that strike against the gneiss and schist, and dip obliquely at it, while a little further east some dip

obliquely [at 50°] away from it, while others are nearly horizontal. A little west of this stream, in a cliff, is a peculiar vertical dyke, about three feet wide, of greenish brecciated stuff, that runs N. 45 E., and apparently does not extend out of the silurian rocks. From this stream to the hamlet of Tonlegee the silurian rocks, chiefly green grits and shales, dip towards the escarpment of gneiss and schist, generally at angles varying from 15° to 25°. In one place, however, close to the margin of the district, so high a dip as 60° was observed, and in the same series of rocks some of the beds to the south, apparently are nearly vertical.

From the place where the boundary leaves this district it goes, first westward for over a quarter of a mile, then northward for about the same distance, afterwards it takes a north-easterly course, which brings it again into this district a quarter of a mile S. of Shanadullaun, from which place it extends for over a quarter of a mile to the N.E., when it turns at a sharp angle and again leaves the district a little S.W. of Shanadullaun. West of Shanadullaun are cliffs of green fossiliferous grits and shales, dipping S.E. at angles varying from 15° to 20°, and striking at the boundary. At the north-eastern end of these cliffs are some green flags that dip to the S.E. at 30°, and curve round till they have a dip of 40° to the S. A little further east are beds dipping to the S.W. at 25°, and in the country from this to Lough Coolin and west of that lake, the rocks generally dip S.E., S.S.E., and S., at angles varying from 10° to 35°, and immediately north of the deserted hamlet of Coolin are some grits and flags which are very fossiliferous.

If we return to the boundary of the silurian rocks, we find that after it left the district a little S.W. of Shanadullaun it takes a slight curve west and then north-east, re-entering again a little to the north, and after proceeding easterly for a short distance it turns due north for nearly half a mile, when it again turns west, and finally leaves this area. North of Shanadullaun the gneiss and schist form cliffs, the rocks dipping S.S.E. at 60°, and in the stream due north of the village, are silurian purple sandstones and shales that dip S., at about 20° away from the metamorphic rocks.* North of these sandstones and shales, and alongside the gneiss and schist are purple sandstones dipping E.N.E. at 15°, while the northern parts of the same beds seem to dip N.E. at 25°. A little farther north, in a small stream, are beds dipping exactly in an opposite direction, namely, to the S.E. at 70°. but becoming nearly vertical a short distance farther towards the east. South of these nearly vertical beds are green grits, shales and conglomeratic grits, some of which are fossiliferous, and they form in one place a marked N. and S. cliff. They have a dip of 15° to the N.E.

Farther north is a line of high cliffs facing Kilbride Bay, and extending in

* This junction between the silurian and the metamorphic rocks in the neighbourhood of Benlevy, above described by Mr. Nolan, seems peculiar, as in only few places do the former rocks overlie the others, for in general apparently they are banked against them or strike, or dip, at them. From this would it not appear probable that along, or close to most part of the present boundary there were pre-silurian cliffs; up against which, the silurian rocks were deposited? The denudation that has removed much of the silurian rocks, would seem, in a great degree to have partly re-excavated the silurian rocks, exposing the old cliff lines. However, in places it would seem also to have worn away these old cliffs, on which account the conglomerates deposited at the base of the ancient cliffs are now exposed, while in other places only the beds above the conglomerates are found, they lying banked against the metamorphic rocks. In some places the apparent dip of the silurian rocks towards the metamorphic rocks might be accounted for by land-slips during or since the formation of the present cliff, and the strike of the former rocks being toward the latter may have been caused by curves and flexures during the subsidence and upheaval of the land; if the upper portion of the beds since then has been denuded away, and the continuity of the beds thereby broken, they would have the appearance of lying transverse to the more ancient rocks, while in reality they are only parts of beds that were deposited against an ancient cliff.
G. H. K.

a nearly east and west direction, and rising in one place to an altitude of 784 feet. This line of hill in general has smooth heather-clad slopes to the south, with steep high cliffs on the north. The beds dip to the S.W. at from 40° to 50°; but in one place, at the western end, so high an angle as 70° was noted. Some of these beds are fossiliferous; in one place, north of the summit, (784), *Orthis reversa*, *Turbo* (?) *Crinoids*, &c., were found. At the highest part of these cliffs, called Croaghacurren, are beds dipping at 10° and 20° to the S.W., and a little further to the west, are green flags that are nearly horizontal. Near the top of the hill which forms the western end of this range of cliffs, there is a peculiar dyke-like mass running through the beds, which seems to have been caused by part of a bed becoming silicified and full of quartz strings, giving it the appearance of a vein. In a cliff at the eastern end a somewhat similar vein of quartzose rock was noted. Both these bear nearly N.E. and S.W.

In the stream which flows through the valley east of this line of cliffs, are rocks which may be described as red mudstone. They are cut up by numerous irregular joints, and nothing like bedding could be found in them except at a point about 200 yards south of the road, where they seem to dip S.W. at 40°. In the same stream, at about 70 yards more S.W., silurian rocks, purple sandstones that dip N.N.W. at 20°, are seen in connexion with gneiss and schist, the dip of the latter varying from 70° to the S.S.E. to 88°, and striking towards the E.N.E. South-west of this, along the stream, are several exposures of these metamorphic rocks dipping S. and S.S.W. at from 60° to 75°; however, in one place the silurian rocks seem to make a little bay into them, towards the east.

In the townland of Boocaun, at the top of the hill, a little west of that village, purplish and greenish fossiliferous grits and shales occur, that dip S.S.W. and S.S.E., at from 20° to 45°; and on the south-western side of the same hill are rocks, some of which appear to be nearly vertical, while others dip N.N.W. and N.E. at 20°. These rocks abound with fossils, *Encrinurus punctatus* being found here abundantly. In the stream south of Boocaun, are green and gray grits and shales dipping S.S.W. at 20° and 25°; and in the same stream to the west of the village, are purple grits and shales dipping S.S.W. at 25°. North of these silurian rocks are gneiss and schist that dip S. and S.S.E. at angles varying from 60° to 75°. Iron pyrites was observed in some places in these rocks. The south boundary of the outlying exposure of metamorphic rocks north of Boocaun, seems to extend eastward until it disappears under that of the carboniferous limestone, which runs in a northerly direction to Lough Mask. On the shore of this lake, opposite Kilbride Ferry and north of the flat bog, are gneiss and schist that dip S.S.E. and S.S.W. at from 30° to 60°: these possibly may be part of this outlying exposure. At and near the extreme N.E. point, the rocks were observed to abound with strings and nodules of quartz and the foliation to be crumpled.

Kilbride Promontory.—Immediately north of Kilbride Bay are metamorphic rocks, chiefly gneiss and schist. These, in the vicinity of the ferry, appear to dip S.E. and S.W. at angles varying from 40° to 60°. On the shore at the ferry, is a dyke of irruptive rock running for about 150 yards in an irregularly N.W. and S.E. direction. This rock was noted as being "greenish gray, slightly mottled with black specks, with widely disseminated small whitish crystals. It effervesces slightly in places with acid. It seems to be some sort of basic rock (*Diorite ?*), as before the blowpipe it fuses easily into a whitish glass. The rock appears to underlie towards the west at about 60°."

Many exposures of gneiss and schist occur along the southern shore of the promontory. Immediately on the west of the ferry there are beds dipping S.S.E. at 75°, and half a mile further west are rocks dipping N.W. at 80°. These latter were noted as "gneiss and mica schist with irregular foliation,

and having numerous strings and nodules of quartz." Further N.W. are somewhat similar rocks dipping also to the N.W. at from 70° to 80°. To the northward, S.W. of Doon rock, the gneiss and schist dip N.N.W. at from 60° to 70°, while immediately south of that rock they dip S.S.E. at 80°. These rocks, which apparently lie close to the margin of the silurian rocks, were noted as "very little if at all micacised." Eastward of Doon rock, N.W. and north of the flat bog, are numerous exposures of gneiss and schist, some dipping S.S.W. and others S.S.E. at angles varying from 60° to 88°.

At about half a mile nearly due east of Doon rock, the boundary between the silurian rocks and the metamorphosed rocks seems to extend towards the S.E. under the flat bog, as in that direction a small exposure of schist appears between the margin of the bog and the lake, about a quarter of a mile north of Kilbride ferry.

The country north and east of these metamorphic rocks is occupied by others of silurian age. On the eastern shore at Lough Mask, immediately north of Bird Hill, are purple sandstones that dip N.E. at 45°. These beds were observed to be full of curious markings perpendicular to the surface of the beds, like filled up burrows, which are supposed by Mr. Baily to be due to annelid borings. On the projecting point of land immediately north of these rocks, are purplish and greenish grits and shales dipping N.E. at 80°, and having fossiliferous calcareous nodules; fossils are also found a little further N.E., nearly opposite Kilbride rock. North of Kilbride rock are green and purple sandstones dipping N.N.W. at 40°, and some of them are traversed by nearly N. and S. dyke-like veins of a curious brecciated or angular jointed shingly rock. A quarter of a mile north of Kilbride rock there seems to be a synclinal curve. This seems proved by curious jointed cut up beds that dip to the N.N.W. at 40°, while a little further north apparently the same beds dip southward at 50°. More to the northward the rocks, which are chiefly greenish sandstones, some being fossiliferous, dip in the same direction or S.S.E., at from 30° to 40°. At the extreme north-east point is a N.W. and S.E. dyke of breccia, north-east of which the beds are cut up by a vertical irregular cleavage and all stratification seems to be obliterated, except in one place, where it is nearly vertical, however the rocks immediately south and north-west of the dyke dip S.E. at 40° and 45°.

On the northern shore are green grits, sandstones and shales, with a few purplish sandstones, some of which have an ashy aspect. Their strike gradually changes from E.N.E., near the north-eastern point, to N.E. as they are crossed toward the west, the dip being S.E. and E.S.E. at from 30° to 45°. Towards the eastern end of this series of rock, dyke-like breccias were observed cutting across the beds, one in particular, which occurs a little more than a quarter of a mile west of Lusteenmore rock, was noted as vertical and about five feet wide. On the shore, running at right angles to this dyke, is a bed of conglomerate containing green grit pebbles and dipping S.E. at about 40°. Most of the rocks both on the eastern and northern shores, exhibit on their surfaces remarkable planing, rounding and striation; hereafter they are more fully described in the table of the supposed ice striæ.

On the northern shore about a mile west of Lusteenmore rock, a purplish or greenish intrusive rock breaks up through the silurian rocks, jasperizing those parts of the shales that are in contact with it, and in one place the sandstone or grit in contact is, apparently, altered into a regular quartzite. As the mass of this irruptive rock occurs in the district on the west its detailed description will be deferred until the whole of it has been examined. To the south of the igneous rock, the silurian rocks dip E.S.E. to S.E. at angles varying from 35° to 50°, while at Doon rock, which, although on low ground, is conspicuous, the silurian green sandstones and shales dip S.S.E. or toward the metamorphic rocks, at 30°. North-east of it are exposures of similar rocks also dipping S.S.E., but at from 50° to 60°, while half a mile east and

close to the boundary of the metamorphic rocks are a few beds of purple sandstone dipping at 50° to the north, or away from the metamorphic rocks. Immediately north of these beds, and extending eastward for a few hundred yards, are green sandstones which exhibit curious markings supposed to be due to annelid borings, similar to those in the purple sandstones north of Bird-hill. These beds are nearly vertical or dip at 80° to the north.

Farther northward, in the neighbourhood of the stream that flows eastward into the lake near Kilbride rock, are numerous exposures of rocks, dipping S.S.E. and S.E. at from 40° to 50°. At the house about half-way between Doon rock and the summit, are rocks dipping to the S.E. at 40°, similar in appearance to the previously-described "annelid (?) sandstones," which seem to extend to the N.E., as other "annelid (?) sandstones" occur in their strike a quarter of a mile farther N.E.

South of Fox-hill there seems to be a fault, a downthrow to the N.E.; for in the stream south of the old church and from that towards the west, the rocks dip southwards towards the metamorphic rocks, while immediately east of the just-mentioned rocks in the stream, and from that to the lake both eastward and south-eastward, the silurians dip away from the metamorphic rocks until the previously mentioned synclinal curve is reached, north of which they have a southerly dip; moreover, apparently the annelid sandstone is jumped about 350 feet towards the north.

North of the old ruined church of Kilbride are greenish sandstones and shales dipping N.N.E. and E.N.E. at from 20° to 60°, while still further north, on the southern slope of Fox-hill, they dip E. at 30° and 40°. At about 300 yards west of Kilbride Church is a long low crag of green flaggy sandstones dipping E.N.E. at 30°, and south of that church, between it and the stream before mentioned, are green sandstones dipping E.N.E. at from 40° to 60°.

In the stream, half a mile west of where it discharges itself into Lough Mask, are the purplish and greenish "annelid (?) sandstones," apparently the N.W. continuation of the previously mentioned beds at Bird-hill. These, as before remarked, dip N.N.W. at 25°.

Islands in Lough Mask.

Rock Island. — This island is almost entirely composed of the purple "annelid (?) sandstones," the continuation of the Bird-hill beds. The beds in general are almost vertical; but on the north they dip at 80° to the north-east. On the south part of the island are some greenish sandstones without annelid borings.

Kilbride Rock.—This rock is composed of fossiliferous purple silurian sandstones dipping N.E. at 50°.

Rams' Island.—A N.N.E. hill of yellowish sandy drift. The shores are covered with blocks chiefly of limestone. Some of those blocks were observed to be 12 or 14 feet long by 6 or 8 feet wide; moreover some of them appear very little moved from their original site. Some large blocks of purplish sandstone also occur in the drift.

Carrigeennagur.—A low hill of sandy clayey drift. The shores, like those of the islands near the south shore of the lake, are covered with perforated limestone blocks.

Carrigeennaweelaun.—Limestone blocks and drift.

Carrigeenlusteenbeg.—Silurian greenish sandstones dipping S.S.E. at 50°.

Lusteenmore Rock.—Silurian greenish sandstones and shales that dip S.E. at 30°.

J. N.

6. Drift and other superficial Deposits.

The drift in this area seems to consist of at least three divisions, viz., *Boulder-clay-drift*, *Moraine or Boulder-drift*, and *Esker-drift*, or *Post-drift-gravels*.

The *Moraine* or *Boulder-drift* always contains local blocks and fragments, some of which are angular and sub-angular, in a more or less gravelly, clayey, matrix; and associated with it are clayey gravels and sand. There is a variety of this drift that may be called *Rocky Moraine-drift*, which occurs on some of the hill slopes, or in steep sloping valleys, consisting of innumerable local blocks of all shapes and sizes up to tons in weight, mixed with very sandy clay, or perhaps more properly speaking, clayey gravel. These drifts are supposed to be entirely of glacial origin. That the *Rocky Moraine-drift* is, would seem proved by its always occurring on planed, polished and striated rock-surfaces. It must not be confounded with the *Rocky drift* hereafter to be mentioned, which seems to have quite a different origin.

The *Esker-drift* or *Post-drift-gravels* may be either the Boulder-clay-drift or the Moraine-drift washed and sifted perhaps by marine or tidal currents. In this district it rarely occurs in *Eskers* (Anglice, *ridges*), but more usually in low undulating hills, or banked against "Drumlins," or *the Esker-shaped hills of Boulder-clay-drift*. Where sections can be seen of its junction with the Boulder-clay, or the Moraine-drift, the division between them is found to be well defined; but horizontally there usually seems to be a gradual change from one to the other; as, *first*, will be found the Boulder-clay-drift, or Moraine-drift; *next*, those drifts partially washed, the finer fragments having been carried away, leaving as residue a *Rocky-drift*; and *lastly*, the Post-drift-gravels. The latter consists of clean sharp sands and gravels, very similar in appearance to marine sands and gravels, and quite unlike the gravels found associated with the Moraine-drift, the latter having more the appearance of the sands and gravels found in river flats. Apparently newer than all these drifts are the *Erratic blocks*, as they usually occur over them; and seemingly subsequent to all are the *Alluvial-flats* and *Peat-bogs*; the latter growing at the present day and in many places forming an envelope which protects the surface of the ground from subærial denudation.

Country West of Lough Corrib.—Over the limestone tract there is more or less drift. The promontory called Ard (*Anglice*, Height) is nearly altogether drift, the mass being Boulder-clay-drift with Post-drift-gravels banked against it. South and south-west of Ard, in the vicinity of Ardnasillagh and Aughnanure Castle, there is an undulating drift being partly Boulder-clay and partly gravel. West of the castle is a circular hill of drift called Knockkillree, and north of it at Corrib View, a similar one, the rocks under which as seen on the east, are beautifully polished and scratched; the striæ bearing N. 80 E. Around this drift hill, except eastward, is a bog, and N.E. of the bog between it and the lake, is a low drift mound. At Portacarron there is undulating Boulder-clay-drift, also in the vicinity of the Glebe House and Lemonfield; large granite erratics being very frequent on the drift to the south of the former. West of Lemonfield there is a large bog, and north of the bog low drift hills, the rocks, under which, as seen a little east of the pier, are scratched and polished, the striæ bearing N. 65 E. In the Lemonfield bog large lumps of bog-butter are of rather common occurrence. One, found while the district thereabouts was being examined, was about four feet under the peat lying in an oblique position; the peat over it evidently had grown since it was placed, proving that it had not been buried recently. It was over three feet long, 1·5 feet in diameter at the largest end, and 9 inches at the other. It would seem to have been originally in a woven cloth inside laths that were placed rather widely apart.*

The weathering of the limestones on the shore of the lake hereabouts is

* Although the marks of the cloth and laths were plainly visible on the outside of the butter, yet no fragments of them, after a careful search, could be found. This may be accounted for when it is considered that the butter was found while the turf was being cut, and the place could not be examined until the turf was saved, as previous to that the turf was spread over the banks.

very peculiar, and as it has occurred since the drift period, perhaps it may be here referred to. Those rocks that have recently had their covering of Boulder-clay-drift removed are, as before mentioned, beautifully planed and polished. Those that now, since the lake was lowered,* are exposed during the summer months, are full of minute round holes, those that were formerly only exposed during the summer months are full of larger holes, while those that are exposed to all weathers are pierced through and through with circular holes. This circular weathering is peculiar, as it does not seem to occur except in the vicinity of lakes. It usually begins on the ice-polished surfaces by forming lines of minute holes along the striæ, but if the rock is naturally jointy the holes will more rapidly increase along the joint lines, so that in a very short time, all appearance of the striæ disappears. Moreover, even if the rock is not jointy, all appearance of the striæ will shortly disappear, as these scratches ran regularly alike over the chemically hard and soft portions of the rock, while the latter will weather much more freely than the former. Professor Melville of Galway seems to be of opinion "that these holes are caused by the acid generated from the decay of mosses or lichens. Humic acid being formed from the decayed of the vegetable matter that might grow in or be swept into the small hollows in the stone, and carbonic acid from the final decay, the latter acid saturating the water, which would then act on the limestone. Once the hollow is begun all acid in the water remaining on the stones along with what may form from the decay of any vegetable matter that may be swept into them, will be concentrated as the water evaporates; therefore principally act on the bottom of the hollow, and thereby bore the cylinders through the blocks."

In this way the holes, which are like inverted funnels, might also be explained, for as the holes deepened the water in them could not evaporate as quickly as when they were shallow; therefore the contained acid would act on the sides as well as on the bottom of the holes, and thereby enlarge as well as deepen them. If the acid generated from the plants are the cause for these weatherings, the reason for their being only found in the vicinity of lakes may be accounted for, by supposing that the moisture from the lakes helps the growth of the acid-forming-vegetables.

Against these suggestions it should be mentioned that in one locality, Dringeen Oughter, on the shores of Lough Mask, a cup weathering occurs, not on the surface of the rocks, but on the surface of one of the beds in the face of a low perpendicular cliff. As this cliff, however, margins a turlough, and the usual winter level of its water seems to agree with this line of weathering, the note made being "cup weathering at the top of the winter floods, but over it are two feet of rock; these holes may be possibly due to the decay of plants."

In the neighbourhood of Oughterard there is undulating drift, and north of Clareville an east and west hill, the west end of which is banked against the high granite ground. Farther southward, on the strip of country occupied by the sandstone, there are peculiar mounds or "drumlins" of drift, that have a general bearing of N. 50 E., the mass of the drift being Moraine-drift; however, against many of them the Post-drift-gravels are banked, and small gravel ridges and mounds occur in some of the hollows between them.

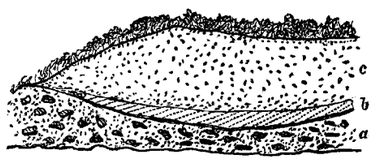
At the bridge, on the old road to Currarevagh, about half a mile N.W. of the Oughterard Military Barracks, a section is exposed of one of these hills, showing a granite gravel overlying a red drift, formed of fragments and the *debris* of rock, apparently similar to some of the underlying sandstone and shales.†

* About fifteen years ago, during the works for the Lough Corrib Navigation, the summer level of the lake was lowered three feet.

† The contained blocks and fragments might possibly be the *debris* of the basal bed of the upper silurian, for at Currarevagh and further north, as previously mentioned, a thick red sandstone of a similar nature to those here found occurs at the base of that group of rocks.

On the country bordering the lake there is more or less drift, most of which is Moraine-drift, a little being Boulder-clay-drift, and on them are gravels and sands of a more recent age. On the north coast, to the west of Inishlannaun, are gravel and sand hills; to the east of Inishlannaun the drift mounds are very irregular, and many have gravelly-drift banked against them. In the stream south of Inishlannaun the following section is exposed. (See Fig. No. 6.)

Fig. 6.



Diagrammatical section of Drift-cliff.
a Boulder-clay-drift. *b* Gravel. *c* Moraine-drift.

From the bog, north of Currarevagh House, southward, nearly to Oughterard, there are a series of remarkable drift mounds or "drumlins," that nearly invariably have a bearing similar to the slope of the high ground west of them. They rise one after another on the sides of the hills and valleys, coming out gradually from the hills, and usually ending downwards rather abruptly; however, a few do tail off down the mountain slope, but with very steep sides. In some cases, as at the road S.S.W. of Currarevagh House, the newer drift (Post-drift-gravels and sand) are banked against the end of these hills. At this locality, besides the Post-drift-gravels just mentioned, there is a low hill of that drift immediately west of St. Cuthbert's Well. The fragments and blocks in the Boulder-clay-drift are usually of the neighbouring rocks; however, in those mounds bounding Lough Corrib and south of the promontory called Annaghwood, a few fragments and pieces of carboniferous limestone were observed. The most elevated of these hills is situated N.E. of Secon, at an altitude of about 500 feet. On the low ground, bordering the margin of the lake, between these mounds are flat peat bogs. In one of them, immediately west of the trigonometrical point 125, under five feet of peat, the cones of the bog-deal (Pinus sylvestris) were observed.

Among the hills there is not much drift, and what does occur is nearly altogether the glacial drift, containing angular and subangular blocks and fragments of the neighbouring rocks.

In the nearly N.W. and S.E. wide valley, east of Carn Seefin, there are small mounds and irregular ridges of rocky Moraine-drift, more, or less, overgrown with bog, that have a general bearing the same as the valley. In the valley N.E. of Knockletterfore there is an undulating Moraine-drift banked against the hill, and on the south slopes of the same hill there is a somewhat similar drift; however, hereabouts its features have been much changed subsequently by the meteoric abrasion.

In the valley at the S.W. of the district, N.W. and S.E. of Lough Agraffard, are mounds or "drumlins" of drift that have a general bearing with the trend of the valley. Most of them are of Moraine-drift, but against many a gravelly drift has been banked. Moreover, there also occur short, esker-like ridges of a clayey-gravel, but not of the sharp nature of the gravels and sands found in the eskers of the central plain of Ireland.

Many porphyritic-granite erratic occur hereabout that must have been brought from the hills to the south, on the southern branches of the Oughterard valley-glacial. A remarkable one (see Fig. No. 7) is perched on

the crag close to the mail-coach rock, and a little east of the village called The Garibaldi.

Fig. 7.

Erratic block on crag east of the village called The Garibaldi.

Country east of Loughs Corrib and Mask.—Over this country the drift is usually the Boulder-clay-drift, but in some places there is a Rocky-drift that appears to be the residue of the Boulder-clay-drift, and in others there is the Post-drift-gravels or Esker-drift. South of Headford the drift is undulating, but seemingly it is inclined to make N.E. and S.W. irregular ridges and valleys. Between Clydagh and Ballyhale there is a rocky drift, also north of Knockalahard and north of Annaghkeen Castle. The principal blocks and fragments in it being limestone, however in places carboniferous-sandstone, silurian, metamorphic rocks, and granite blocks and fragments were observed, the latter apparently being rare. North-west of Clydagh, adjoining Lough Corrib, it was noted that "the drift is very stony, and inclined to form N.E. and S.W. irregular ridges." The bogs near Lough Corrib have a tendency also to extend N.E. and S.W., while the large bog further inland, east of Ross Abbey, is very irregular. S.E. of the Headford demesne are blocks of red jasper that apparently occur in the drift; the jasper being similar in appearance to the veins of that rock found among the hills to the N.W., on the west of Lough Mask. Further eastward and a mile east of Crossursa a clay from which bricks can be made, has been raised; it seems to occur in the drift. A mile N.N.E. of Lough Hackett is a ridge of Esker-drift. In Lough Hackett, or as it was anciently called Lough Cimbe, there is an artificial stockaded island or crannoge, and of it we read in the Annals of the Four Masters, A.D. 991, "The wind sunk the island of Lough *Cimbe*, suddenly, with its *cheach* and rampart, that is thirty-feet." A similar circumstance is recorded in the Annals of Clonmacnoise, but under the date of A.D. 984.

In the Headford demesne, not far from the Castle, trenches or shallow pits, full of human bones have been discovered, but from the arms, &c., found buried with them, they are supposed to be rather modern, and to have been interred there after one of the battles fought between the followers of the De Burghs and the Binghams. The south extremity of the county of Mayo is for

the most part, covered with an undulating rocky-drift, in which the fragments and blocks are usually angular or semi-angular and of limestone, some being of a considerable size, however there are a few well-rounded blocks of schist, sandstone, granite, &c. In the vicinity of Ballycurrin, while excavation in Boulder-clay-drift, a boulder of fibrous gypsum was found,* which Professor King of Galway says is similar to some of the county Antrim rocks.

Further northward, east and west of Ballymacgibbon bay, the drift is very rocky, and nearly altogether made up of angular fragments and blocks of the carboniferous-sandstones and conglomerates.

North-east and north of Shrule there are extensive peat bogs that have a general north and south bearing, while the intervening country is for the most part, covered with a deep undulating Boulder-clay-drift. Eastward and southward of Kilmaine there is an undulating drift in irregular hills and ridges, with a few turloughs and marshy hollows. West of Kilmaine are some short ridges and hillocks of gravel and sand. East and south of the village called Cross, the drift is rocky and made up for the most part of carboniferous-sandstone fragments and blocks. West of Turloughmore, in the cutting for the new river, a section of rocky drift over 30 feet thick, is exposed, the rock surface under the drift being weathered.

In the vicinity of Lough Mask there are some well-defined mounds or "drumlins" of Boulder-clay-drift that range about N.E. and S.W., and north of Cong, there is one that bears N.N.W. and S.S.E.

G. H. K.

Country north of Lough Corrib.—As the country immediately west of Cong is mostly occupied with bare crags of limestone, little drift is seen, and that which occurs is generally gravelly. Near Cregdotia this gravelly-drift was noted to contain rounded and semi-angular blocks of the neighbouring silurian and carboniferous rocks, and N.W. of this hamlet, at Breandrim House is a conspicuous drift mound or drumlin, that bears N. 10° E. The country on the southward from this to Lough Corrib is generally covered with undulating drift mostly containing limestone debris, however there are also fragments of sandstone and silurian rocks, and west of Cappacorcoge are two parallel drift hills, the axes of which bear about N. 30° E., while a smaller hill with a similar bearing, lies N. of Ballynamona. Between Cappacorcoge and the western gate of Ashford demesne the following section was observed:—

	Feet.
5. Vegetable soil,	2
4. Reddish clay, with some rounded blocks,	5
3. Coarse sandy gravel,	2
2. Rounded blocks, chiefly of local rocks, in a sandy, clayey matrix,	3
1. Fine purple coloured gravel	4
	16

North-east of Ballynamona, at a depth of from four to six feet under the bog, is a viscid grayish substance, which does not effervesce with acid, and may perhaps have been formed from the debris of the softer silurian rocks. When dried and mixed with lime, it makes hydraulic cement; and was extensively used while constructing waterworks at Ashford, the seat of Sir A. E. Guinness, Bart.

North and north-west of Ardaun are several drift hills, chiefly made up of Silurian debris and fragments, and having a general bearing to the north-east. N.W. of Ardaun is an irregularly shaped bog, and north of it, on the shore of Lough Mask, is an alluvial flat, with a small bog bounding on the west, a N. and S. arm of Lough Mask.

* Communicated by Charles Lynch, esq., D.L., Ballycurrin.

In the neighbourhood of Fairhill the country is principally occupied by undulating gravelly drift; and a remarkable line of drift mounds, principally silurian debris, occurs on the slope of Benlevy, extending from about half a mile west of Fairhill, in a north-westerly direction, to Lough Mask. The axes of these hills are parallel, or nearly so, and bear about N. 35° E., having a similar general bearing to the ridges of drift in the demesnes of Rosshill and Petersburgh, and the drift islands adjoining,* as also the bays which indent the shores north of these demesnes.

The eastern and southern slopes of Beulevy are mostly occupied with rocks, but in a few places there is a sandy clayey, or gravelly drift, with blocks of the neighbouring rocks, some of them smooth and rounded, but most of them more or less semi-angular. In the townlands of Carrick, which form the south slope of Benlevy, the rocks were observed to have smooth-polished, often grooved, sloping surfaces, towards the west, while they terminate abruptly or crag off towards the east.

South of Benlevy, along the Cornamona river, is a boggy flat, while the promontory of Doorus is rocky, with bog between the outcrops of rock; towards the middle are some considerable drift hills of irregular outline, having a general east and west bearing. The drift is of a similar character to that of the islands in this part of Lough Corrib, being a sandy clayey drift, with more or less rounded and sub-angular blocks of local rocks. The eastern end of this peninsula is chiefly occupied by peat bog, there are, however, three or four remarkable hills of drift similar to those just described, and having a somewhat similar bearing.

On the north-east of Benlevy, about Coolin Lough, there is an undulating country which seems to have a coat of coarse stony gravelly drift, with in most places, an envelope of mountain bog. This drift is full of angular and semi-rounded blocks of silurian rocks, many of them being of great size. The ridges have a similar bearing to those described in the neighbourhood of Fairhill. The elevated country north of Benlevy is in a great measure covered with mountain bog over drift, of a somewhat similar character to that on the north-east. Occupying the country bounding Kilbride Bay on the south, and north of the range of cliffs which bound the elevated district on the north, is a bog, but in places between it and the lake are small mounds of drift, the axes of which bear about N. 60° E.

North of Kilbride Bay, on the promontory similarly named, there is much bog; however, bordering the bay there are some roundish mounds of sandy clayey local drift whose axes have a general bearing coinciding with the lie of the valley now occupied by this bay. North and west of this are slightly sloping bogs, while farther north on the higher ground is the usual mountain bog occurring among knapps, bosses, and other exposures of rocks; with, on some of the slopes, an angular gravelly clayey-drift.

J. N.

Ice (?) Striæ, &c.—In the area contained within the limits of this sheet of the map, many of the rock surfaces were observed to be planed and scratched, some also being beautifully polished, and all having a similar appearance to the ice worked rock surfaces found at the present day in Alpine and Arctic regions. On this account it has been suggested by various observers, that the rock carving, &c., is the work of ice.

The scratches or striæ that have now to be described, appear as if they belonged to at least, two distinct systems, one being much older than the other. The older, which may be called the *Primary*, seem formed by a force that came from the N.E., and apparently, have been cut either by floating ice (icebergs) that was drifted by a current to the S.W., or by a massive sheet or *nappes* of ice that once covered the central plain of Ireland; and had a

* All the islands in the part of Lough Mask included within this sheet of the map have the same general bearing.

general flow in a similar direction. The newer seem due to systems of glaciers that had their sources in the hills of west Galway and south-west Mayo.

The ancient glaciers of west Galway or Yar-Connaught, as it is called on the old maps, seem, with the exception of those occupying a small area at the N.W., to have been branches of a large glacier that filled the valley now occupied by Galway Bay; and the main feeder of it would appear to have been a tributary that came down the valley now occupied by Lough Corrib. The last-named glacier was the principal one in this district, and from it were branches in the transverse valleys, the largest of the latter being that of the Oughterard valley. Besides the Galway Bay glacier, its branches and their tributaries, there seem, in the north of the district, to have been tributaries to the branch of a glacier that flowed northward and westward. This latter system occupied the valley in which we now find Lough Mask, and appears to have had tributaries descending from the valleys in Slieve Partry and Benlevy, the highlands west and south of Lough Mask.

An attempt has been made to classify the striæ observed, and in the following table to divide them according to the glaciers or branches of glaciers to which they are supposed to belong, giving the first column (marked Striæ A) special to what seem to belong to the primary striation; the second (marked Striæ B) to those that belong to the main valleys, namely, the glaciers of either the Lough Corrib or the Lough Mask valleys; the third (marked Striæ C) to the tributaries of those valleys; and the fourth (marked Striæ D) to the striæ of the minor valleys.

The primary striæ, in a country that has subsequently been occupied by a system of glaciers, in most instances ought to have been planed away or more or less obliterated, therefore it appears expedient, striæ should not be put among that class unless they occur in places where it seems probable the older marks might still exist; on which account on an examination of the table, it may be observed, that striæ in some localities are recorded as if they were due to one of the minor glaciers, while possibly their proper place should be among the primary striæ.

The reader's attention may also be directed to the striæ belonging to some of the tributaries cutting and evidently being newer, than the striation belonging to the ice in the valley to which the former were only a branch; as for instance, the striæ supposed to have been cut by the branch glacier of the Oughterard valley being found in the Lough Corrib valley cutting and therefore newer than the striæ, evidently due to the ice flowing down the latter; and in other places the striæ of the minor valleys cutting the striæ belonging to the valleys, of which they are tributaries. This, however, may be accounted for, if it is supposed that as the climate ameliorated the main glacier retreated up its valley, and left its branches as independent glaciers, which at times extended, partly or entirely, across the main valleys. Similar facts have frequently been observed and recorded by the numerous explorers of Alpine regions; from which, it would appear, that the above suggestions may probably be correct.

The first sixteen observations in the following table, to the end of those in the townland of Ballyweeaun, are in connexion with the country, the ice from which is supposed to have gone northward through the valley of Lough Mask; therefore, the striæ in the second column (marked striæ B) belong to the ice of the Lough Mask valley, and those in the third and fourth columns to that of its tributaries; while the rest of the table consists of notes in connexion with the ice of the Lough Corrib glacier, its branches and tributaries. A variation of 10 or even 20 degrees in the direction of striæ belonging to the same system, may be due to those that have been recorded lying on different sides or slopes, of the same hummock of rock, as the ice would seem to have had a tendency to slide down such slopes.

TABLE OF SUPPOSED ICE STRIÆ.

County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
Galway, 13/4,	Kilbride, on the shore north of Foxhill in various places.	-	-	-	N. 25 E.	These striæ would seem to have been cut by ice slipping down the hill into the valley on the north of the Kilbride promontory, or possibly they may be due to the ice of that valley turning northward to join into the glacier of the Lough Mask valley. The rocks along this shore are usually planed, rounded, polished, grooved, and striated.
,,	Killbride, a little west of the N.E. point.	-	-	N. 65 E.	-	On one rock surface; the latter evidently being the newer. The first seem due to the ice of the Lough Mask glacier and the latter to a branch of that glacier.
,,	Kilbride, a little south of the N.E. point.	-	N. 40 E.	-	-	The N. 50 E. striæ seem due to the ice of the Lough Mask valley; while the N. 65 E. may have been cut by the ice turning out of the mouth of the valley of Kilbride Bay; more especially as east of them there is a drumlin with similar bearings, while farther south and south-west are other drumlins, whose bearings have a greater easting.
,,	Kilbride, on one rock surface a little further south.	-	N. 50 E.	N. 65 E.	-	
,,	Kilbride, on the shore near Kilbride rock.	-	N. 50 E.	-	-	
Galway, 26/2,	Kilbride, at the ferry,	-	N. 65 E.	-	-	These seem evidently, to have been cut by the ice coming out of the Kilbride Bay valley. North and west of the ferry, there are small mounds of drift with similar bearings to the ice striæ; while north of the last locality, there is a twin drumlin or double drift mound, the axis of which bears N. 65 E. There is a slight wind in the valley at the mouth of Kilbride Bay, which seems to have been followed by the ice, thereby making slight variations in the bearing of the striæ on the three different rock exposures at small distances apart.
,,	Kilbride, on the shore, a little west of the ferry.	-	N. 70 E.	-	-	
,,	Kilbride, on the shore, half a mile farther west.	-	N. 50 E.	-	-	
Mayo, 117/4,	Islands in Lough Mask,	-	-	-	-	Drift mounds or drumlins, bearing N. 25 E., while those farther south, as recorded in the following note, bear N. 30 E., and those to the S.S.W., N. 35 E. Immediately farther northward, outside the limits of this district, both the drumlins and the newest striæ bear N. 15 E., while still farther N. they gradually range through N. 10 E., N. 5 E., to N. and S., apparently showing that the cause which form the striæ formed also these drumlins or drift mound; and that it seems to have been ice sweeping in a gentle curve from the hills of Benlevy to the north of the Lough Mask valley.
Mayo, 120,	Country immediately south-east of Lough Mask.	-	-	-	-	Drift mounds that run N. 30 E., similar to the bearing of the rock islands in the S.E. part of Lough Mask. Immediately north of Coug there is a drift mound partly banked against a crag, bearing N. 15 W., in a similar direction to the valley of the Cong River.
Galway, 26/2,	Cappaghnagapple, on the shore of Lough Mask.	-	-	-	-	Drift mounds bearing N. 65 E. and N. 80 E. The N. 65 E. have a bearing similar to the neck of Kilbride Bay, and the N. 80 E. to the bearing of its whole valley.

TABLE OF SUPPOSED ICE STRIÆ—*continued.*

County Map	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
Galway, 26/2,	Cappaghnagapple, on the north slope of Boocaun hill.	–	–	N. 70 W.	N. 70 E.	These occur at a height of 550 feet. The N. 70 W. are grooves, and seem to have been cut by the ice coming out of the valley of Kilbride Bay; while the N. 70 E. apparently are newer, and cut by ice sliding down the small valley south-east of Croaghacurren.
,,	Cappaghnagapple, about 300 yards farther north.	–	–	–	N. 60 E.	
,,	Cloghbrack Lower,	–	–	–	N. 70 E.	Apparently cut by ice sliding down the small valley south-east of Croaghacurren.
,,	Coolin, on the slope of the hill N.W. of the lake.	–	–	N. 60 E.	–	Apparently due to the ice going down the Coolin Lough valley to the Lough Mask valley.
Galway, 26/4,	Coolin, near the summit of Benlevy △ 1,370.	–	–	N. 60 E.	–	Grooves at a height of 1,355 feet; apparently cut by the ice going down the Coolin Lough valley.
,,	Coolin, on the slope south of the lake.	–	–	N. 65 E.	N. 45 E.	On the same rock surface. The latter cut the former. The N. 65 E. striæ may have been cut by the ice going down the Coolin Lough valley to join the Lough Mask valley glacier; while the N. 45 E. striæ seem due to ice sliding into the Coolin Lough basin.
Galway, 27/1,	Islands and country near Fairhill,	–	–	–	–	Drift mounds on the N.E. slope of the hills and islands in Lough Mask, the latter also being drift mounds, that have a bearing of about N. 35 E.; the former extend with the general slope of the ground, and the latter with the lie of the valley of Lough Mask. The mass of the drift is the Moraine-drift, but in some of the large mounds it seems partly to be Boulder-clay-drift.
Galway, 27/2,	Breandrim and Gortnaclassagh,	–	–	–	–	Conspicuous mound or drumlin of drift; its axis bearing N. 15 E. If these drumlins, as supposed by Mr. Close, are due to the ice; this and those more to the northward, would seem in some way connected with the ice of the Lough Mask valley.
Galway, 27/3,	Ballyweeaun, on the east slope of Benlevy.	–	–	N. 70 W.	N. & S.	The N. 70 W. seems to have been cut by ice going eastward to the Lough Mask valley; and the N. and S. by younger ice going northward. On the slope of the hill, half a mile S.E. of Coolin Lough, is an undulating stony drift forming irregular N. 35 E. ridges.
,,	Ballyweeaun, on the ridge, a quarter of a mile west of Gortuarup House.	–	–	–	N. 25 E.	These seem evidently to have been cut by ice going northward, as, with other evidence, the hummocks of rock all slope southward and crag northward. The locality is close to the summit of the ridge forming the east shoulder of Benlevy which slopes southward to the Lough Corrib valley and northward to the Lough Mask valley.
,,	The vicinity of Carrowbaun,	–	–	–	–	Drift mounds bearing from N. 30 E. to N. 45 E., and Drift mounds bearing N. 40 E., — These are on the ridge of ground that apparently divided the Loughs Corrib and Mask valleys, and may be due to either of their glaciers.
Galway, 27/4,	The vicinity of Toberbiroge,	–	–	–	–	
Galway, 27/4,	Islands in Lough Corrib,	–	–	–	–	General bearing N. 35 E. to N. 45 E.
Galway, 27/3,	Ardaun West,	N. 30 E.	–	–	–	Might possibly have been cut by the primary ice.
,,	Illaunaknick, an islet in Lough Corrib,	–	–	N. 65 E.	–	These seem to have been cut by the ice of the Cornamona branch of the Lough Corrib valley glacier deflected by the ice coming down the Maum Bay valley.
,,	Carrick east, on the shore of Lough Corrib.	–	–	N. 75 E.	–	
Galway, 26/4,						
Galway, 26/4,	Carrick east and middle, south slope of Benlevy.	–	–	N. 80 W.	–	The rocks on this mountain slope, tail to the westward and crag to the eastward; and the dressed rock, grooves, and striæ appear due to ice coming down the Cornamona Bay branch of the Lough Corrib valley glacier.
Galway, 39/2,	Dooros, on the shore of Cornamona Bay.	–	N. 80 E	N. 70 W.	–	These occur on one rock surface. The N. 70 W. agree with the bearing of the lie of this part of the Cornamona Bay and river valley, but the N. 80 E. are evidently the newer. Those latter may be due to the ice of the Lough Corrib valley glacier coming out of Maum Bay; or possibly, both sets might have been cut by the ice from the Cornamona valleys at different periods.
,,	Dooros, shore of Maum Bay, west margin of the district.	–	N. 65 E.	–	–	These seem due to the ice turning out of the Maum Bay or main branch of the Lough Corrib valley glacier. In the last locality the N. and S. striæ are evidently older than the others, but they seem to have been cut by ice sliding down from the hills to the northward. However, possibly, they might be part of the primary striation, deflected by the hills on the south.
,,	Dooros, shore of Maum Bay, a little farther S.E.	–	N. 70 E.	–	–	
,,	Dooros, shore of Maum Bay, a little farther S.E.	–	N 80 E.	–	–	
,,	Dooros, shore of Maum Bay, a little farther S.E.	–	N. 80 E.	–	N. & S.	
,,	Cormorant Rock, a rock a mile N.E. of Dooros village.	–	–	–	N. 25 W.	Seemingly cut by the ice coming from the hills on the north, into the Lough Corrib valley.
Galway, 40/1,	Lawrence's Island,	–	–	N. 65 E.	–	The striæ B seem to have been cut by the ice of the main glacier coming out of the Maum Bay valley; while the striæ C appear due to the ice of the Cornamona Bay branch of that glacier. On Kelly's Island the two sets of striæ were observed on one rock surface, and the N. 70 E. are evidently, newer than the E. and W.
,,	Rocks N.N.W. of Inishvinlush,	–	N. 80 W.	–	–	
,,	Cloonbrone, north shore,	–	–	N. 60 E.	–	
,,	Cloonbrone, south shore,	–	N. 80 E.	–	–	
,,	Kelly's Islands,	–	E. & W.	N. 70 E.	–	
Mayo, 120,	Green Island, Islands in the N.E. part of Lough Corrib, and S.E. of Cong.	N. 45 E.	–	N. 75 W.	–	The dressed hummocks tail to the N.E. The newer striæ are across the axis of the dressed hummocks, and seem to have been cut by a force coming from the W.N.W.
,,	Sloe Island,	N. 40 E.	–	–	–	
Mayo, 121/3,	Ballymacgibbon south, near the lake shore.	N. 30 E.	–	–	–	The dressed hummocks slope to the N.E.
Mayo, 122/3,	Cloonnameeltoge,	N. 40 E.	–	–	–	Hereabouts the drift is undulating very irregularly.
,,	Gorteens,	N. 40 E.	–	–	–	
Mayo, 123/2,	Ballisnahyny,	N. 50 E.	–	–	–	Drift in irregular mounds.
Mayo, 123/3,	Ballycurrin demesne,	–	–	–	–	Boulders of fibrous gypsum, said by Professor King, of Galway, to be similar to that rock as it occurs in Antrim, were found in boulder clay drift while excavating for a boat quay.
Galway, 28/1,	In whole area,	–	–	–	–	Ridges of drift and bogs have a general bearing of N.E. and S.W.
Galway, 28/2,	In whole area,	–	–	–	–	In general there is no special bearing for the main direction of either the bogs or ridges of drift; however, Derrymore hill bears about N.W. and S.E.

TABLE OF SUPPOSED ICE STRIÆ—*continued.*

County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
Galway, 39/4,	Derroura, on the N.W. shoulder of Carn Seefin.	–	–	N. 53 E.	–	At a height of 577 feet. These seem to have been cut by ice sliding down into the Lough Corrib valley; however, they possibly might chance to be some of the primary striæ.
,, . .	Letterfore, on the summit of the hill,	–	–	N. 65 E.	–	At a height of about 850 feet, and a mile south of Carn Seefin.
,, . .	Letterfore, in the valley east of the last.	–	–	N. 43 E.	N. 10 W.	The N. 43 E. striæ seem to have been formed by ice coming from the N.E., and it appears scarcely possible that ice from this place could have gone N.E. to the valley of Lough Corrib. If these suppositions are correct, these, as well as those just now mentioned in Derroura, and at the previous mentioned locality in Letterfore may be primary, more especially as there is no high land between them and the central plain of Ireland; however, as they possibly may only be secondary, they are classed among them. Another supposition for their formation is, that they were cut by ice going down the minor valley in a S.W. direction to join into the glacier of the Oughterard valley. The N. 10 W. striæ were formed by ice sliding into one of the minor valleys.
,, . .	Barretleva, on the N.W. slope of the hill.	–	–	N. 58 E.	–	These may possibly be primary for somewhat similar reasons as those given in the last remark; however, these coincide with the fall of the ground into the valley of Lough Corrib, and therefore may possibly have been cut by ice sliding down the hill.
,, . .	Barretleva, at a height of 700 feet,	–	–	N. 51 E.	–	
Galway, 40/1, .	Inishdooros, east end, . . .	–	N. 80 E.	–	–	These all seem to have been cut by the ice coming down the Lough Corrib valley, for at this place the lake turns towards the west to join the valley occupied by Maum Bay. In the first locality the two sets of striæ are on one rock surface, the N. 70 W. being the newest, and possibly they may be due to ice coming down from Maum, while the older were cut by ice coming down Cornamona Bay on the north-east of the Dooros promontory. In favour of this last supposition, it is found that the striæ on the S.W. point nearly coincides with the direction of the newer, while those on the N.W. part is a medium between the two.
,, . .	Inishdooros, north-west part, .	–	N. 70 W.	–	–	
,, . .	Inishdooros, south-west point, .	–	E & W.	–	–	
,, . .	Inishdooros, west coast, opposite Rocillaundoo.	–	N. 80 W.	–	–	
			N. 80 E.	–	–	
,, . .	Cannaver Island, ...	N. 30 E.	N. 85 W.	N. 32 W.	–	The N. 85 W. striæ agree with the general bearing of the entrance into the valley of Maum Bay, and the N. 32 W. with that of the valley on the west of Benlevy. The N. 30 E. was evidently formed by ice coming from the N.E., and they agree with the axis of the "tors" or dressed hummocks of rock; also with the general bearing of the islands to the north-east. These primary striæ occurring here, seem to be in favour of those on the hills to the S.W. (in Derroura, Letterfore, &c.), as previously suggested, being also primary.

Galway, 40/2,	Inishmicatreer, on the west side, .	–	–	–	–	Rocks rounded and polished, but no striæ observed.
Galway, 40/3,	Cannaver Island (south), . .	–	E. & W.	–	–	Seems due to the ice coming out of the valley of Maum Bay.
,, . .	Currareevagh, shore of the lake, .	–	N. & S.	N. 80 E.	–	The first agrees with the axis of the dressed hummocks of rock, and may have been formed by the ice coming down the valley of Lough Corrib, the others by the ice from the hills on the west.
,, . .	Currareevagh, south of last, . .	–	–	N. 80 E.	–	
,, . .	Currareevagh, in small valley, .	–	N. 25 W.	–	–	This has a similar bearing to the valley of Lough Corrib hereabouts.
,, . .	Annaghwood, on the north of the island.	–	–	N. 70 E.	–	Seems due to the ice from the hills on the west. The dressed hummocks bear N. 10 W., and slope or tail northward.
,, . .	New village, ...	–	N. 47 W.	N. 68 E.	–	The first is on the face of a low cliff on the N.E. slope of the hill. The second is a short distance from it, and seems due to the ice slipping down the hill to Lough Corrib; while the first may be due to the Lough Corrib valley glacier.
,, . .	New village, ...	N. 43 E.	N. 35 W.	–	–	The first is at the road in the east corner of the townland, the second a little higher up the hill than those just now recorded. The first seem due to the primary glaciation, and the second to the Lough Corrib valley glacier.
,, . .	Gowlaun, } In various places,	–	–	N. 63 E.	–	Seems due to the ice from the hills on the west, coming down to the Lough Corrib valley.
,, . .	Ballygally, }					
Galway, 41/1, .	Inishmicatreer, on the east shore, .	N. 40 E.	N. 75 W.	–	–	The first are supposed to be primary, and the second due to the ice of the Lough Corrib valley glacier. The latter are well marked over a large polished surface, and nearly obliterate the older.
Galway, 41/3, .	Inchiquin, on the S.W. shore, .	–	N. 85 W.	–	–	Supposed to have been formed by the ice of the Lough Corrib valley glacier.
,, . .	Inchiquin, on the N.W. shore, .	–	N. 60 W.	–	–	
,, . .	Greenfield, by the roadside, . .	N. 28 E.	N. 76 E.	–	–	On one rock surface, under rocky boulder drift.
,, . .	Curraghmore, on the shore of Lough Corrib.	N. 32 E.	–	–	–	Supposed to be primary striæ.
Galway, 53/2, .	Derryglauna, on the summit of Keerauntoole, 526 feet.	–	–	N. 30 W.	–	These seem to be due to ice that flowed down the Oughterard valley.
,, . .	Lettercraff and Letterfore, . .	–	–	N. 80 W.	N. 35 E. / N. 55 E.	The first seems due to the Oughterard valley glacier, and the other may have been caused by ice sliding down the hills, or to the primary glaciation. They are not placed as belonging to the latter, because in a deep seated valley, like that in which these occur, the primary striæ could scarcely have escaped being planed away. The N. 35 E. are well marked small grooves, while the others are on one rock surface.
Galway, 53/4, .	Leam East, on the north slope of Knockmoyle.	–	–	E. & W.	–	The dressed hummocks tail to the N.W. These striæ bear down the valley towards Oughterard.
,, . .	Leam East, on the N.E. slope of Knockmoyle.	–	–	N. 73 W.	N. 3 W.	The first are supposed to belong to the glacier of the Oughterard valley; and the others to ice sliding down the hills into that valley.
Galway, 54/1, .	Lettercraff, ...	–	–	N. 75 E.	–	

TABLE OF SUPPOSED ICE STRIÆ—*continued.*

County Map.	Townland and Locality.	Strie A.	Strie B.	Strie C.	Strie D.	Remarks.
Galway, 54/1,	Claremount, in different places,	–	N. 2 E.	N. 81 E.	–	On the S.E. slope of the hill the dressed hummocks of rock have a general N. and S. bearing, but crag to the S.E.; seemingly, as if there had been ceeded by a flow from the north that formed the hummocks which was succeeded by a flow from the westward, the latter planing off the S.W. cornersof theprags, and thereby leaving what remainedlooking towards the S.E. The first shape may have been formed by the older ice of the Lough Corrib valley, when that glacier was of huge dimensions; and the second, subsequently, by the ice of the Oughterard valley.
,,	Derreenmeel, on the shore of the lake,	–	–	N. 80 E.	–	Supposed to be due to ice coming from the hills into the Lough Corrib valley.
,,	Derreenmeel, at the road,	–	N. 25 W.	–	–	On ground 190 feet high. These agree with the general bearing of the Lough Corrib valley.
Galway, 54/2,	Lemonfield, near the quay,	–	–	N. 64 E.	–	These seem due to the ice coming out of the Oughterard valley into
,,	Annaghkeelaun, on the shore of the lake.	–	–	N. 80 E.	–	the valley of Lough Corrib.
Galway, 54/3,	Glengoola west, S.E. of Knockhawn,	–	–	N. 72 E.	–	On one rock surface, the N. 87 W., being the newer. They are supposed
,,	Glengoola west, at the coach road,	–	–	N. 87 W.	–	to have been cut by the Oughterard valley glacier at different periods
,,	Glengoola east, west of the mine, on the small hill north of the pond.	N. 59 E.	–	E. & W.	–	during the time it was retreating up the valley; however, the first may possibly, be due to ice coming into that valley.
			–	N. 76 W.	N. 2 W.	
,,	Glengoola east, west of the mine, and just outside the south margin of the area contained in sheet 95.	N. 55 E.	–	N. 87 E.	–	All these are on one rock surface. The N. 2 W. are the newest, and may have been formed by ice coming either from the hills on the N. or S. The N. 59 E. seem to be the oldest, yet they may have been cut by ice that came from the hills on the S.W.; however, provisionally, they are put among the primary striæ, as possibly they belong to that series.
			–	–	–	All the rock surfaces hereabouts are marked with nearly E. and W. striæ.
Galway, 54/4,	Annaghkeelaun, on shore of the lake,	N. 48 E.	–	N. 80 E.	–	At heights varying from 600 to 800 feet. These seem evidently, to belong to the primary striation as they come from the N.E., all the dressed hummocks sloping in that direction and craging to the S.W.; moreover, no high ground intervenes between them and the central plain of Ireland.
,,	Aughnanure, near the Old Castle,	–	–	–	–	Seems due to the ice coming out of the Oughterard valley.
Galway, 55/1,	Illaunfaddamore, in several places,	–	–	N. 75 E.	–	Supposed to be the primary striæ.
			–	–	–	The last, which are the newer, seem to have been cut by the glacier of the Oughterard valley, and the first by that of the Lough Corrib valley. If this supposition is correct, this tributary (the Oughterard valley glacier) must have existed after the Lough Corrib valley glacier had retreated up that valley.
Galway, 55/3,	Ardnasillagh, shore of the lake,	–	N. 33 W.	–	–	Seems due to the ice of the Lough Corrib valley.

7. MINES, AND MINERAL LOCALITIES.

COUNTRY ON THE WEST OF LOUGH CORRIB.

County.	Townland.	Minerals.	Proprietors.	Agents.
	GLAN MINES.			
Galway, 39/4, .	*Derrowra*, . .	Lead, copper, and sulphur ores.	H. Hodgson, esq.,	Mr. Robinson.
,, .	*Curraghduff West*, .	,, ,, ,, .	,, .	,,
,, .	*Curraghduff Middle*,	,, ,, ,, .	Messrs. Griffith & Hodgson.	,,
,, .	*Curraghduff South*, .	,, ,, ,, .	,, .	,,
,, .	*Barretleva*, . .	,, ,, ,, .	H. Hodgson, esq.,	,,
Galway, 40/3, .	Gowlaun, . .	Sulphur ore, . .	,, .	,,
,, .	*Gortnashingaun*, .	,, . .	,, .	,,
,, .	Farravarra, . .	,, . .	Messrs. Griffith & Hodgson.	,,
,, .	*Gorteenwulla*, .	Copper & sulphur ores,	H. Hodgson, esq.,	,,
,, .	*Ballygally*, . .	,, ,, .	,, .	,,
,, .	Drumminnakill, .	Sulphur ore, . .	,, .	,,
,, .	*New Village*, . .	,, . .	,, .	,,
,, .	*Barnagorteeny*, .	Lead & sulphur ores,	,, .	,,
	OUGHTERARD MINES.			
Galway, 54/2, .	Eighterard, . .	Lead & sulphur ores, with native sulphur.	,, .	,,
,, .	Carrowmanagh, .	Native sulphur, .	J. Doig, esq., .	Mr. E. O'Flaherty.
,, .	Illaunnacreeva, .	Lead & sulphur ores,	G. F. O'Fflahertie, esq.	
,, .	*Lemonfield*, . .	,, ,, .	,, ,,	
,, .	Ardvarna, . .	,, ,, .	,, ,,	
,, .	*Portacarron*, . .	Lead & sulphur ores,	Captain Nolan.	
Galway, 54/4, .	*Moyvoon East*, .	,, ,, .	J. O'Hara, esq., D.L.	
,, .	Fough West, . .	Native sulphur, .	J. Doig, esq., .	Mr. E. O'Flaherty.
Galway, 54/3 & 4,	*Canrawer West*, .	Lead, copper, and sulphur ores, with barite.	G. F. O'Fflahertie, esq., and Messrs. Waddle & Co.	Capt. Floyd.
Galway, 54/3, .	*Cregg*, . . .	,, ,, ,, ,, .	,, .	,,
,, .	*Claremount*, . .	Lead & sulphur ores,	Law Life Society,	Mr. Robinson.
,, .	*Tonweeroe*, . .	Lead ore, . .	,, .	,,
	GLENGOWLA MINES.			
Galway, 54/3, .	*Glengowla East*, .	Lead, sulphur, zinc, copper, and barite ores.	G. F. O'Fflahertie, esq.	
Galway, 53/4, & 54/3.	*Glengowla West*, .	,, ,, ,, ,, .	,, ,,	
Galway, 53/4, .	Derryeighter, . .	Sulphur ore, . .	Captain Nolan.	
,, .	*Leam East*, . .	,, . .	Law Life Society,	Mr. Robinson.
Galway, 53/1, .	Letterfore, . .	,, . .	,, .	,,

COUNTRY ON THE EAST OF LOUGH CORRIB.

Mayo, 121/3, .	Ballymacgibbon South.	Lead ore, . .	Miss Finn.	
Mayo, 123/3, .	Ballycurrin, . .	Gaussen, . .	C. Lynch, esq., D.L.	
,, .	*Gortbrack*, . .	Lead & sulphur ores,	,, ,,	
Galway, 55/1, .	Curraghmore, .	,, ,, .		

COUNTRY NORTH OF LOUGH CORRIB.

Galway, 39/2, .	*Doorus*, . . .	Sulphur ore, . .	Sir A. E. Guinness, Bt.	Mr. Burke.
Galway, 27/4, .	*Ashford*, . . .	—	,, .	,,

NOTE.—Townland names printed in *italics* are places where works have been carried on.

The minerals of commerce found in this district are seven in number—viz., *Galenite*, *Pyrite* (iron pyrites), *Marcasite* (iron pyrites), *Pyrrhotite* (magnetic iron pyrites), *Chalcopyrite* (copper pyrites), *Sphalerite* (blende), and *Barite* (barytes). However, besides these there is some *Limonite* (brown hematite), and a little native sulphur.

There is a variety of the pyrite very coppery, and the pyrrhotite is generally nickeliferous. Moreover, it and the coppery pyrite are locally called *sulphur ore*, as they have been worked for the extraction of sulphur from them, while the pyrite and marcasite (locally called *Mundic* and *Bastard Mundic*) are considered poor ores not worth working, as they contain no copper ore. The compact variety of barite or the heavy spar is known by the name of *Cawk*, the sphalerite by that of *Jack*, and the flourite as *Blue John*, the names received from English miners.

Many of the so-called sulphur ores may be called pyrrhotitic schist, as, properly speaking, they are not in lodes, but are part of a bed of schist, in which the principal constituent is pyrrhotite, accompanied by pyrite, and associated with these are quartz, with some felspar mica and chalcopyrite.

These mineral schists are very variable in character, as often the minerals will only be found in parts of the beds, in the rest mica taking their place as an essential, the minerals appearing only as accessaries.

Country West of Lough Corrib.

(*Oughterard District.*)

In this country various workings have from time to time been carried on, and although in no case have they been properly developed, yet they are called mines. They form three groups—viz., *the Glan mines, the Oughterard mines*, and *the Glengowla mines*. Besides these there are a few mineral indications that may be mentioned in connexion with the group of mines nearest to which they chanced to have been observed.

Glan Mines.

Derroura (Galway $\frac{39}{4}$).*—Numerous trials have been made in this townland, one of the oldest being a level on a bed of poor pyrrhotitic schist, or perhaps more correctly a schist in which pyrrhotite is an accessary. This locality is situated a little south of Derroura well. To the N.E. of the townland, on the hill slope, are numerous open casts, of which John Kelly says†—"They were opened the year after the battle of Waterloo (1815), by a Captain Oates, while searching for a lode of copper, as large tumblers of copper were found on the back of some of the beds of limestone" that are there situated. Subsequently Colonel Martin, of Ballinahinch, sank a shaft a little south of the Waterfall, for a depth of about fifteen or sixteen fathoms, principally through a hornblendic schist. Later still, an adit was driven in southward from where the townland boundary crosses the stream, but in none of them was the lode discovered. Farther south-west, a little south of the herd's house, Colonel Martin sank a shaft, about ten fathoms, on a N. 47° W. lode,‡ that contains *galenite*, with *pyrite* and *chalcopyrite*. A

* Part of this townland, and also some of the mineral localities, are in the district on the west (Sheet 94), but it has been considered best not to separate them from one another.

† We were accompanied over the Glan mines by John Kelly, of Gortnashingaun, and John Devany, of Canrawer, intelligent miners, to whom we are indebted for much information. The examination of the district was made in the years 1865 and 1866.

‡ All bearings are true; the magnetic bearings are 27 degrees east of those given, the magnetic bearing of the above being N. 20° W.

few years ago Mr. Hodgson made a deep open cast along the course of the lode, and in it the lode at the surface, can be seen to have a slight hade to the S.W., but in depth it seems to be perpendicular; also, that it lies in a line of dislocation or fault, for the south-west wall is a hornblendic schist, while the north-east wall is a crystalline white limestone. Of this vein John Kelly says:—"Colonel Martin found a large bunch of copper near the surface on the back of the lode."

On the west of the herd's house surface trials have been made this year (1866) by Mr. Hodgson's orders, on a wild lode that contains quartz, with calcite strings and lenticular patches; also some rich *copper ore*.

At the same time, on the N.W. of the herd's house, and to the north of the stream, a similar trial was made on a good-looking N. 15° W. quartz lode that hades W. at 60°, and makes *pyrite* and *chalcopyrite*.

Curraghduff.—In the stream that flows through Curraghduff west, and empties itself into Lough Corrib, at the cottage called Captain Tracy's Lodge, and about 500 yards south of that house, there is a granite vein with a gausseny back. Farther south, at the base of the cliff, and immediately N.E. of the trigonometrical point 480, there is a small N. and S. lode containing specks of *pyrite*. In its southward strike at the stream that divides Derroura and Barretleva, a small trial was sunk on what seems to be the continuation of this lode, and *pyrite* and *chalcopyrite* found. This lode seems to occupy a line of dislocation or fault, for at the trigonometrical point 480 the beds are displaced; moreover, 300 yards southward of the last-mentioned trial, and in the strike of the lode, a fault has been proved.

Curraghduff Mine.—At the junction of Curraghduff West and Middle, works were formerly carried on by Colonel Martin, and subsequently by Mr. Hodgson. Two large surface pockets of *chalcopyrite* were found, one west, and the other south of the forge, respectively, in Curraghduff West and Middle. The ground here is much tangled, besides being cut up by cross courses and slides, only a small portion of the lode running regularly, that seems to have a bearing of N. 72° W. Towards the west, at the boundary of Derroura, the lode appears cut off by a slide; and towards the east by a cross course that throws it towards the south. On the east of the cross course a large bunch of ore occurred, and the lode haded N.E. at about 45°. At this mine no deep workings were opened. Immediately west of the forge, Colonel Martin opened a shaft over ten fathoms deep, and close to it Captain Tracy, Mr. Hodgson's agent, sank another about a similar depth; but in neither of them did they cut the lode, or find any copper. A little south-east of the forge is an incline on the lode, six fathoms long, and at an angle of 45°. Southward of the incline, a shaft about five fathoms was sunk, and joined to the incline by a short drive, the lowest four fathoms being on the west of the lode. On the east of the cross course, close to the car-track to the mine farther south, are open works, in which "good *copper* was found." At this place the lode can be traced for some distance towards the east, where it seems to be cut off, either by a slide or cross course. From the valley on the east, an adit was partially driven in to cut this lode. This adit bears nearly east and west for nine fathoms, and N.W. for nine fathoms, eighteen fathoms in all, according to the testimony of John Devany.

Curraghduff Middle and South (Galway $\frac{39}{4}$).—On the south of the Curraghduff Mine, along the junction of Barretleva and these townlands, are numerous beds that are more or less impregnated with minerals; some being *coppery*, others *pyritous*, and a few (generally limestone) *leady*. They are cut up and displaced by cross courses, slides, or courses of granite, and on most of them small drives or open trials, have been made. Many of the beds on the back of granite veins change into pyrrhotitic schist, or into schists in which *pyrrhotite* is an accessary. A bed of this class of schist in

which *chalcopyrite* also seems to be an essential, runs nearly S.W. from the S.W. corner of Curraghduff south. Most of the sulphur ore in those schists seems to be the pyrrhotite (*magnetic pyrites*). Some of the trials and drives just mentioned are very old, having been made years ago by the Blakes of Furbogh; and the Martins of Ballinahinch, while others have been opened within the last twelve years by Mr. Hodgson and other explorers. Hereabouts no promising lode was observed.

Barretleva (Galway $\frac{3.9}{4}$).—In the north part of this townland are pyrrhotitic schists and wild quartzy lodes containing some *pyrite* and *chalcopyrite*. On the back, or associated with many of the limestone beds, pockets of *galenite* were found, but in no instance does a lode seem to have been discovered.

Leamnaheltia Mine.—This is situated on the hill in the east part of Barretleva, and about half a mile S.S.E. of the Curraghduff Mine. The main lode bears nearly E. and W. (N. 83° E.), and hades N. at about 75°. The lode stuff is a hard killas, in which are quartzy strings and pockets with *chalcopyrite* and *pyrite*. The works carried on were, a shaft nine fathoms deep, and at five fathoms a drive towards the east of about eight or nine fathoms, and towards the west of about six or seven fathoms. The *copper ore* continued down to the bottom of the shaft, most of it occurring near the north wall.

The main lode seems to be cut off towards the west by a N. 16° W. cross lode that hades slightly to the E. On this lode two shafts were sunk; the northern, of unknown depth, by Colonel Martin, the southern by Captain Tracy to a depth of six fathoms. The lode stuff is vuggy white quartz, in which are drusy cavities with *pyrite* and *chalcopyrite*, and a course of the latter is said to occur near the west wall.

Half a mile W.S.W. of Leamnaheltia Mine a lode of *pyrrhotite* occupies a line of fault that bears N. 9° E. Where this crops to the surface the lode is "*stone ore*" for its full thickness, and has a lime wall on the west, and a gneiss east wall.

Three hundred yards north of the "Stone ore lode" is a fault that bears N. 56° W. The "fault rock" has in it strings of quartz and *pyrite* with a a trace of copper. In the cliff south of Leamnaheltia Mine some of the beds run gaussen.

Half a mile east of Leamnaheltia Mine is a N. 77° E. lode that hades N. at 80°. It is two feet wide, and has *galenite*, *chalcopyrite*, and *pyrite* in a gangue of quartz. On this a small trial shaft was sunk, and some good though mixed stones of ore were brought to the surface. This lode seems to be cut off on the east by a course of the granite.

A little south-west of the last lode is a small vein in which *chalcopyrite* was found, and eastward, in the townland of Gowlaun, *pyrite* was observed in two or three places.

Gortnashingaun (Galway $\frac{4.9}{3}$).—In the east part of this townland is a N. and S. *pyrite* lode, on which a trial was made.

Farravaun (Galway $\frac{4.9}{3}$).—Near the road, in gneiss, are flying veins of *pyrite*.

Gorteenwulla (Galway $\frac{4.9}{3}$).—In the flat on the east of the road traces of *pyrite* were observed. In the stream that forms the south boundary of this townland, are two quartz lodes. The western bears N. 60° E., and makes *chalcopyrite*, while the eastern runs N. 20° E. and contains *pyrite*. They seem to cut one another a little north of the stream.

Ballygally (Galway $\frac{4.9}{3}$).—At the N.E. corner of this townland there is a small nearly E. and W. *pyrite* lode. Farther south, and S.W. of the new school-house, are two nearly E. and W. (N. 80° W.) lodes, containing *pyrite*; and on the north lode two trial pits were made. The south lode can be traced east to the road. At the hamlet between the lodes and the new school-house, tumblers of *galenite* were found.

Drumminakill (Galway $\frac{4.9}{3}$).—On the shore of Lough Corrib, quartzy strings with a trace of *pyrite*, were observed.

New Village (Galway $\frac{4.9}{3}$).—Traces of *pyrite* in various places in this townland, but no lode observed.

Barnagorteeny (Galway $\frac{4.9}{3}$).—In the N.W. part of this townland are old workings that are said to have been made by Colonel Martin. They seem to be on a lode containing *galenite*, and bearing about N. 15° E. They consist of a shaft, at the hamlet, a shallow adit driven in to unwater the shaft; and on the course of the lode, a few small trials. Traces of *pyrite* occur in this townland.

In the Glan district, none of the lodes have been proved in depth, as all the workings are near the surface, none of the shafts being sunk more than fifteen fathoms.

Oughterard Mines.

The mineral indications in the neighbourhood of Oughterard occur in two distinct groups of rocks, one being the *Metamorphic rocks and granite*, the other in the *Carboniferous rocks*. As those in the former do not extend up into the latter, they consequently must be older than the Carboniferous period.

Mines and Minerals in the Carboniferous Rocks.—The minerals in the newer rocks do not seem to occupy regular lodes, but rather enlarged joints, that run nearly N. and S., in which they occur as pockets and lenticular patches, associated with dolomite, calcite, and quartz.

Eighterard (Galway $\frac{5.4}{2}$).—On the shore of Lough Corrib the N. and S. joints in the limestone are dolomitised, and some of them contain calcite, with *galenite* and *pyrite*. The minerals in one joint were remarked to be more developed than in others, and to be associated with quartz, calcite, and dolomitic sand.

In the eastern part of this townland, and also in that of *Carrowmanagh*, *native sulphur*, associated with calcite, bitter and pearl spar, &c., occur in geodes or in drusy cavities. Similar geodes were found in the Owenfough,* the river that on the south and east, divides this townland from *Fough West*.

Illaunnacreeva (Galway $\frac{5.4}{2}$).—A rocky island off the shore of Eighterard, where some of the N. and S. joints make *galenite* and *pyrite*.

Lemonfield (Galway $\frac{5.4}{2}$).—On the shore of Lough Corrib, pockets and strings, containing calcite, galenite, pyrite, quartz, and dolomitic sand, occur in the joints that have bearing varying from N. 5° W. to N. 5° E. Due west of Geese Island the proprietor, Mr. O'Flahertie, sank a trial shaft about two fathoms deep, and found "a nice bunch of lead."

A little N. of Lemonfield House there is a N. and S. vein of dolomitic and vuggy spar, with drusy cavities, but it does not seem to be metalliferous. A little east of the house is a N. 10° W. compact calcite lode that looks unproductive, and 270 yards S.E. of the house there is a N. 6° E. lode of a similar character. Four hundred yards S.W. of the house, in the townlands of Lemonfield and Ardvarna, there is a N. 17° W. lode containing *galenite*, *pyrite*, and *sphalerite*, in calcite. In the townland of Lemonfield a shaft three fathoms deep was sunk, and the lode found to improve as it was followed down. In the townland of Ardvarna, on the back of this lode, there is a mass of *gaussen*.

Portacarron (Galway $\frac{5.4}{2}$).—Old shallow workings occur along the course of a N. and S. lode, which contains calcite and *galenite*.

Moyvoon East† (Galway $\frac{5.4}{4}$).—This lode has similar bearings to that last

* This stream is also called the "Owenriff;" *Anglice*, "Sulphur," or "Brimstone River."

† This locality is at the junction of sheets 95 and 105.

mentioned, and lies in its exact course, and they may possibly be one lode; however, as a large bog intervenes between the two places it could not be traced. In this townland, at nine feet below the surface, a nice course of *lead* five inches wide, occurs. The lode generally runs along the main joints (N. 5° E.); but at the depth just mentioned, it strikes across from one joint to another. The gangue of the lode is calcspar and dolomite, moreover, the limestones in the vicinity seem to be dolomitised. Farther southward, in the townland of Killaguile, in the district contained in sheet 105, or the "Galway Sheet," tumblers of *lead* are said to have been found in the strike of this mineral vein.

In the townland of *Gortrevagh* is a strong perpendicular N.S.E. course of vuggy calcite and dolomite. A trial 2·5 fathoms deep was sunk on it by the proprietor, Mr. E. O'Flaherty, without finding it metalliferous.

Canrawer West and *Claremount* (Galway 54).—Under part of these townlands there are rocks of carboniferous age, and in the ditch at the N.E. corner of the workhouse graveyard, *galenite* occurs between the beds of limestone ("lay in lay") and may point to a lode in the vicinity. In the River Fough, at the base of the Salmon Leap, there is a floocan course with *pyrite*, in a fault that bears N. 14° W. There is also a pyritous shale on which a trial shaft was sunk, the explorers being misled by the ramp of *gaussen* on the back of the bed of shale.

Tonweeroe (Galway $\frac{54}{3}$).—A shaft was sunk in this townland, on a N. 20° E. joint that makes *galenite;* in Colonel Martin's time.

Mines and Minerals in the Metamorphic and Granitic Rocks.—In these older rocks there are regular lodes, some of which may have been in the rocks previous to their being metamorphosed, while others would seem to be more modern, but all are older than the carboniferous period, as none of them penetrate upwards into the rocks of that age. Besides the lodes there are numerous metalliferous flying veins, strings, and "indications." The geodes of native sulphur that are recorded as occurring in the carboniferous limestone, may possibly be the results of the decomposition of the older mineral veins, &c., containing *pyrite, chalcopyrite, galenite,* &c., for such foreign substances as vegetable or animal remains, probably may have acted as centres on which the sulphur, from the sulphuric acid (set free by the decomposition of those minerals), may have concentrated; more especially as in many instances the native sulphur, beside being in geodes and drusy cavities, occurs inside fossil shells.

The western portions of Canrawer West and Claremount (Galway $\frac{54}{3 \text{ and } 4}$).—Adjoining the River Fough, west of the Salmon Leap, *galenite* occurs in detached particles scattered through the rock (a white fine-grained intrusive granite); there is also at the old mill, a small nearly N. and S. lode that contains *barite,* or *heavy spar, galenite,* and *pyrite.* In connexion with this lode various works have been carried on; Colonel Martin, in Claremount, sank a shaft on its course alongside the road from Oughterard to Clifden; Mr. Hodgson, of Currarevagh, drove along its course for about three fathoms, where the lode appears at the old mills, and a little south of this, Mr. O'Fflahertie sank a shaft seven fathoms deep. A little south-west of "O'Fflahertie's shaft" a private company (Messrs. Waddle and Co.), under the agency of Captain Floyd, have now (1866) sunk a shaft on the underlie (west side) of the lode. They went down eleven fathoms, then drove five fathoms towards the south, and at the end of the drive put down a winze shaft three fathoms. This trial was through a hard granite ground, except the last fathom, which was a "green peachy rock" (Chloritic?) containing drusy cavities and geodes, with lenticular patches composed of *chalcopyrite, pyrite,* quartz, crystals of calcite, *barite* and *galenite.* The "green peachy rock" they followed in the south drive and winze. East of "Floyd's shaft," and a

little south of the Spa well, are strings containing *galenite.* On these a trial was made, but discontinued, as in depth they decreased.*

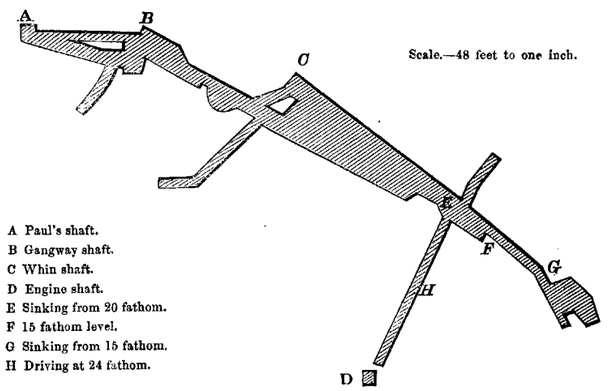
Glengowla Mines.

Glengowla East (Galway $\frac{54}{3}$).—The principal known lode in this townland, lies a little N.W. of Lough Ateeaun, and due south of Glengowla Bridge. This lode bears N. 87° W., hades S., and is cut off on the west by a course of the granite that run N. 53° W. On the west of this granite vein a nearly E. and W. fault occurs that may be the continuation of the lode, in which case the lode is jumped a little to the south.† This mineral vein was discovered during farming operations, by "tumblers" of lead occurring near the surface. These were extracted by Mr. O'Fflahertie, during which operation the lode was discovered and worked by that gentleman for some time, and afterwards by Mr. Hodgson under the agency of Captain Tracy. Subsequently they were discontinued, as the mineral property became involved in a lawsuit, during which the mine got flooded, and since has not been unwatered.

The accompanying plan and section, reduced from the original plans of Captain Tracy, show the extent of the workings previous to their discontinuance, copies of which are lodged in the Mining Record Office, Jermyns-street, London.

Fig. 8.

Plan of Glengowla Lead Mine, reduced from a map by Capt. Tracy.



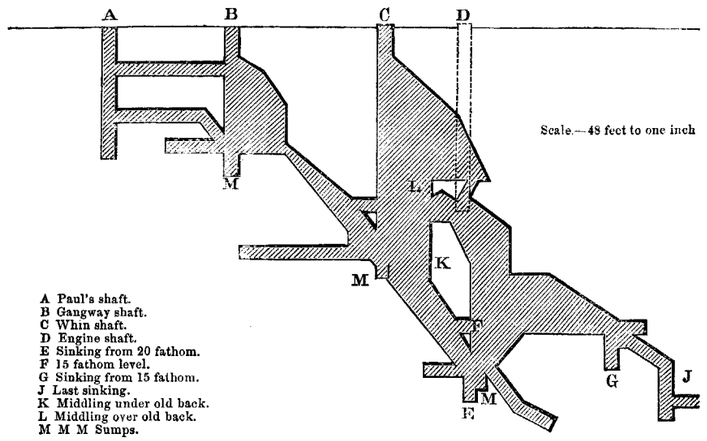
A Paul's shaft.
B Gangway shaft.
C Whin shaft.
D Engine shaft.
E Sinking from 20 fathom.
F 15 fathom level.
G Sinking from 15 fathom.
H Driving at 24 fathom.

* There are other mines in Messrs. Waddle and Co.'s "set," namely, those at the S.W. of Cregg's; however, they are in the district to the south (*sheet* 105, *or the "Galway Sheet"*), and will be found in that memoir.

† The appearance of the lode on the surface of the ground, as also the "lead" of the lode, would point to a throw to the northward. However, open casts have been made thereabouts without finding it.

Fig. 9.

Section of Glengowla Lead Mine, reduced from a map by Capt. Tracy.



The works consist of an engine shaft, a slide down the lode for twenty-six fathoms, and from it several levels driven east and west upon the lode. The whin shaft is sunk to the depth of eight fathoms and communicates with the engine shaft by a level. At the east end of the lowest level a winze five fathoms deep, was sunk ten fathoms east of the whin shaft. This latter is the latest working at the mine, and when discontinued they had struck on "a nice 'lead' of *lead*," a specimen from which is in the possession of Mr. O'Fflabertie.

A perpendicular shaft, calculated to cut the lode at forty fathoms, was begun and sunk for a depth of about seven fathoms on the underlie of the lode, and a cross cut from the seventeen fathom level has been driven under this shaft. Five fathoms east of the whin shaft a cross course (N. 5° E.) with only a west wall, was driven on for three fathoms, there being a little *lead*.

The gangue of the lode was nearly altogether *calcite*, in which were *galenite*, *pyrite*, and *barite*, with some *sphalerite* and *chalcopyrite*, and associated with them are beautiful octohedron crystals of *green flourite* and crystals of *quartz*. The lode was vuggy and the *lead* occurred in bunches. Three hundred and ninety-two tons of *galenite* with a few tons of *sphalerite* and *barite* were dressed, carted to Galway, and shipped from thence. The *galenite* was "Potter's ore" and contained 80 per cent. of lead with only a trace of silver.

The works connected with the mine were a watercourse 1·5 miles long from the Owenfough near its egress from Lough Agraffard, which secures a fall of about 20 feet to turn an overshot wheel, 18 feet in diameter. The latter is capable of pumping, winding, &c. There is also a two-horse whin, with inch chain and buckets; agent's house; blacksmith's shop; magazine; dressing-floor; &c.; but all are now more or less out of repair.

Glengowla, West (Galway $\frac{53}{4}$ and $\frac{54}{3}$).—"Floyd's lode" lies about eight hundred yards west of the Glengowla mine, is vertical, two feet wide, bears N

50° W., and contains, in a gangue of calcite; *galenite*, *pyrite*, *sphalerite*, and *barite*, associated with purple *flourite*. A small trial was made on it. Farther west at Whittaker's bridge, across the Owenfough, are traces of *galenite* and *pyrite*.

Derrada (Galway $\frac{54}{3}$), *Derryeighter*, *Leam*, *East* (Galway $\frac{53}{4}$), and *Letterfore* (Galway $\frac{53}{1}$). Traces of *pyrite* and strong *spas* were observed in various places. These possibly may indicate the presence of mineral lodes.

Country on the East of Lough Corrib.

(Headford District.)

Ballymacgibbon, South (Mayo $\frac{121}{3}$)—In a boss of silurian rocks, close to the road near the N.W. corner of this townland, flying calcite veins were observed, in which are traces of *galenite* and *mundic*.

Ballycurrin (Mayo $\frac{121}{3}$). On the shore of Lough Corrib, and north-west of Ballycurrin Castle, are cake-like patches of *mundic* mixed with *bastard mundic* (*pyrite* and *marcasite*), also *gaussen*. One of these is very large, and they all seem to lie on the limestone; however, it is not evident from what is exposed, whether they are only surface deposits or are connected with underlying veins.

Gortbrack (Mayo $\frac{121}{3}$).—This locality is situated about three-quarters of a mile south-east of Ballycurrin Castle. At the N.W. corner of the townland "bunches of *galenite* and *mundic*" (pyrite) were found in the broken surface of the limestone rock, and open casts were made by Mr. Lynch of Ballycurrin without success, in search of a lode.

Curraghmore (Galway $\frac{55}{1}$).—At the south extremity of this townland, on the shore of Lough Corrib, there is a N. 18° E. vein of calcite, and at the surface are traces of *galenite* and *mundic*.

Country on the North of Lough Corrib.

Doorus.—In the promontory of Doorus some small trials have been opened on lodes and mineral indications. A little east of the village of Doorus is a nearly perpendicular quartz vein that bears N. 25° W., and is about five feet thick. A little N.W. of the village is an old working now usually called the *Doorus Mine*. This seems to be a thin, irregular lode, varying from four inches to four feet wide. It has a slight underlie to the northward, with a regular hanging wall. The lode stuff seems to be a very hard killas, with strings of quartz, in which are *pyrite* and *chalcopyrite*. At the shaft in the rocks north of the lode, there is a ramp of marcasite (*iron pyrites*). The shaft is said to have been sunk twenty fathoms by a Captain Paul, ten years ago, who at that depth drove a cross-course north and south ten fathoms in length. In the rocks near the lode there are strings and nodules of *pyrite*. At a quarter of a mile N.W. of this mine is a bed of pyrrhotitic schist, whose essentials seem to be *pyrrhotite*, *pyrite* and quartz, with as accessaries *chalcopyrite*, mica, &c. Farther west a shallow shaft was sunk on a similar *pyrrhotitic* schist, which possibly might be the continuation of that just mentioned, but if it is there has been a slight shift in the beds between the two localities. Farther north, a little S.W. of the mouth of the Cornamona River, is a ramp of *pyrrhotite*, with which are associated a little *chalcopyrite* and *pyrite*.

Farther S.W., on the shoro of the lake, at the margin of the district, are two quartz lodes, the northern bearing N. and S. and the southern N. 40° E. On the latter, which is a very compact quartz lode stained with *peroxide of iron*, a surface trial was made at the time the Doorus Mines were worked.

Ashford.—At the south of the demesne a trial was sunk on a calcite vein in the carboniferous limestone, but as nothing else was met with, it was abandoned.

G. H. K. and J. N.

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

[redacted]