

Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEETS 104 AND 113 WITH THE ADJOINING
PORTIONS OF SHEETS 103 AND 122

(KILKIERAN AND ARAN SHEETS),

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING A PORTION OF THE

COUNTY OF GALWAY.

BY

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Perched boulder on a partly submerged ice-worn hummock of rock in Gleniemurrin Lake. Glentrasna Hills in the distance.



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

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

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

Condensed memoirs on particular districts will also eventually appear.

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

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PREFACE.

THE country described in the following pages was geologically surveyed by Messrs. G. H. Kinahan, H. Leonard, R. J. Cruise, and the late Mr. F. J. Foot, whose life was terminated by an unhappy accident in January, 1867. The description has consequently devolved on the three officers first named. The survey of many parts of this region has been carried on in the face of much difficulty. The coast and islands of this part of Ireland are exposed to the unceasing swell of the Atlantic, and to frequent storms, which render visits to the islands not devoid of danger. To this is to be added the difficulty sometimes found in obtaining quarters for the surveyors in a region out of the beaten track of tourists, and inhabited by a population of small farmers, fishermen, and cotters.

It is proper that I should add, that the examination of this tract was carried out under the direction of my predecessor, the late Professor Jukes, F.R.S.

EDWARD HULL,
Director of the Geological Survey of Ireland.

GEOLOGICAL SURVEY OFFICE, DUBLIN,
28th December, 1869.

EXPLANATION

TO ACCOMPANY

SHEETS 104 AND 113 WITH THE ADJOINING PORTIONS OF

SHEETS 103 AND 122

(KILKIERAN AND ARAN SHEETS),

OF THE

GEOLOGICAL SURVEY OF IRELAND.

GENERAL DESCRIPTION.

THE area contained within the limits of Sheet 113 is, for the most part, occupied by the Atlantic Ocean and the entrance to Galway Bay. The two northern islands of Aran are situated towards its western margin; and immediately to the south of it, in Sheet 122, is Inisheer, the extreme south-easterly island of the Aran group. Parts of the islands of Lettermullan and Gorumna, with the portions of the mainland that lie east and west of Cashla Bay, occur inside its north margin.

Within Sheet 104, and the adjoining portion of Sheet 103, there is no town; there are, however, small villages, harbours, &c., that should be enumerated, as hereafter they will be referred to while describing the country. In the east part of Sheet 103 is the hamlet called Moyrus, S. of Roundstone, and the harbour of Blackhaven, or Cloonile. In Sheet 104 are Carna, a scattered hamlet on the most northern waters of Mweenish Bay; Casheen Bay, a good harbour, north of the island of Lettermullen; Kilkieran, a small village on the bay of the same name, where there is a good pier and haven; Inver and Screeb, where there are salmon fisheries; Maumeen, on the Fearnmore, or Greatman's Bay, near the N.E. end of Gorumna Island, where there is a harbour; and Costello, or Cashla Bay, where there is good anchorage and harbour for large ships.

In parts of Kilkieran and Camus Bays there are good oyster beds; and beds of this mollusc also occur in Bertraghboy and Cloonile Bays, which lie farther N.W., the entrance into them being south of Roundstone, in Sheet 103. In Bertraghboy Bay there is also a good harbour and anchorage.

The Aran Islands, at the mouth of Galway Bay, lie in a N.W. and S.E. direction; being about sixteen miles long, from Carrickemon-macdonagha, the N.W. point of Illaun-ceragh (the western of the Brannock Islands), to Trawkeera Point, the eastern extremity of Inisheer. They consist of three large islands, Inishmore, Inishmaan, and Inisheer, with four small islands off the N.W. point of Inish-

more, called the Brannock Islands; and on its east coast, at the entrance of Killeany Bay, Illaunatee, or Straw Island; the last named being joined to the island by a sand-bank during low water. Connected with the Aran Islands there are very few detached rocks, besides those to the N.W., which are included under the general name of the Brannock Islands; only three occurring off Inishmore, called Island-a-reefa, Craghalmon, and Carrickymonaghan; and one, a spring-tide rock, called Finnes, half a mile from the shore of Inisheer.

Sounds.—North of Inishmore, between it and Yar-Connaught, is the *North Sound*, about five and a half miles wide. Between Inishmore and Inishmaan is *Gregory's Sound*, from one to one and a half miles wide; while Inishmaan is separated from Inisheer by the *Foul Sound*, which is one and a quarter miles wide between the nearest points; and Inisheer, from the barony of Burren, county Clare, by the South Sound, about four miles across.*

In *Inishmore*, the places of most note are, Kilronan, on Killeany Bay, the principal village in the islands; on the south of the bay, Killeany, the ancient capital of the islands, and the royal manor for Yar, or West Connaught; Oghil, Kilmurvy, Onaght, and Bungalow. In addition to these villages may be mentioned the two light-houses; one near Oghil, on the highest part of the island, and the other on Illaun-ceragh, the western of the Brannock Islands.

On *Inishmaan*, the middle island, are the villages called Kinbally, Ballintemple, Ballinlisheen, Moneennamaga, and Moher; also the ruins of pagan fortresses, called Doonconner and Doonfarbagh.

Inisheer.—The villages on this island are Ballyhees, Largy, and Furmina. At Fardunis Point there is a light-house, 112 feet high, that exhibits, at an elevation of 110 feet above high water, a fixed white light. "Near Trawkeera there is a lough, a quarter of a mile long, and a cable wide, which it has been supposed might be converted into a useful harbour for the fishing boats, by cutting an entrance through the rocky shore." (*Bedford's Sailing Directions*.)†

* The old name of the *North Sound* was "Bealagh-Lougha Lurgan;" *Anglice*, "The way of Lough Lurgan;" Lough Lurgan being the ancient name of Galway Bay. This name for the Sound is still in use among the natives of the islands on the north of Galway Bay. *Gregory's Sound*—old name, "Bealagh-na-haite," *Anglice*, "The way of Aite;" Ben Aite being the hill near its west shore. The present title is derived from Saint Ceannannach's real name, Gregory, and the ruins of his church are in the vicinity on Inishmaan. *Foul Sound*, *Irish name*, "Bealagh-na-fearbog." Of this, Nimmo says in his *Piloting Directions*—"On the N.W. part of Inisheer is Foul Sound, a rocky ledge extends one-third over, having six feet water on it." While in the *Sailing Directions for Galway Bay and Harbour*, by Captain G. A. Bedford, R.N., there is the following description:—"This Sound has hitherto been greatly misrepresented, and its inappropriate name tends to perpetuate for it a bad character, which it by no means deserves. From the north-western point of Inisheer, a reef named Pipe Rock (marked on the Ordnance, and called Carrickapeepa) extends rather more than a quarter of a mile, or scarcely above one-fifth the breadth of the Sound, and with this exception it is entirely free from danger. * * * The bottom is principally coral gravel, broken shell, and rock, and from this cause, perhaps, it may have been originally designated as Foul Sound, in distinction to Gregory Sound, where the bottom is chiefly sand."

South Sound, old name, "Bealagh-na-Finnis," *i.e.*, "The way of Finnis Rock. This rock, Mr. Nimmo describes as being "about a quarter of a mile from the shore, dry with spring tides only."

† On this island are the ruins of a few churches, an old castle, and a telegraph tower, with the sites of two doons.

1. Form of the Ground.

Mainland.—The land on the north of the Galway Bay is intersected by numerous chains of lakes, bays, and creeks; the centre portion of Sheet 104 being an archipelago, bounded by Kilkieran Bay on the N.W., and Fearmore and Camus Bays on the east. Various harbours and bays are formed by the islands and promontories; and the following descriptions may be quoted from Captain G. A. Bedford's, R.N., "Sailing Directions for Galway Bay:"—

"Cashla, called also Costelloe Bay, is the easternmost of the harbours of Connemara, and the first that occurs below or west of Galway, from which it is distant nineteen miles. It is easy of access, particularly since the erection of an iron beacon in 1846 on the Cannon Rock, which lies at the mouth of the bay. There are two anchorages; "the lower," abreast the martello tower, where the depth is six fathoms, over a bottom of stiff mud and shell. This anchorage is open to southerly and S.W. winds; but in the upper part of the bay there is good shelter, even for large ships, in three fathoms, at low water.

"To the westward is Greatman's or Fearmore Bay, the entrance to which is about two miles from Cashla, and bounded on the north and west by Lettermore and Gorumna islands, the largest of the archipelago studding the extensive estuary between this and Kilkieran; which bays communicate with each other by Dangan Pass, more than five miles from the mouth of Greatman's Bay. This bay is very inferior as a harbour to Cashla; at low water vessels drawing from twelve to thirteen feet may get into a wild sheltered anchorage two miles above Trabaan Point; but the channel is very much contracted by some middle shoals that lie off Gorumna chapel."

The land usually is low, seldom rising into eminences of greater elevation than from 200 to 500 feet. To the east of Sheet 104 there is a high line of hills, ranging N.E. and S.W., with, at the N.E., spurs extending toward the west, making peaks. One, northward of Glentrasna (*Anglice*, the transverse or cross valley), is 1,088 feet; Shannawona, 1,138 feet; Shannaweeleen, 879 feet; Lugganaffrin, 905 feet; Cloghermore, 928 feet; Lugganimagh, 718 feet; and Formoyle, 509 feet. West of Kilkieran Bay, and nearly parallel to it, is Slieve Moirdaun; its principal summits being Derryrush, 951 feet; Benagower, 1,164 feet; Avogh, 1,120 feet; Bealmaam, 741 feet; another peak, 609 feet; and Knockieran, 552 feet. Of its westerly spurs, the highest point of the northern, Shannockdonagh is 527 feet; and of the southern, the Eagle's Cliff, 512 feet.

The south-east side of the main ridge is very steep, more especially over Lough Aconeera; northward of which the ground rises in a little more than half a mile from the sea level to the summit of the range 1,164 feet. Moreover, there are isolated hills which also exceed 500 feet. Knockadav, north of Screeb, being 631 feet; Bovroughaun, about three miles E.N.E. of the north end of Cashla Bay, 541 feet; and Knockduff, a remarkable pap-shaped hill, south of Bovroughaun, 407 feet. Cuileen and Knockboy may also be mentioned, though they are under 500 feet, the former being 331 feet, and the latter 360 feet, as they form distinct features rising from the west in the flat part of the promontory of Errisainhagh, Cuileen being on the south, and Knockboy to the north of the plain.

In Sheet 113, on the west of Lettermullen, are some islands and rocks. *Eagle Rock* is the largest of the group of small islands lying N.W. of Golam Head, its highest part being thirty-five feet

above the mean sea-level. To the W.N.W. is *Fish Rock*, always above water; as is also *Seal Rock*, which lies about half a mile to the southward. *Golam* is a wild rugged hill, rising near its south shore to a height of ninety-five feet. Formerly there was a telegraphic station on it, and the ruins of the tower still remain. Now it is uninhabited during the winter months, but during the rest of the year it is resorted to, principally on account of the facilities it affords for collecting and drying sea-weed for burning into *kelp*.*

Lettermullen is a wild, rugged looking island, having irregular slopes towards the south-west and south. *Gorumna Island* is the largest of the archipelago studding the extensive estuary between Greatman's and Kilkieran Bays. The south portions of Lettermullan and Gorumna, on account of their subjacent rock being principally of the metamorphic series, have a more verdant aspect than the parts of the mainland and island which lie in their neighbourhood.

Between Greatman's and Cashla Bays is the long, narrow promontory which separates these harbours. At its southern extremity are two wild rocky heads, between which is a small cove called Doleen Harbour, to which, when the wind is not blowing from the south or south-west, small boats can resort. On the east of Cashla Bay the aspect of the country is usually wild and rugged; but in the neighbourhood of Blake's Lodge and Cashel House, there are more than ordinary signs of cultivation.

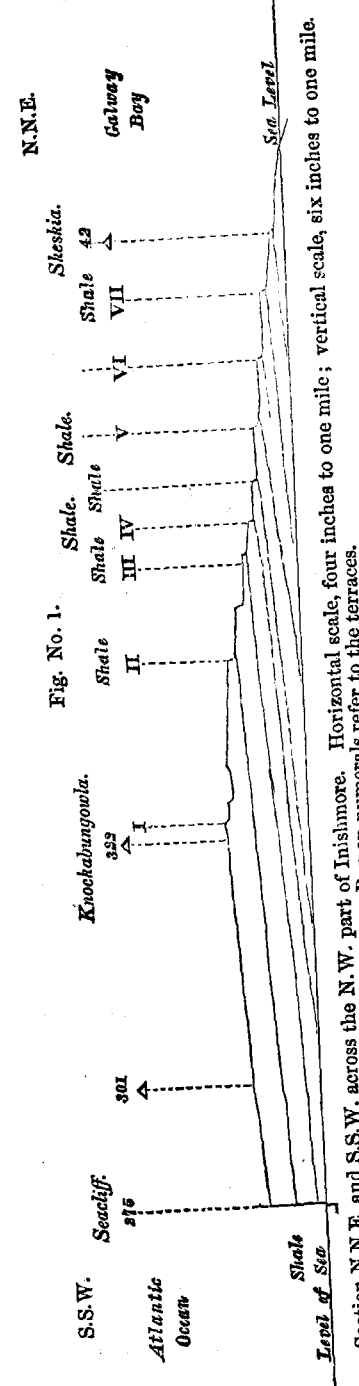
The rest of the country, for the most part, is covered with peat, from a few inches to many feet in thickness, except on some of the steep slopes where usually there are crags; but even in such places the interstices and hollows are occupied by bog.

In some places, where drift hills occur, and the envelope of peat is only of a slight thickness, the land, by cultivation, has lost its natural appearance; while many of the low lying bogs and moors are also cultivated, more especially on the seaboard.

Most of the valleys, whether terrestrial or submarine, as well as the hills, range nearly N. and S., or have a bearing of about N. 35° E.; however, there are some remarkable E. and W. features—Bertraghboy and the valley to the N.E., also Kilkieran bay with the promontory on the west, commonly known as Errisainagh, with its accompanying hill-range called Slieve Moirdaun; the Screeb River valley, and the valley of the Cashla River, are the main features in the district that range nearly N. 35° E. Those that bear nearly N. and S. are Blackhaven or Cloonish Bay, part of Ard Bay, Mweenish Bay and the valley to the north; Lough Skannive valley, Casheen Bay, Fearmore, or Greatman's Bay, Cashla, or Costelloe Bay, a long valley towards the east, extending south from the upper part of the Cashla River valley, with its accompanying range of hills.

* Of kelp there are two varieties, one made from the black-weed, and the other from the red-weed. The black-weeds principally grow above low water mark of neap tides, while all the red-weeds grow below it. The red-weed kelp is the most valuable, as it gives salts containing iodine, and it is manufactured from the "*Laminaria digitata* vera," "*L. digitata stenophylla*," "*L. saccharina*," "*L. phyllitis*," and "*Alaria esculata*." The principal black-weeds are "*Fucus vesiculosus*," "*F. nodosus*," "*F. seriatus*," &c. However it should be mentioned that below low water are certain non-iodine producing plants, locally called *Keeshagh*, such as "*Chorda filum*," "*Hemanthalia lorea*," and "*Laminaria bulbosa*," which may be burnt into a kelp of a similar quality to the black-weed kelp.

Fearmore and Cashla Bays are very marked features, more especially that of Cashla Bay, for the valley from it extends north to Camus Bay a little south of which it branches;



are very marked features, more especially the valley from it extends north to Camus Bay, a little south of which it branches; one branch going N.N.W. between Rossmuck and Camus Hill, and by Inver-nagleragh Lough, to and beyond the north margin of the district, while the second branch extends by Screeb Lodge, also out of the district on the north. Fearmore, or Greatman's Bay, may possibly be also on the line of a great feature, for although there is not a marked depression in its direction, land occurring in part of its course, yet the feature is traceable across these lands, and farther north it is well marked in the uppermost part of Kilkieran Bay, and the valley of the Invermore River.

The valleys lying nearly east and west, although not so marked, are peculiar. The most northern extends through Bertraghboy Bay and up a gut to Gowlabeg, from thence north of Slieve Moirdaun, through Loughs Aligan, Ailtarra, and Creggaun, to Lough Adav, and from that into the country on the north of this district. This line of depression crosses hills and valleys, rarely forming a well marked feature, but always being traceable. A second depression seems to run along the south shore of the entrance to Bertraghboy Bay, and from that, in a nearly east and west direction, to Lough Awee, from which it crosses Slieve Moirdaun range to Lough Aconeera, and from that to Screeb Bay, towards the east. South of this valley, and north of the hamlet called Kilbrickan, another of these depressions occur, and on the line of it, there is a remarkable cut into the west shore of Kilbrickan Bay. This, although it does not form a valley through Slieve Moirdaun, yet is remarkable, as in its line, south of Avogh rock, the continuity of the rocks seem to be broken. South of the last, a line can be traced from the village of Moyrus, through Loughs Bola and Glen-naun, across Slieve Moirdaun, to Glen-nauid, and from that, north of Salialea and Rossmuck. A very continuous valley

extends from Ard Bay by Carna, Kilkieran pier, through Camus Bay, to Loughs Cloondola and Formoyle, while the hills forming the island of Lettermore extend nearly east and west, and south of it; other east and west features could be named, but none so marked as those previously mentioned.

Aran Islands.—From the N.E. shores of the Aran Islands the land rises in series of cliffs, or huge steps, which form continuous terraces (see section Fig. No. 1), while from the summit of the island there is a gradual fall south-westward, it however, ending at the sea-board, in cliffs that, at the present day, are being formed by the Atlantic ocean.

Inishmore is eight and a-half miles long, from its N.W. point to Gregory's Sound, and of various widths, being only half a mile wide at Portmurvy, while at Kilronan, it is a little more than two miles across. Viewing Inishmore from the hills west of Galway town, it appears to be three islands. This is caused by two low valleys, which extend across it; one west of Killeany Bay, and the other south-west of Portmurvy. The latter is so low, about fifty feet above the sea, that it has been mistaken by Galway-bound ships for one of the channels into the bay, for which reason it has received the name of the "Blind Sound." Of it, O'Flaherty says:—"About the year 1640, upon an extraordinary inundation, the sea overflowing that bank, went across over the island to the N.W."*

On the Ordnance Map, the only height in this valley is one of sixty-six feet, but this is not in the lowest part.†

The previously mentioned steps forming continuous terraces, are several miles in length, two of them extending from the south-east to the north-west of the island. These, the third and fourth, reckoning from the highest terrace, can be traced from Benaite at Gregory's Sound, along the flanks of the valleys, until they join into the sea cliff, about half a mile from the north-west point of the island.‡

At this sea cliff, on the north-west of the island, there are two well marked terraces, above the third and fourth, and one below them; but if they are followed about a mile to the northward, in the neighbourhood of the village of Bungowla (See Fig. No. 1), there are four below them, making in all eight terraces. These do not continue far; for towards the south-east, at Kilmurvy, there are two above, and only three below the continuous terraces (Nos. 3 and 4); at Oghil, two above and five below; at Kilronan, two above and three below; and at Killeany, and from that to Gregory's Sound, only one above them. The second, third, and fourth terraces, extend north-

* In Mallet's list of earthquakes for 1640, there is one mentioned on the 4th of April, at 3.15 A.M., felt in France, Belgium, and Holland. Perhaps it might have been the wave resulting from this seismic commotion which caused the inundation. On the 15th of August, 1852, a large wave rolled in on the west coast of the island, drowning fifteen persons, who were fishing on the rocks. This may also have been an earthquake wave, but as Mallet's list does not extend to this date, no record of an earthquake could be procured.

† From this and all other heights copied from the Ordnance in this explanation, 8.48 feet must be deducted, to find the true mean height above the sea, as the Ordnance datum is this height above the mean tides in Galway Bay.

‡ Though these are continuous terraces, yet they may not be the same set of beds throughout, as will be explained hereafter.

west as far as the valley south-west of Kilronan, and on the west side of this valley, one terrace is above, and three below. From this to the north-west of the island, the four upper terraces are found, except in passing the "Blind Sound," where all of the terraces disappear, except the third and fourth.*

On the north-west of the village of Kilronan, the terraces below the fourth are increased by five, before they come to the village of Oghil, making nine terraces in all; but after this place is passed, they gradually die out, their continuation being cut off by the sea, and all have disappeared, excepting No. 3 and 4, before the Blind Sound is reached; however, on the north-west of Portmurvy most of them set in again, and continue to Bungowla, west of which they gradually merge into the sea cliffs. Such terraces are not confined to the land now above the sea level, as submerged terraces occur in Galway Bay on the north-east of the island.

The sea cliffs on the north-east side of the island are low, and are often replaced by strands, or shingle-beaches. On the south-west they have taken a definite character, being usually perpendicular, and often over fifty feet in height; however, at the north-west point of the island, under the shelter of the Brannock Islands, there is a heavy shingle-beach, on which boats can land in fine weather. From the north-west point, south-eastward to Gregory's Sound, the cliffs are either perpendicular or terraced. From Mweeleenareeava, a little south of the Brannock Islands, to Doocaher, except for a short distance at the "Blind Sound," the cliffs are perpendicular, although at the base of some of them, as will be hereafter mentioned, there are sea-terraces or steps below the high water mark of spring tides. At Doocaher the cliffs are about 100 feet high, and from that towards the north-west they gradually rise to 234 feet at Corker; from which they lower by degrees to the "Blind Sound;" but north-west of this, at Dunaengus, there is an ordnance height of 265 feet, and they attain their greatest altitude (300 feet), about a mile farther north-west, a little south-east of Polladoo. From Doocaher towards the south-east, to the point called Illaunanaur, there are sea-terraced cliffs (excepting a few short breaks), which are surmounted by a rampart formed of large blocks. This latter is called in Professor King's MS. account of the Aran Islands, "The Block Beach."†

From Illaunanaur to Portdeha on the west of Gregory's Sound, the cliffs are perpendicular or terraced, but on the north of the latter place the sound is bounded by a strand.

From the sea cliff, on the south-west of the island, the land rises, reaching altitudes of 213 feet, half a mile west of Killeany; of 406 feet (the highest point of the island), a little south-west of Oghil Fort; and 354 feet, half a mile south-west of the village of Onaght.

Inishmaan is three miles long from the north-east to the south-

* What seems to be the line of the fifth can be traced, but it is covered with sand. Our attention was first drawn to this fact by the fishermen on the island.
† Professor W. King, F.R.S., of the Queen's College, Galway, has written an account of the Natural History of these islands, to the MSS. of which he kindly gave us access.

west, and one and a half miles wide, between Trawtagh on Gregory's Sound, to Trawletteragh on the Foul Sound.

On the north-east face of the island there are seven terraces, the three lowest extending nearly across it, while the four highest not only cross it, but they also turn round the south-east side for a greater or less distance, forming terraces overlooking the Foul Sound. From the highest of the terraces the land rises in small broken steps, until it reaches heights of 225, 243, 259, 275, and 251 feet. These eminences form an irregular W.N.W. and E.S.E. ridge, and from this ridge south-westward, the land falls gradually to the low cliffs on the south-eastern margin of the island.

The north part of the island is bounded by low cliffs, strands, or shingle beaches; on the S.W., from Trawtagh to Aillinera, the cliffs rise in steps, at the latter place being perpendicular, and about 200 feet high, from which, southwards, the surface gradually falls to about 40 feet at the cliff opposite Taunabruff, the south-western extremity of the island. From the south part of Aillinera, where the cliff is about 170 feet in altitude, southward to Taunabruff, and then north-east to Clogharone, the cliff is cut into sea-terraces and surmounted by a "Block beach."

In the centre of the island there is a nearly north and south valley, the floor of which is about 180 feet above the sea level.

Inisheer is less than two miles across from the shore, north of the village of Ballyhees, to Fardurris point, and two and a half miles from Trawkeera point to Tonefeehney; and its highest part, where stands the ruins of the Telegraphic Tower, is 212 feet. According to the late Mr. Foot's maps it seems to rise gradual from the south shore, while to the north and east there are terraces, and running nearly north and south (N. 15° E.), there seems to be a ravine immediately east of the Telegraphic Tower. Captain Bedford says of this island:—"Its shores are everywhere rocky, except at its north-east side, where there is a small sandy beach called the North Strand, off which, at a quarter of a mile, a vessel may find temporary anchorage in seven fathoms, sandy bottom, and be sheltered from S.W. winds." On the cliff at the north-west, extending from opposite the hamlet called Ballyhees, to the S.W. point of the island, there seems to be a block beach as Mr. Foot has noted: "Natural barrier, formed of large blocks, the debris of the subjacent rocks."

G. H. K.

2. ROCK FORMATIONS.

Name.	Colour on Map.
Recent Deposits, including Bog and Alluvium.	<i>Pale sepia.</i>
Drift, or Glacial Deposits.	<i>Engraved dots.</i>

AQUEOUS ROCKS.

d. Carboniferous Limestone.	<i>Prussian blue.</i>
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GRANITIC ROCKS.

G. Granite, When Intrusive.	<i>Carmins.</i>
Gp. do. When Porphyritic.	<i>do.</i>
Gf. do. When Foliated.	<i>do.</i>

IGNEOUS ROCKS.

Name.	Colour on Map.
F. Felstone.	<i>Vermillion.</i>
P. do. Quartziferous Porphyry.	<i>do.</i>
D. Diorite (Greenstone), Diabase, &c.	<i>Rose Lake, &c.</i>
Δ When Metamorphic [Hornblende Rock].	<i>do.</i>
Σ When changing into Serpentine, Steatite, &c.*	<i>Pale carmine with grey wavy lines.</i>

GRANITIC ROCKS.

Granites.—There are two classes of this rock, namely, the intrusive (or irrupted from within or below), and those that seem to be, at least partially, of metamorphic origin. The first are very quartzose and occur in mass, near Oughterard,† from which it has been suggested that they might be called *Granites of the Oughterard or Quartziferous type*. The second class has been called *Granite of the Galway type*; it nearly always has, as one of its essential constituents, Oligoclase, from which it might be called the *Oligoclase Granite*. The Oligoclase Granites are often *porphyritic* and *foliated*.

Professor Haughton has divided the Granites of Ireland into two classes, as follows:—

I. The Granites of Leinster. The Granites of Mourne and Carlingford.

II. The Granites of Donegal, Mayo, and Galway.

The first class seem to be nearly identical with the *Quartziferous or Oughterard Granite*, and the second are those mentioned above, as the *Porphyritic and the Foliated Granites*.‡

M. Delesse "distinguishes two kinds of granite, one irruptive, the other metamorphic, the latter taking often a gneissoid structure."§
G. *Intrusive Granite* (Oughterard type).—The mass of this rock is similar to that described in the previously published Memoirs,|| as occurring in the neighbourhoods of Oughterard, Salthill, &c. It occurs in tracts, courses, veins, dykes, and pipes. In the tracts

* Some of the granites are supposed to be of metamorphic origin. Among the quartziferous porphyries are rock mineralogically granite, but petrologically they belong to the felstone group. Some of them possibly may be metamorphosed felstones, while others undoubtedly are not. There seems, however, to be two distinct groups of rocks, one allied to the felstones, for at the margins and in small dykes they merge into felstone, while the rocks that possibly may belong to a separate group, appear always to be granitoid in aspect, and never merge into a felstone. On Sheet 104 the quartziferous porphyries are distinguished by a capital P, while on Sheet 113 they, as well as the felstones, are marked by a F.

† Memoir, Explanation of Geological Survey Map, Sheet 95.

‡ For a full resume of the Rev. Dr. Haughton's conclusions on the Granites of Ireland, see Warrington W. Smyth's, F.R.S., &c., &c., presidential address to the Geological Society, London, Quarterly Journal, Vol. XXIV., p. lxxiv.; Memoir, Geological Survey of Ireland, Ex. Sheet 95, p. 9, and Ex. Sheet 105, p. 9.

§ "Volcanoes," by G. P. Scrope, F.R.S., 2nd edition, 1862, p. 300, foot-note.

|| Description of Sheets 95 and 105.

and wide courses, its conspicuous essentials seem to be orthoclase, quartz, black mica, a greenish mineral (mica,?) and pyrite (iron pyrites), with in places white mica and marcasite—while in the veins, dykes, and pipes, it seems to be composed of orthoclase, quartz, pyrite, also perhaps marcasite, and the just mentioned greenish mineral; however, in some places there may be black, or even white mica, but the rock is nearly always more compact and fine-grained than the granite in the tracts and wide courses, also generally more quartziferous; sometimes its constituents are nearly imperceptible. As accessories in the intrusive granite, were observed white mica, ripidolite, marcasite, chalcopyrite (*copper pyrites*), fluorite, calcite, galenite, barite, molybdenite, &c., moreover, a greenish mineral,* called by the miners *peach*, and supposed to be a chlorite, often occurs in nests and small lenticular patches, in such places being generally associated with some of the accessories, such as galenite, chalcopyrite, &c.

The tracts of this granite usually occupy low ground, while the courses, veins, dykes, and pipes are found in the high lands; in the former places apparently having been exposed by the denudation that cut away the overlying rocks.† It is not unusual among the granite forming the tracts and courses, and indeed often also in the veins and pipes, to observe a structure that at first sight has the appearance of an obscure foliation; and yet it cannot be so called, as the constituents of the rock do not appear to have the least tendency to occur in leaves. Perhaps it might possibly be some kind of a close, irregular, parallel-jointed structure, introduced during the cooling of the rock, and answering to the open lines called by Scrope, *Shrinkage fissures*. This structure is scarcely perceptible in a hand specimen, but in the mass of the rock it is often very conspicuous; in fact it is one of the distinguishing characteristics by which, at first sight, this variety of granite generally may be detected.

Gp. and Gf. *Porphyritic and Foliated Granite* (Metamorphose), *Galway type*. The granite, the mass of which may possibly have been formed *in situ*, is usually porphyritic and often foliated; its conspicuous essential minerals being quartz, pink, or flesh coloured, felspar (*Orthoclase*), green felspar (*Oligoclase*), white felspar, black mica, and a green mineral (*mica or chlorite*), while the following occurring as accessories were observed, amphibole (*hornblende*), titanite (*sphene*), ripidolite, marcasite and pyrite (*iron pyrites*), white mica, chalcopyrite (*copper pyrites*), galenite, fluorite, barite, &c. It should be mentioned that in some places the white mica, and in others, the amphibole, seem locally to be essentials.

The orthoclase generally occurs in large crystals, often twins, some of which are two inches in length, but usually not more than half or a quarter of an inch. This felspar generally gives the porphyritic character to the rock; however, in some places the white crystals are porphyritically developed, and on rare occasions, the green; but in

* The true *blue peach* of the miner is ripidolite (*chlorite*), and the mineral here found is very like it in appearance; however, it has not been analysed.

† See Memoir, Ex. Sheet 95, p. 9.

many places in this area none of the felspar is conspicuously developed; all the crystal of the different kinds being more or less of an even size. In places there are irregular patches, of a variety which is "very coarsely and irregularly constituted of orthoclase, quartz, and silvery white mica," apparently answering Cotta's description of the rock he calls *Pegmatite*.*

Traversing the granite are veins of a fine grained crystalline aggregate of quartz and felspar, in which the mica is very sparingly developed, or in such minute flakes, as often to be invisible to the naked eye; these veins vary from half an inch to five feet in width. They are always very quartziferous, and often a hand specimen is identical with some varieties of the intrusive granite, from which it may be suggested, that both are of somewhat similar origin; having been deep seated silicious parts of the granite, that took longer to cool, and were squeezed up into the shrinkage fissures, as the upper part cooled and consolidated.

Usually on looking over an expanse of this porphyritic granite, at the east of this area, the large crystals of felspar are found to lie in irregularly parallel lines; while in the rest of the tract this structure is not apparent; moreover, towards the east the porphyritic granite appears gradually to change through foliated granite, into gneiss and schist; while in the islands, at the south, and also to the north-west of the area, the boundary is most irregular, as if the granite had been forced up into the metamorphic sedimentary rocks. A fact, however, that may perhaps be in favour of a metamorphic origin for this class of granite is, that in places both here and in the district to the north, there are tracts of very coarse gneiss; which, in places is so metamorphosed, that it has lost all traces of stratification, and parts of it appear identical with the porphyritic granite of the *Galway type*.

In some places there is a very finely crystalline variety of this granite, none of the crystals being larger than middle-sized shot. Its constituents seem to be similar to those in the coarsely crystalline parts. This fine granite sometimes appears in tracts, at other times in irregular nodules, which are often associated with a granite that apparently is foliated in blackish, schistose layers, and elongated lenticular patches coming in this sometimes continue for considerable distances, and effect the rock for spaces varying from a few feet to many yards in width. The coarsely crystalline variety, previously mentioned as agreeing with Cotta's description of pegmatite, oftener occurs in pipes and lenticular patches than in regular veins.†

There are other rocks, as suggested in a foot note on the table of rocks, that lithologically are granites; however, it is believed that petrologically they are of the felstone type, or allied to felstones; moreover, all are capable of being included among the quartziferous

* "Rocks" classified and described by B. Von Cotta; P. H. Lawrence's *trans.*, p. 206.

† For further details of these and the intrusive granite, the reader is referred to the Memoir Explanation of Sheets 95 and 105, in which will also be found reasons for supposing some of the granites to be rather of a metamorphose than of an intrusive origin.

porphyries of the various writers. In all of them part of the quartz has crystallized out previous to the other minerals, which seems to exclude them from the true granite group; for Scheerer and other authorities 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 siliceous, 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, given rise to quartz veins, &c."

Moreover, in these rocks besides that the mass of the siliceous crystallized out first, another difference between them and a true granite is that much of the felspar does not crystallize, but remains as a paste, and causing their weathering to be similar to that of all the felstones, forming a regular, slightly undulating, even surface of a dull whitish colour, and never having the rough uneven surface, so characteristic of the true granites.*

Foliation.—In the Memoirs to accompany sheets 95 and 105, the supposed causes which induced foliation in the metamorphosed sedimentary rocks have been recorded, and the reason given for suggesting that this structure has followed the most marked structure in the original rocks. Moreover, it has been suggested that the foliation which appears in some of the granites of the *Galway type* may have been introduced by some such cause. These suggestions seem applicable also to the rocks in this district, and numerous examples of the different kinds of foliation could be figured and referred to; but as they are somewhat similar to one or other of those figured and explained in the Memoirs just now enumerated, it has been considered unnecessary to occupy space with them, more especially as none of the examples observed were more characteristic than those figured [Ex. sheet 95, and figs 1, 2, 3, 4, 5, and 6, Ex. sheet 105.]

From the foregoing remarks it appears that the foliation in the metamorphic sedimentary rocks, and also in the metamorphic granitic rocks, apparently has been induced by the most marked structure in the original rocks; but of the latter there is no positive proof, except perhaps that next the sedimentary rocks, the dip and strike of the foliation in the granite, apparently is the same as that in the associated stratified rocks. Against this latter suggestion it should be stated that my colleague, R. G. Symes, F.R.G.S.I., has pointed out, south-west of Lough Conn, Co. Mayo, a foliation similar to that in this district, and in an exactly similar granite, except that

* The compact veins or veins of segregation in the granites, and also some of the veins and small parts of the intrusive granite, may weather somewhat like the felstones, being lithologically a felsite but petrologically a granite. Such portions are those in which the minerals forming the granite are not properly developed, these parts of the rock being nearly altogether a siliceous felspathic compound.

† Memoir, Geological Survey. Ex. Sheet 95, pp. 14, 15, and Ex. Sheet 105, pp. 13 to 15, and 39 *et sequi*.

it occurs in veins cutting across the bedding of metamorphic sedimentary rocks.

D. Doleritic and Dioritic Rocks.—The basic plutonic rocks appear to be of different classes and ages; some being dolerites, while others seem to be diorites; there are also rocks, more or less, highly crystalline that probably are metamorphosed to a greater or less degree, having been altered by the action which mineralized the associated sedimentary rocks. The description of this latter group will hereafter be given.

The basic rocks appear capable of a two-fold sub-division. The newer, which seem to answer the description for *Melaphyre* [of the Continental geologists], have a resinous lustre, varying from glistening to dull; are of a dark greenish or blackish colour; both hard and tough; some are compact, others granular; and they break with a semi-conchoidal or uneven fracture. The older, or *Diabasic*, vary from pale to dull green colour, often slightly purplish; vary from flaky to granular, usually have a sub-metallic, or metallic, pearly glistening lustre, and break with an uneven to a hackly fracture.

The rocks classed as Dioritic vary from a green to a dark green, inclined to a blackish colour; usually have an uneven fracture, are compact, although most of them are at the same time easily broken into small fragments, on account of a reticulated structure.* In some there is a submetallic glimmering lustre, while others are dull, and all seem to be opaque.

All these basic igneous rocks fuse before the blowpipe with greater or less facility.

F. Felstones.—Of the felspathic rocks there are some that seem to be more modern than others, while another class are probably metamorphosed. (See dyke at Knockboy, page 42.) The rocks that undoubtedly are not metamorphosed vary from compact to splintery, and granular, sometimes being porphyritic. In colour they are generally greenish, bluish, or gray, and rarely purplish. Those that have an even to a conchoidal fracture, are usually compact, with an impalpable structure, and are subtranslucent, while the varieties that have an uneven to a hackly fracture, are usually coarsely granular, or splintery, and translucent. Some felstones that undoubtedly are older than the others, have from a porcelain to a saccharoid aspect, and are of a white, pinkish, or pale greenish colour, often banded, caused by layers of slightly different colour, and sometimes texture, alternating.†

In nearly all of these felstones there are peculiar structures; however, some weather evenly, but in others there is a platy arrangement, rudely parallel to the walls of the dyke. In a few there is a

* When in mass, this class of greenstones are generally not so easily broken, as the reticulated structure more often occurs in the dykes, when it seems to be caused by a rude columnar structure, perpendicular to, and a platy structure, rudely parallel to, the walls of the dykes.

† See sketch of "canal in which lava is in the last stage of motion." [*Vesuvius*, by John Phillips, M.A., F.R.S., *Diagram*, XVIII., p. 121], as it seems to explain this peculiar structure; more especially as among the rocks of Yar-Connaught it seems only to occur near the termination of a dyke.

spheroidal structure;* while in some dykes there are plate-lines cutting obliquely across; and in others jointing, forming a rude columnar structure, except that the joint planes are as often oblique as perpendicular to the walls of the dyke; with the last there is in places a very irregular platy structure, developed between the joints, usually perpendicular to them, but sometimes oblique. In a few there are systems of irregular joints, which cause the rock to weather into an angular shingle; this is very prevalent in many of the older felstones, those of the porcelain and saccharoid aspect, and in a few instances it was remarked that the systems of joints were so arranged that the rock broke up into nearly regular cubes, and parallelopipeds.

Besides these, there are quartziferous porphyries, one variety at least being newer than the granite, as it sends veins into it; however, as this porphyry is in appearance so closely allied to the rocks of the group which are supposed to be metamorphosed, all shall hereafter be described together; but special attention will be drawn to all rocks that possibly may not be altered. It is therefore scarcely necessary to reprint them here, more especially as in this area no new facts for or against the theory were observed, except some in relation to the associated "derivate" rocks, and these will be enumerated when describing the metamorphic sedimentary, or fragmental rocks.

The igneous rocks next to be described are those that are supposed to be metamorphosed, and consist of basic or hornblende, and felspathic or felstone rocks.† *Hornblende metamorphic rocks* (*Hornblende rock*, &c.) These were not found among the granites, but associated with the metamorphic sedimentary rocks. They occur in tracts, courses, veins, or dykes, pipes and lenticular patches.‡ They vary much in composition; however, the commonest variety is similar to the rock called by Houghton and others, *Hornblende rock*;§ which apparently is a compound of hornblende, greenish bluish felspar (*labradorite*?), marcasite or pyrite, and sometimes epidote; in some places there being flakes of a silvery-whitish mineral, that appears to be diallage. This rock ranges from finely crystalline, so as to be nearly compact, to a rock with crystals of

* Some of the supposed metamorphosed felspathic rocks are ruptured and displaced by faults, while the newer felstones can be traced across these ancient faults, but there are also newer faults that displace and rupture *all* the rocks. The felspathic rocks that are dislocated by the more ancient fault are probably more ancient than the time at which the sedimentary rocks were metamorphosed; however, this is not positively proved, for this class of ancient fault are also found displacing the boundary of the granite, and therefore it is possible, although not probable, that these felstones were intended in the time between the formation of the granite and that of the faults.

† The facts for and against these igneous rocks being metamorphosed, have been given, and analyzed in previously published memoirs. (See Ex. Sheet 95, and Ex. Sheet 105, pp. 11, *et sequi*.)

‡ *Tracts*, are intended to express, when the rocks occur in large regular or irregular masses; *courses*, when the rocks occupy long narrow, but at the same time considerable spaces, running with a similar, or nearly similar, strike to that of the associated rocks. *Dykes* or *veins*, when the rock is cutting across the associated rocks, dykes being perpendicular, or nearly so, while veins may be from any angle to horizontal; and pipes, small outbursts coming up in regular or irregular patches, although remarkable in themselves, yet are so insignificant that they cannot be represented on the one inch, or published, maps.

§ Dana, Krantz, Cotta, &c.

hornblende from three to four inches long. In places it changes into a rock full of crystals of white felspar, and this again may merge into a rock in which free quartz is a constituent; sometimes the white felspar is developed, nearly to the total exclusion of the other constituents; on rare occasions the rock changes into a white or pinkish felsite, with disseminated crystals of hornblende.*

In places the rock has a nodular or spheroidal, or concretionary structure; spheroids from the size of a man's fist to four or five feet in diameter, being irregularly heaped up together. The interstices usually are filled with a schistose matter, that has a sort of curled foliation, rudely parallel to the outside of the enclosed nodules; but at other times they are occupied with a palish felspathic, or even with a quartzose, rock; or perhaps with two or more of these substances mixed together.

In the northern part of the district the hornblende rocks are found to vary much in composition; but this does not seem to be the case to the south, for in the islands of Gourmna and Lettermullen, the rock is usually a finely crystalline aggregate, often not more so than crystalline diorites, in other localities, while none of them have the coarsely crystalline texture so prevalent to the northward, and in other places in Yar-Connaught.

Associated with the hornblende rock are hornblende schists and conglomeritic gneiss and schist, which sometimes are regularly interstratified with them, but more especially they are tangled up together, or the hornblende rock seems to merge into these hornblende schist, and conglomeritic rocks. From this it may be conjectured that if the hornblende rock is metamorphosed igneous rocks these associated rocks are probably metamorphosed igneous ashes. These associated rocks will be more fully described among the metamorphosed sedimentary rocks.

Various accessories appear in the hornblende rock, some being locally essentials, thereby forming numerous varieties. These will be mentioned in the places where these were observed, among the *detailed descriptions* (p. 29, *et sequi*).

Felspathic Metamorphic (?) Rocks.

As mentioned in the previously published memoirs,† the metamorphism of these rocks is not so conspicuous as that of the hornblende or basic plutonic rocks; for some that are undoubtedly metamorphosed are similar, or nearly so, in appearance to others that undoubtedly are not metamorphic; the latter sending veins into, and therefore being newer than all the granites and metamorphic rocks. Moreover, that it is hard to make a distinction seems proved; for in this area in some of the conglomeritic gneiss and schist, enclosed fragments and blocks of felstone were observed (see page 46), a hand specimen, from which, seemingly, was identical with many of the newer felstones.

* The description here given seems to me to be that of an ordinary diorite or greenstone. When free quartz is present it then becomes a syenite. EDWARD HULL.

† Memoirs, Geological Survey of Ireland. Ex. Sheet 105, p. 16, *et sequi*, and Ex. Sheet 95.

These supposed metamorphic rocks are very variable in texture and appearance; some, as just observed, apparently being similar to an unaltered felstone, while others are highly porphyritic, and lithologically are granites; however, petrologically, they seem to belong to the felstone group. Some of these also, as previously mentioned, are supposed to be newer than the granite, while others apparently are older; so that it seems impossible to describe them separately, the only alternative left being to call special attention to all rocks, and mention the reasons why each should be put in one class or the other.

The metamorphosed felspathic rocks occur both in tracts, courses, dykes, and veins, not only in the metamorphic sedimentary rocks, but also in the granites, except the intrusive granite, which necessarily was intruded subsequently to them. This seems to be a good test for the age of all plutonic rocks supposed to be metamorphosed; for if they occur in the intrusive granite they must be newer than all the metamorphosed rocks, and if they are cut by the intrusive granite, and this latter rock was intruded at the time the sedimentary rocks were metamorphosed, necessarily all the rocks or cuts must be older than that time.

Felspathic irruptive rocks are not uncommon in the country on the north of Galway Bay, and most of them are newer than the granite; however, there are some that are probably older and metamorphosed. A peculiar variety of the latter is granular felstone, which may be affected by a structure, having the appearance of foliation, causing it, when weathered, to split in flag-like, or slaty masses. Some of these contain globules of quartz, and belong to the group called *quartziferous felstones*, or when the felspar is also developed in crystals, to that of the *quartziferous porphyries*, according to the quantity of quartz they contain, and their aspect being granitic. Some of the quartziferous porphyries have their matrix compact throughout, often dark coloured (greenish or bluish), and contain distinct globules of quartz, crystals of orthoclase, sometimes oligoclase, lamina of mica, and crystals of marcasite or pyrite. On the outside of some of the particles and blebs of quartz, the crystal faces can be recognised, but the major part of the globules seem to be regularly formed minute balls. Some of these balls have an internal structure which radiates from the centre. In some of the quartziferous porphyries it was observed that many of the orthoclase crystals (pink), are enclosed in an envelope of light green oligoclase, somewhat similar to the so-called "Rappakivi Granite" of Finland. Many of the highly crystalline quartziferous porphyries change into varieties that have a matrix resembling granite; but distinct crystals of orthoclase, oligoclase, globules of quartz, and also laminae of mica, are separately and prominently developed,* and after losing these characters, they seem to be absorbed into the mass of the associated granite.

As just mentioned, the quartziferous porphyries when associated with the granites, seem gradually changed into them, but when they

* This is, nearly, Cotta's description for a rock, which he calls "Granitic Granite Porphyry." Cotta, p. 213.

occur among the metamorphic sedimentary rocks another change is apparent, for in accordance with the extent of the metamorphism in those rocks, so generally is the change which may be observed in the felspathic intrusive rocks. If the associated sedimentary rocks are much altered, usually the felspathic plutonic are more or less granitic in aspect; while if the associated rocks are only slightly mineralized, the irruptive rocks generally are more or less similar to the more modern felstones, and felstone porphyries; and often with the naked eye, or hand lens, undistinguishable from them.*

In the granite of Carrowroe and thereabouts, were remarked courses and veins of a greenish yellow rock, which seems to be a variety of felstone, or quartziferous felstone, as it often contains quartz blebs. The peculiar colour seems due to the secondary action which developed minute, acicular hyaline crystals of some the epidotic minerals. These rocks, in places, seem to be newer than the granite, while in others, to merge into it.

Beside these rocks there have still to be described the quartziferous porphyry that was previously mentioned,† as undoubtedly newer than the granite. The age of this rock was not unquestionably proved in this district; however, farther N.W., Mr. Leonard has met with an exactly similar rock, and found thereabout (N. of Omev Island), that the rock is undoubtedly newer than the granite. Of a specimen of this rock, from the area now being described, Mr. D. Forbes says it contains "Orthoclase, quartz, and a little hornblende, and might be called a hornblendic quartz porphyry or a somewhat porphyritic syenite."‡ In this rock the mass of the silex is always developed in blebs, or globules.

We have still to mention rocks belonging to a class different to those previously described, as in them a foliation is conspicuously developed, having the texture of a typical gneiss, "regular leaves of mica felspar and quartz." However, these rocks are evidently irruptive, as they come up through the metamorphic sedimentary rocks; having cut, broke, and displaced their stratification previous to their being metamorphosed. Apparently they would seem to have been at the first igneous rock, into which foliation has been introduced by metamorphic action.

METAMORPHIC SEDIMENTARY ROCKS.

v. μ. Q. λ. *Gneiss, Schist, Quartzite and Limestone*.—Of these there are every variety, from rocks scarcely distinguishable from grits, sandstones, shales, and slates, to rocks so metamorphosed as to be nearly deprived of all foliation, and undistinguishable from granite. The slightly altered rocks principally occur to the southward in the

* As previously mentioned in one place in this district, enclosed blocks of felstone were observed in a conglomeritic gneiss, they apparently being unaltered. (See also page 46.)

† See page 22.

‡ From MSS. notes by D. Forbes, F.R.S. In Mr. Forbes' MS. the term is "porphyrite."

islands of Gourmna and Lettermullin. However, in a few other places, very slightly altered rocks were also observed.

The limestone is very schistose, no real limestone having been observed in this area; in fact, the rock, strictly speaking, ought to be called calcareous schist. The quartzite is either white or light palish green, very compact, but at the same time, when fractured, of saccharoid aspect. Few or none of the beds are without flakes, or leaves of mica, usually white on the planes of bedding, and the rocks merge by an increase of the mica into mica schist; while, on the other hand, there are varieties intermediate between quartzite and a rock scarcely distinguishable from a grit. The schist is very variable, both in texture and composition. There is every variety of mica schist from coarse to fine, and from an argillaceous schist, through a typical mica schist to a quartzite on the one hand, and a felsite schist on the other. The felsite schist is very compact, but yet has a tendency to split into leaves, of a whitish or yellowish pale light green colour, and when typical, is similar to the rock called by Krantz *Leptinite*, or *Whitestone*.* From this the change is gradual by becoming micaceous into mica schist. In some places the mica schist also contains hornblende, as an essential, and this mineral often increases till it nearly or totally excludes the mica, and changes the rock into hornblende schist.

The gneiss is various in texture and also in composition; of the former class there is every variety from a schist, or from a rock very little differing in appearance from a grit or sandstone to one which may be called a foliated granite.† In composition there is typical gneiss composed of leaves of quartz, mica, and felspar; however, in this district hornblende often replaces the mica, or occurs in combination with it. In some there is an excess of quartz, in others of felspar, or perhaps mica; in the latter case, nearly changing the rock into mica schist. The felspars are variable; in some there are two, or even three, such as pink (*orthoclase*); green, greenish, or waxy (*oligoclase*); bluish (*labradorite*?) and white; and of the micas there are white, black, brown and greenish; while the quartz is usually milkwhite or transparent. These constituents occur more or less together in the same rock; but in some gneiss hornblende replaces the mica, it being generally accompanied by a greenish mineral that seems to be chlorite, and often by the bluish felspar (*labradorite*?) or by the oligoclase. In some places the hornblende gneiss is of a well defined type, but often it is more or less nodular, concretionary and schistose; or it becomes conglomeritic, containing for the most part large and small lumps of the different varieties of the hornblende rock, along with some of quartzite, gneiss, schist, or

* Krantz collection, Geological Museum, Stephen's Green, Dublin, No. 87.

† This very coarse gneiss seem to be nearly, if not identical, with the rock which, far the eastward, (see *Memoir Ex. Sheet 105, p. 7, et sequi*) has been called *Foliated granite*; and classed with the granites. Then it gradually merges into the mass of the porphyritic granite, while there is a considerable thickness of gneiss and schist between it and the mass of the porphyritic granite. Moreover, in places, it has shales interstratified with it, and longitudinally it seems to change into ordinary gneiss and schist. The true nature of this rock, and whether it is the same as that in the district to the east, can never be properly determined without a careful microscopical examination.

felsite. These conglomeritic rocks, as previously mentioned, are associated with tracts of the metamorphic hornblende rocks, being dovetailed and interlaced into them. The hornblende schists that resemble the finer varieties of the hornblende rock, and often occur in lenticular particles in a mass of that class of rock, being always intimately connected with it, may have been the rocks formed from the given particles abraded off the original plutonic rock, or the outside parts disintegrated and pulverized from their contact with the water, into which such rocks are supposed to have been intruded. There are also agglomerates associated with these rocks which may possibly be of igneous origin. I may here refer, for the sake of comparison, to the massive volcanic agglomerate and ashes that are found interstratified and associated with the large sheets of plutonic rock that occur among the Carboniferous rocks, and occupy a considerable portion of the plain of the county of Limerick,* and the huge conglomerate of volcanic origin in the vicinity of the harbour of Valencia, county of Kerry.† Among the metamorphosed rocks of this district these rocks occur associated together, and may therefore possibly be the remains of an ancient submarine volcano.

It is supposed that the hornblende rocks were ejected contemporaneously with the deposition of the derivative rocks, which now are metamorphosed into gneiss and schist. The basic intrusive rocks dovetail into nodular and conglomeritic gneiss and schist, both apparently having a general identity in chemical and mineralogical composition; but the gneiss and schist are evidently metamorphosed sedimentary rocks, while it is just as evident what is now the hornblende rock was intruded up among them previous to their being metamorphosed.

Foliation.—The foliation in the mass of the sedimentary rocks in this area is parallel, or nearly so, to the stratification; however, there is also oblique foliation, which seems always to have been induced by the oblique lamination; a nodular foliation, due to nodular or concretionary structure; a curled foliation, due to the lamination curling round enclosed blocks or fragments; and crumpled or wavy foliation, following the crumpled or wavy lamination, as originally developed in the unmetamorphosed rocks respectively.‡

d. *Carboniferous Limestone.*—This consists of limestones, with a few interstratified beds of shale and clay. The first named are usually thin bedded, but in a few places beds of considerable thickness were observed. Chert layers, nodules, and pipes are very prevalent in places, and sometimes make up nearly the mass of the rock. In places the rock is magnesian, in others a dolomite; and in one place the latter rock is so ochreous when decomposed that it might be economically useful as a pigment. These limestones are similar in appearance to those in the barony of Burren, co. Clare, which are

* *Memoir, Geol. Survey, Ex. Sheets 145 & 144.*

† *Memoir, Geol. Survey, Ex. Sheet 182, p. 26, et sequi.*

‡ For foliation and lamination in the metamorphose and original rock, the reader is referred to the *Memoirs, Ex. Sheet 105, pp. 14, et sequi*, also 39 and 40, and *Ex. Sheet 95, pp. 13, 14*. What has been stated above regarding Mr. Symes' observations (p. 18, 19) shows that this view of the coincidence of foliation with original structure is open to exceptions, and ought to be received with reserve. E. H.

supposed to belong to the uppermost part of the Carboniferous limestone formation.

Drift and other Superficial Deposits.—Of the different kinds of drift, there seem to be here represented the *Boulder Clay Drift*, the *Boulder or Moraine Drift*, and the *Blowing Sand*. These, with the other superficial deposits, will be fully described in a special section, near the end of the detailed descriptions.

3. Relations between the form of the Ground and its Internal Structure.

The subjacent rocks of the Aran Islands are limestones, with which are interstratified some thin shales and clay beds. The shales and clay seem in a great measure to have guided the denudation that carved out the terraces; for at the base of many of the well marked cliffs, shale or clay beds occur; therefore the outcrops of this class of beds in a great measure coincide with lines of cliffs or terraces. The shales, no matter how insignificant, are of great economical importance, as they prevent the water from sinking into the lower limestones, and it consequently bursts forth in clear copious springs at the base of the cliffs. In a few places continuous beds of chert are found to act similarly, but as they are generally affected by joint lines, their efficiency is usually spoiled.

The transverse valleys, including Gregory and the Foul Sounds, bear nearly N. and S., and in Inishmore and Inisheer there are ravines, having a similar bearing; most of them run along breaks or fissures in the strata, while some may be on lines of fault, but on account of the similarity of the different beds of rock, the evidences of a fault or dislocation are not easily obtained. Mr. Foot does not record a fault in Inisheer, and in Inishmaan there scarcely could be one; in the S. E. part of Inishmore, between Gregory's Sound and Kilmurvy there does not appear to be a displacement; but between Kilmurvy and the Brannock Islands there may be one or two slight faults, as the shale beds seem to be shifted south of Onaght, and at Bungowla, but in neither of these places could it be positively asserted that there is a dislocation. The submerged valleys, that is Gregory's and the Foul Sounds, may be along lines of break; however, as they are obscured by the water, it is only safe to record that they have a similar bearing to the principal lines of break and fissures, and to the main system of joints (about N. 10 E.).

The Maum or pass in Inishmaan is on a line of break in the strata, and the valley west of Killeany Bay partly follows one, while the valley called "The Blind Sound" does not seem to have a break in connexion with it, but to have been formed by a similar denuding agent to that which formed the terraces and the larger part of the Killeany valley. The agent that excavated the Killeany valley, after it had cut in towards the west for more than half a mile, seems to have met one of the nearly N. and S. lines of break, along which it subsequently worked, and thereby changed the direction, and brought the valley out at Pollnabrickenagh. All the nearly north and south lines of break affect the terrace to a greater or less degree, as when they cross there is a fissure more or less marked. The terraces are more or less undercut, and may have been formed by marine action,

but of this there is no direct proof, if they were, the force of the waves would seem to have come from the E.N.E., while, at the present day, it is from the S.W.*

The islands and the mainland to the northward of Galway Bay are composed of granite, or the associated metamorphic and igneous rocks; the metamorphic rocks forming the highest land, which is situated to the N.E. of the area (Sheet 104), and north of the peak called Shannawona. However, south of Shannawona are other considerable heights, composed of the porphyritic granite, as is also Slieve Moirdaun, the range immediately west and parallel to Kilkieran Bay. Under the rest, which is undulating, and forming no very conspicuous heights, is either granite or the metamorphic rocks; the granite being partly of the Galway, and partly of the Oughterard type, the latter always occurring in low ground.

In the metamorphic rock country are peaks and knolls composed of hornblende rock. This seems remarkable, as this class of rock now weathers much more freely under meteoric abrasion than the associated metamorphic sedimentary rocks, except the hornblende rock, had a greater power of resistance to the denuding agents than its associates. If ice was that denuding agent, this may be accounted for, as naturally the hornblende rock is tough and hard; therefore, it would resist being worn away by such a denuding power; but under meteoric abrasion to which the rocks are now exposed they should disintegrate freely, for many of their constituents are easily decomposed, different combinations of iron entering largely into their composition.

The action of, comparatively speaking, recent ice is very conspicuous in this district, but that such a denudent had the power to cut out the main features of a country is questioned by many careful observers; nevertheless, in this area the most striking features have nearly similar bearings (about N. 35 E.), to the "primary" ice striæ on the central plain of Ireland. These striæ are supposed to have been carved by the movement of ice that formed a cap on a large part of the northern hemisphere, over the land that is now Ireland, and flowed in a general direction from the N.E. or N.N.E., towards the S.W. or S.S.W. In this district the principal N. 35 E. features are Bertraghboy Bay, the promontory called Errisainagh, Slieve Moirdaun, Kilkieran Bay, the valley of the Cashla River, &c.

Next in importance as characteristics are the features that bear N. and S., or nearly so. These seem in a great measure due to courses of soft rock and lines of breaks, in some of the latter dislocations or faults having been observed, while in many others they appear likely to occur.†

* In a paper, "Notes on some of the Drift in Ireland" (Dublin Quarterly Journal of Science, Vol. VI., p. 249), I suggest that a northern marine current formerly flowed from Killala Bay to the mouth of the Shannon. If such a current ever existed it would be inclined to flow westward if possible, and therefore some of the water should have come out through the valley now occupied by Galway Bay, and act against the eastern shores of the Aran Islands.

† It may here be observed that these lines of break, in the metamorphic rock country, immediately north of, and in the tract of *Granite*, of the *Galway type*, that stretches from Galway town (Sheet 105), westward to and beyond Roundstone Bay (Sheet 103), seem to form a system of an irregular fan-shape. Westward of Round-

In some places the more modern intrusive rocks of the felsite type, and also some quartziferous porphyries appear to have taken advantage of these lines, as many of the dykes run in similar directions. Glaciers, from what are now the hills of Yarrow-Connaught, flowing down into the valley now occupied by Galway Bay, have occupied and deepened the valleys that extend along the N. and S. courses of soft rock and lines of break; but, whether previously these valleys were partly formed, or that the ice itself cut them out is not apparent.* The other surface features that extend east and west, as before mentioned, are only partially conspicuous. They would also seem to be induced by lines of break, that often are dislocations or faults, along which meteoric abrasion has partly formed valleys, ravines, or fissures, in the more favourable places.

To a combination of the fissures and valleys along the lines of the three classes of breaks, just enumerated, the formation of the archipelago near the centre of the district seems to be due, but more especially those that extend N. and S. and E. and W. The hollows occupied by the various lakes in the area all seem to be connected with some or other of these breaks, as if the "fault rock" in places in them had been excavated out by the passing ice. These hollows are long and narrow when the ice action took place along part of one of the breaks, but irregular at the crossing of two or more. On some of the hills small hollows occur, which could not have been formed except by ice excavating, and carrying away the broken up "fault rock," caused by dislocations crossing.

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stone the break bear west of north; in the neighbourhood of Roundstone, and for some distance towards the east they are nearly N. and S., while farther east towards the N.E. part of the area contained in Sheet 104, they have an easting which outside the eastern limits of the district, of which this memoir is descriptive, the easting increases more and more as we proceed toward the village of Moy Cullen, and south eastward towards the town of Galway (Sheet 105). This can be observed on the Sheets of the map, as the valleys or fissures now occupied by stream coincide in a great measure with the general direction of these breaks; the only striking exception to the general rule being a nearly east and west valley in Sheet 105, extending through Buffy Lough; but even this valley in its uppermost or western portion has the general bearing of the lines of break in that neighbourhood. May not these facts suggest that these lines of break are in some way connected with the cooling of the mass of the Porphyritic Granite? Perhaps having radiated from the part that last cooled, a sort of elongated centre.

* For the direction of all the noticed ice striae, and remarks on the supposed systems of glaciers, see the table in the detailed descriptions (page 75, *et sequi*).

DETAILED DESCRIPTION.

For convenience of description this area may be divided into five sub-districts, namely—I. *The Aran Islands*; II. *Errisainagh District*, or the promontory between Bertraghboy and Kilkeran bays; III. *Rossmuck and Gorumna District*, or the islands and promontory in the archipelago in the centre of sheet 104; IV. *Inver and Screeb, or the Northern District*; and V. *Cashla or Costello District*, being the south-eastern portion of the area.

I. THE ARAN ISLANDS.

Inishmore.—The rocks nearly everywhere on this island have a S.S.W. dip, varying from 3 to 5, however in a few places rising as high as 10°.

At the N.W. of the island, immediately S.E. of Lough Amurvy, there is a thick bed of dolomite, the continuation of which was observed for half a mile towards the N.E. along the coast. This occurs in the beds over terrace No. 6; on the east of Lough Amurvy, over terrace No. 4, there are patches and strings of a dolomite which weathers into a reddish yellow earthy ochre.

In the neighbourhood of Bungowla, shale or clunch beds were remarked under the limestone that form the terraces Nos. 2, 3, 4, 5, and 6. The beds forming the terrace No. 5 were measured and gave the following section:—

Section No. 1.					Feet.
					over 20
5. Gray limestones,	.	.	.	.	1
4. Shale,	.	.	.	.	0.5
3. Limestone flag,	.	.	.	.	0.5
2. Shale,	.	.	.	.	4
1. Limestone,	.	.	.	.	26

On the part of the sea cliff called Bentlevemore, south of Bungowla, the surface bed is full of pipes of chert—S.S.W. of Sruffaun in the beds over terrace No. 4, patches and a small vein of dolomite occurs. A little S.E. of Sruffaun, at the base of the cliff, forming terrace No. 5, there is a shale bed 3 feet thick—over it are blackish limestones that are succeeded by 4 feet of shale.

West of Kilmurvy, under terrace No. 4, a section was measured as follows:—

Section No. 2.					Feet.
					over 20
7. Limestone,	.	.	.	.	2
6. Black shale,	.	.	.	.	3
5. Limestone,	.	.	.	.	0.5
4. Knobby shale,	.	.	.	.	2.5
3. Limestone,	.	.	.	.	4
2. Clunch,	.	.	.	.	2
1. Limestone,	.	.	.	.	34

South of Kilmurvy a N. and S. dyke of dolomite was observed on terrace No. 3.

West of Oghil, shales occur under terraces Nos. 3, 4, and 6. A bed near the top of the cliff forming terrace No. 6, is of a peculiar knobby structure and weathers with the appearance of a breccia. On terrace No. 7, due south of Portcowroogh, there are patches of a bed very ferruginous as well as dolomitic—these weather into a blood-red ochre clay, which seemingly might be used as a pigment. East of Oghil shales were noted under terraces Nos. 3, 4, 6, and 7.

The village of Kilronan is situated on terrace No. 6, under which is a shale bed that brings the water supply to the Glebe and the upper village wells; and on the valley to the S.W. shales were observed under terraces Nos. 3 and 4, and traced out of the valley toward the N.W. along the sea cliff as far as the Blind Sound; north-westward of which, as seen in the face of the cliff, they seem to be very thin in places, being mere partings between the beds.

At Doocaher the shale beds in the cliff become very thin, the highest not being a foot thick, and the lowest one only a parting; they are about 40 feet distance from each other. About a quarter of a mile S.E. of Doocaher the outcrop of the lowest shale bed dips under the sea, and from that till Gregory's Sound is nearly reached it was not again observed. The upper shale thickens as it is followed toward the S.E., in one place being noted as three feet thick.

At the cliff, half a mile south of Killeany Lodge, strings and pockets of calcite occur.

Five hundred yards N.W. of Killeany, the section of the cliff forming the terrace No. 4 was measured, and gave the following results:—

Section No. 3.

	Feet.
5. Dark gray limestone,	8
4. Dark blue limestones with productæ,	4
3. Black shales full of small nodules, in which frequently are shells,	from 1 to 1.5
2. Flaggy black shales,	1.5
1. Black shales,	over 3
	18

A measured section of the continuation of the same cliff at a point south of Killeany Pier gave—

Section No. 4.

	Feet.
11. Dark gray limestone,	20
10. Knobby shale bed,	0.25
9. Gray shale,	0.25
8. Dark gray limestone,	1.5
7. Knobby shale,	2
6. Shaly limestone,	1
5. Black clunch,	3
4. Black flaggy shales, very like coal-measures shales,	1
3. Black compact limestone,	2
2. Yellowish gray shaly clunch with small rusty pockets,	1
1. Dark gray limestone,	over 5
	37

Bed No. 14 contains *Goniatites*, *Producti*, *Posidonomya* (?), and plants, apparently fucoids.

East and south of Killeany there is a roll in the beds, the dips being respectively west at 5° and north-west at 3°—further S.E. in the continuation of the same cliff, the section N.E. of Benaite was measured.

Section No. 5.

	Feet.
8. Dark gray limestone,	8
7. Dark blue limestone,	2
6. Knobby bed,	0.5
5. Flaggy bed,	0.25
4. Shale,	1.5
3. Flag,	0.25
2. Shale,	3
1. Gray limestone,	over 3.5
	19

A little south of Killeany the cliff under terrace No. 3 was also measured and gave—

Section No. 6.

	Feet.
9. Dark gray limestone,	over 6
8. Flaggy black limestone,	4
7. Black limestone,	1
6. Gray shale,	0.25
5. Limestone full of <i>Producti</i> ,	0.25
4. Gray shale,	2
3. Limestone flag,	0.5
2. Black ferruginous shale,	3
1. Black limestone, surface only seen.	
	17

On the N.E. face of Benaite, overlooking Gregory's Sound, there is a fine-jointing affecting the limestones and splitting them into flags. On the sea cliff due south of Killeany, there is a large rough rock surface, unaffected by a single joint.

Drift.—In some of the nearly N. and S. shallow hollows, there appears to be a thin coating of boulder clay, while in two places of the kind it certainly occurs, and contains polished and striated blocks of limestone, granite, and metamorphic rocks—the underlying limestone rocks are rounded, scratched, and polished. One of the patches referred to, about 80 feet wide, 300 feet long, and 1.5 feet deep, was remarked on the sea cliff about 500 yards N.W. of Dunængus, where the striae on the subjacent rock bears N. 15 E.—the other occurs on the sea cliff south of Cowrugh and S.E. of the small promontory called Nalhea; in this place the striae bear N. and S., and the patch of boulder drift is about 40 feet wide, 400 feet long, and 2 feet deep. In other places on the island wide grooves were remarked, and as they have nearly similar bearings to the striae just now recorded, it is very probable that they also were formed by ice; however, if they were, the polished surface, and from two to four inches of the surface of the rock have since been weathered off. A good example of these furrows can be seen on a rock surface near the shore of Killeany Bay, and about 200 yards N.E. of Lough Atalia. This is of a semicircular form, about 7 yards long, nearly a yard wide, and about a foot deep, having a bearing of N. 25 E.

Although so few patches of boulder drift were observed on this island, yet that it once was partially, if not entirely, covered by a similar deposit, would appear suggested by the numerous erratics scattered about, that seem to be the residue of the boulder clay which remained after the lighter portions were carried away, they being as numerous on the higher as the lower parts of the island. These erratics are principally large and small blocks of sandstone, limestone, granite, and metamorphic rocks; the two latter being similar to the rocks found *in situ* in Yar-Connaught; the limestones may be indigenous to the island or the *débris* of some of the rock which once existed between here and Galway, while the nearest known sandstones are those north and west of Oughterard, a village on the shores of Lough Corrib, about 16 miles N.W. of Galway. The sandstone blocks seem to be more numerous than the other kinds, and they might possibly have been drifted from the neighbourhood of Oughterard, but it is more probable that they are the *débris* of the sandstone that formed the shore beds round the islands and shores of the sea that may have existed during the Glacial period, between the islands of Aran and the present north shore of Galway Bay. A fact connected with the small erratic blocks to which attention seems first to have been drawn by Captain Bedford, R.N., is that they occur in lines that run nearly N. and S. (N. 10 E.) This is the bearing of the principal joints, and as the lines of small blocks always lie along

an open joint, would it not seem to suggest that the blocks have been rolled about since the joints were first weathered, and having been caught in the hollows remained there. To strengthen this supposition it may be mentioned that on the crags about Lough Corrib, the small blocks lie in lines corresponding to the bearing of the principal joints, while the large blocks that could not be so easily moved, similar to the large blocks on Aran, are promiscuously scattered about. The large erratics have protected from weathering the portions of rock underneath, and they now stand on pedestals of rock that rarely exceed six inches in height, and usually are from three to five inches, thereby placing on record the amount of waste by weathering the rocks have undergone since the islands were last raised above the sea level.

In the cultivated or enclosed parts of the crags these pedestals are often higher than six inches, but in those localities their height is not entirely due to weathering, but to the loose top-bed having been removed by the inhabitants to build the fences with. This to an observer will appear evident, as all the blocks near the fences have high pedestals, some reaching 1.5 feet, while at some distance from the fences they may be only a foot in height, and near the centre of the enclosure, where none of the surface stones have been taken away, the natural pedestals will be found, which rarely, if ever, exceed six inches in height.

Sea Cliffs.—Of the cliffs on the N.E. and N.W. of this island scarcely more can be said than that already mentioned in the general description, but those on the S.W. are peculiar, as in places they are terraced by the waves of the Atlantic. Moreover, some of them are surmounted by the previously mentioned "Block beach." This peculiar accumulation of blocks does not occur at all on the N.E. shore, while to the N.W. it was only found at the point, due-east of the north point of the Brannock islands. On Inish-Eeragh the westernmost of the Brannock Islands, there is also a block beach which is thus described by Captain Bedford:—"On all but the eastern side there is a margin of massive blocks of limestone, upheaved by the violence of the sea, and which now form a sort of barrier against its farther encroachment The highest part of the island is the summit of the upheaved beach at the north-west side, which is 36 feet above the mean level of the sea."

The north part of the N.W. coast of Inishmore, as before mentioned, is a perpendicular cliff that either extends upwards from the sea level, or has at its base a few steps.

The vertical cliff seems to be caused in a great measure by vertical master joints, some of which cut through all the visible beds, while others only reach the shale beds; in the former case the cliffs are perpendicular down to the sea, while in the latter there are steps or sea terraces at the base of the cliffs.

Beginning at the N.W. to examine these cliffs, the observer will find that immediately E. of Mweeleenareeava there are master joints ranging N. 70 W., that extend down to the shale beds which inland lie under terrace No. 5, and as these shales at this place meet the sea at about half neap tide, there is a perpendicular cliff above this level, while below it there are steps.

From this for nearly a mile towards the S.E. the master joints bear E. and W., or a few points on either side of that line, and as they extend below low water level of neap tides the cliffs are perpendicular. S.E. of Polladoo there are four sets of steps at the base of the cliff, and the note made on the ground is as follows:—"Cliff over 250 feet high. Two shale beds; the cliff rises perpendicular from the highest. These shale beds are supposed to be the continuation of those under terraces Nos. 2 and 3." South of Portmurvy there are from four to six of these sea terraces, and the cliff is less than 50 feet high. South of Gurtnagapple the cliffs are low but perpendicular; hereabouts, nearly E. and W., master joints occur about

two yards apart, and as the sea undermines the cliff, masses of rock, tons in weight, that are disconnected by these joints, topple over and fall, forming a breakwater at the base of the cliff. This breakwater extends for about half a mile.

At Corker there is a perpendicular cliff formed by E. and W. master joints. In the face of the cliff there are two shale partings about 40 feet asunder, the lower being about 60 feet above half neap tide. They seem to be the representatives of the shales under terraces Nos. 3 and 4.

The small promontory called Nalhea is bounded by N. 15 E. master joints; here the shale beds have dipped below the sea level.

South-east of Nalhea there are four or five sea terraces at the base of the cliff, and at Whirpeas the cliff is about 140 feet higher than the level of neap tide, a shale bed occurring about 40 feet above this level. To the east of this, at Pollnabriskienagh, the limestones are traversed by E. and W. master joints, and the sea yearly causes great destruction of the rock. This cliff, which is about 100 feet high, is undercut at the base. At Benshee-frontee the point a little N.W. of Doocaher, "The Block Beach," sets in and extends to the S.E. point of the island, having only five small breaks in it; three at the cooses or small bays in the vicinity of Doocaher, one at the coose called Doughatna, and one about 40 yards wide at the Glassan rock—in all of which places the base of the cliff is undercut, while that part which is surmounted by the "block beach" is stepped; however, although it is undercut and forms a cave at Doughatna, yet below the cave there are six very low steps. The highest part of the cliff on which this beach occurs is in the vicinity of Doocaher, and about 100 feet above the sea level, while the lowest part, a quarter of a mile west of the Glassan rock, is about 35 feet. The S.E. point of the island, where the beach ends, may be 100 feet high.

These steps at the base of the cliffs are usually from four to seven in number, seemingly having been cut, one by low water of spring tides, another by low water of neap tides, another by high water of neap tides, another by high water of spring tides, with one or two intermediate steps when the limestones are thin bedded, and the systems of joints do not extend through more than one or two beds. However, in places they are modified by master joints, along which cooses are cut, or perhaps two or more steps will merge into one, according to the number of beds through which the joint penetrates. At one place, east of Carrickurra, there is a step above high water of spring tides on which the block beach rests; at this place the cliff is about 50 feet high.

The stones forming the "block beach" are cast up during the winter gales, and some of them are of a considerable size. A little south of Doughatna the following observation was made:—"Great quarrying seems to be going on here during the gales. Blocks 30 x 15 x 4 feet tossed and tumbled about." And again, half way between Doughatna and the Glassan rock there is this note:—"A block 15 x 12 x 4 feet seems to have been moved 20 yards and left on a step 10 feet higher than its original site."* East and west of the Glassan rock there are two caves which run for a considerable distance inland, and connected with both are "puffing holes." The western puffing hole is 85 yards from the sea margin, and the eastern 33 yards. On the north-east side of the latter there is a small "block beach," the blocks in which have all the appearance of being yearly tossed about by the waves, while more are added to it, and we may suppose some sucked into the abyss below. Other puffing holes were observed further N.W., but none so large as those just mentioned.

* It seems remarkable that there is no "block beach" on the cliff south of Portmurvy, as it is less than 100 feet in height, and most part is formed of steps.

Recent Deposits.—The recent deposits consist of peat bog, so small and thin as to be scarcely worth mentioning, and *sub-ærial sands*. The sands are very considerable, occurring in all the islands. They are ever changing their positions, and in O'Flahertie's History we find mention of various churches, tombs, and fields, now covered or nearly covered by them. During the examination of Inishmaan, tombs were pointed out near its east shore that had only a few months previously been discovered, as up to that time they were covered with sand, which now has been blown away.

At Trawmore, on the south of Killeany Bay, proofs have been lately discovered, not only of the movement of the sand hills, but also that this part of the land, since the islands were first inhabited, has changed its level, as human structures are found under the strand and extending out seaward. The following account of them is curtailed from a history of the islands by their present vicar, the Rev. W. Kilbride:—"The extreme eastern point of Inishmore forms a spit of land jutting into the sea. On one side of it is Gregory's Sound, and on the other Trawmore. The latter name is, however, frequently applied to the whole plain." The sand from this plain is being blown away "to the southward and south-eastward into Gregory's Sound, which in consequence has shallowed considerably, some say to the extent of four fathoms; at all events, the fishermen at present use their spillards and lines with the greatest ease and safety where formerly they were cut and destroyed by the sharp rocks at the bottom." This movement of the sands has gradually uncovered the ruins, which consist of "two cloghauns or stone cells, with beehive-shaped roofs and structure in every point similar to those usually called *Leabuidh Diarmaid agus Graine*, or 'Dermot and Graine's bed,' and old walls or single stone fences dividing the ground into regular fields and gardens, evidently under cultivation in former times. These walls extend out seaward, and all the structure until very lately were completely covered over by sand from 10 to 20 feet in height." They must apparently have been buried "a long time ago, for it cannot be less than a thousand years since Eany's church was first erected on part of this sandbank, which still remains. The Liagaitreabhs are of pagan origin and belong to pagan times. The legends of Dermot and Graine belong to the first centuries of the Christian era, when Druidism flourished in Ireland; and as the myths relating to these mystical but renowned personages rest on a belief in the metempsychosis, so we may refer all these 'leabuidhs' to something in connexion with the pagan worship of the ancient Irish. Dermot and Graine belonged to the middle of the second century, and their leabuidhs must have been introduced subsequently to that period; therefore we are led to infer that this sand plain may have been formed between their age and the time when Eany's church was built. This gives a space of three or four hundred years, and in some epoch of that period the sand may have accumulated, and thus covered up the liagaitreabh disclosed within the past few years." This author also mentions other places to which the sand hills have moved during the historical period, one of the most remarkable being at St. Coeman's burying-place on Inisheer, where a "hillock, which in O'Flahertie's time (A.D. 1684) was a nice green plain, is now only a mass of sand."

South of Portmurvy, and north and south of Killeany Bay, the limestone rocks are covered with a similar fine sand deposit.

On a casual examination these sands appear to be of recent formation, containing, as they do, land and *marine* shells, besides in places overlying peat bogs; these facts, however, may not prove their age, for the wind, more especially in exposed situations, on account of their loose and frail nature, shifts them backwards and forwards, by which means they may submerge peat bogs; and as they are a favourite resort for all kinds of land

snails, every gust of wind buries hundreds of the latter. Moreover, when on the seaboard during low water, thousands of marine shells may be blown up among them, as will be seen by any observer who, braving the cutting shower of sand, traverses them during a gale of wind. As they are ever changing their position, it is evident that they have only recently assumed their present form.

On the rest of the island, excepting the two or three small patches of boulder drift and a few insignificant bogs or morasses, the surface soil is a thin coating, either formed of the weathering of the underlying limestone or the decayed remains of the plants that grow year after year on the rocks. A stranger looking at the islands of Aran would be inclined to suppose them almost a barren rock; but anyone forming such an opinion would be greatly mistaken, as, although the rock protrudes to the surface in most places, yet the herbage among the rocks is of the richest description. Of these islands, O'Flahertie says, when he wrote in 1684, "The soile is almost paved over with stones, soe as in some places nothing is to be seen but large stones with openings between them, where cattle break their legs. Scarce any other stone there but limestone, and marble fit for tombstones, chymney mantle trees, and high crosses. Among these stones is very sweet pasture, so that beefe, veal, and mutton are better and earlyer in season here than elsewhere."

Inishmaan.—The rocks on this island dip S.W., at angles varying from 3° to 10°. Seven continuous terraces occur, but whether they are the continuation of the terraces on Inishmore or not it was impossible to prove.*

Under the first, second, and fourth of these terraces, counting from the uppermost, shale beds were found; they also appear to occur under terraces Nos. 5 and 6. The shales under the upper terrace were only observed towards the west. Those under the second terrace are 9 inches thick north of Kinbally; at the Roman Catholic Chapel in the centre of the island, 6 inches, while a little west of Moher they are 3.5 feet thick, and east of Moher 4 feet. The shale below the fourth terrace seems to be about 2 feet. Below the fifth and sixth terraces there seems to be shale debris, however, it may only be the debris of very earthy beds of limestone.

In the north part of the island the joints have no regular bearing, while in the south part they coincide with those on Inishmore, being about N. 10 E.

Drift.—No undoubted boulder drift was observed; however, the same kind of erratic blocks occur, and similarly circumstanced, to those on Inishmore.

On the crag over and south of Trawtagh, there is a wide semicircular shaped furrow which bears N. 40 E., and may be due to ice.

Recent superficial deposits.—Above the sea level at Trawletteragh there are stratified gravels containing marine shells.

The north-east part of the island from Trawletteragh to Trawndaleen is a fine sub-ærial sand, containing marine and land shells, the same as those in the similar sands, described as occurring on Inishmore.

Sea Cliffs.—On the west coast the sea cliffs rise in steps, as they are followed southward from Trawtagh until at Aillinera they reach their maximum height (nearly 200 feet), southward of this they gradually fall to nearly the sea level at Allyhaloo, the S.W. point of the island. Immediately south of Aillinera at a height of about 170 feet, there is a "block beach" which is continuous from this point round the west and south-east sides of the island.†

* There is a thick homogenous bed forming the fifth terrace on this island, and a similar bed occurs in the terrace called No. 6 on Inishmore.

† South of Aillinera the block beach is on higher ground than on which it now occurs on any of the cliffs of Inishmore. The cause for this is not apparent, unless it may be that hereabouts the tides seem to run against the cliffs with greater force than elsewhere, and thereby the waves may be enabled to hurl the blocks to a greater height.

The cliffs below it are always in steps very similar to those described below the "block beach," on the S.W. of Inishmore. In one place steps were observed above high water mark of spring tides, on which the following record was made:—"At Taunabruff the limestone is thin bedded, and the winter storms have formed seven low steps between the high water mark of spring tides and the "block beach."

On the west coast some of the blocks are remarkable for their size, and the distance and height to which they have been moved by the force of the waves.

The following are the most notable:—About one hundred yards southward of Pollnashedaun "large blocks have been quarried by the sea, the largest measured being $15 \times 5 \times 4$." South of Taunabruff a "block $20 \times 5 \times 1$ has been raised 20 feet and moved 31 yards from its natural site." A little south of this, near Aillyhaloo, a "block $19 \times 8 \times 3$ was raised 5 feet and moved 8 yards; and another $27 \times 9 \times 4$ was raised 4 feet and carried 9 yards."

On the S.E. coast the "block beach" is peculiar, being formed of small blocks; also in other places the blocks seem to be rearranged yearly, while here they do not seem to have been moved for years, and the impression formed at the time was, that the tidal current cannot hereabout now set as strong in the same direction against the coast as formerly, because samphire, seapink, &c., now grows freely on the two terraces below, as well as among the blocks forming the beach; moreover, the blocks seem not to have been stirred or added to, by the sea, for years." This beach was found extending as far towards the east as Clogharone, the S.E. extremity of this island.

The following notes are copied from the late Mr. Foot's maps:—

Inisheer.—"This island, like the mainland in the barony of Burren, County Clare, is nearly bare limestone, with herbage springing up through the chinks and crevices. It consists of thick and thin bedded dark blueish, and sometimes pale grey limestones, compact and finely crystalline, abounding locally in producti, corals, crinoids, &c., traversed by joints, one (the principal set) bearing N. 17 E., another N. 11 or 12 E., and another N. 15 E. These in places are crossed by another set which bears generally E. 25 N., and more only for short distances. There is a general dip to S. or S.E. at from $1\frac{1}{2}^{\circ}$ to 3° ."

Notes on the rocks at the west of the island; "thin and thick bedded limestones, generally blueish (dull) grey compact, but often pale grey, finely crystalline, dipping S. or S.E. at from $1^{\circ} 30'$ to 3° , traversed by joints, the principal of which run N. 17 E., and N. 12 E., that are occasionally crossed by others bearing N. 25 E., and running only for short distances. The stone at the S.W. point of the island near Tonefechney, is considered the best for building purposes on the island." The Rev. W. Kilbride informed us, that at the time the lighthouse was built on this island, blocks were taken from the S.W. quarry and brought to Dublin to be worked into marble.

Large deposits of the "blowing quartzose sand" also occur on this island.—G. H. K.

II.—ERRISAINHAGH DISTRICT.

Islands off Errisainhagh.—*Inishtreh*.—This is a small island on the extreme N.W. of the Errisainhagh promontary in sheet 103; during low water it is joined to the mainland by a bank of gravelly shingle, which also covers the greater part of the island—the rock is the porphyritic granite.

Freaghillaun, Rush Island, and Inishbigger.—These islands lie in the entrance to and W. of the Moyrus Boat Harbour. The granite of Inish-

bigger is even-grained to slightly porphyritic, while that of Freaghillaun and Rush Island is of the ordinary porphyritic type; the S. and N.W. shores of the former island are covered with large rectangular blocks of an even-grained granite, with black mica, similar to the rock about Mall Head.

St. Macdara's Island,* or as it was anciently called Croach mic Dara, i.e., *Macdara's stack or rick*, is thus described by Mr. Kinahan, "A peaked rick-shaped island of about 60 acres in extent, and rising gradually from the sea level to a nearly east and west ridge; its highest point being 102 feet. The ridge has slopes eastward and westward, that increase in abruptness as they approach the shore."

"The island seems to be nearly altogether formed of granite, except towards the east, where a dyke of green quartzose porphyry, about 30 yards wide, crosses it in a S.W. and N.E. direction. The granite appears to have similar constituents to that of the granite near Galway, namely, pink orthoclase, green oligoclase, a white felspar, black mica, and quartz, with, in places sometimes as essentials, at other times only as accessories, hornblende, sphene, iron pyrites, epidote, chlorite, and white mica. As the minerals that crystallize out are generally of nearly a similar size, the rock has usually a uniform and rarely a porphyritic aspect."

"The shape of the island may partially be due to ice erosion, as many of the rocks have the appearance of being ice dressed; moreover on a few, ice striae that bear N. 10 E., were observed. However its slopes, more especially those northward and southward, appear in a great measure to be due to the structure of the rock, as it is inclined to split off nearly everywhere in plates a few feet thick. This remarkable weathering can be well examined at the S.W. of the island, where the waves of the Atlantic are yearly quarrying largely, and hurling up the blocks above high water mark, thereby forming a beach of huge blocks, and one of considerable size that was measured, gave $21 \times 21 \times 2$ as its dimensions. On the east part of this island there seems to be a very thin coat of sandy drift, while on the rest is a peaty soil."

Off the S.E. of St. Macdara's Island there is Illaunnamorlagh, a small shingle island that is joined to the larger one during low water.

Mason Island lies a little E.S.E. of St. Macdara's. The rock is an even-grained granite similar to that on St. Macdara's Island. To the north of the island there is a well marked N. and S. jointing in the granite, which appears to be only local, as it does not occur on the southern shores. On the west there are numerous angular blocks and boulders scattered along the shore, while on the east the rock is covered with sand. Passing through the old chapel in ruins, and running through the island, is a N. 30 W. fissure caused by the weathering of a soft course of granite.

Wherroon, Avery and Ardnacross Islands.—The two former lie N.W., and the latter E. of Mason Island, from which it is separated by a creek which is fordable during low water, while all are nearly covered by the tide at high water; the rock is similar to that on Mason Island.

Mweenish Island, Inishtroghe, and tidal rocks.†—Mweenish bounds Ard Bay on the south, and is connected with the mainland by a pass that is fordable at half tide. The rock is principally an even-grained granite, similar to the rock on the mainland N. of the island; there are, however,

* St. Macdara's Island is famous for the ruins of a beautiful small Cyclopean church, dedicated to the saint; unfortunately this is fast disappearing for the want of a little care. The exact time this church was built is not now known, but judging by the style of the architecture, is supposed to be previous to the tenth century.

† Mweenish island lies within sheet 104, with the exception of a small headland on the W. that runs into sheet 103.

a few places on the N.W. and S. of the island where the rock is slightly porphyritic. South of, and about Lough Oran, there are well marked N. and S. joints, and a little W. of this lough several rotten E. and W. courses of granite that decompose freely were remarked. Several felstone dykes occur, generally of a bluish grey or purplish grey colour; and at the "Well of the Seven Daughters" a compact N. 10° W. quartz lode was observed, stained in parts with iron. The rock on Inishtroghen is similar to that on Mweenish, as are also the tidal rocks.

Duck Island lies about half a mile S. of Mweenish, and its subjacent rocks are similar to those on the S. part of that island. Five nearly N. and S. felstone dykes were observed. The three to the east are porphyritic, that to the west a blue compact felstone, breaking with a conchoidal fracture, and the fifth, which is the largest, running through the centre of the island, is of a pale greenish blue colour, and inclines to be porphyritic. The last mentioned is probably a continuation of a similar one, observed crossing obliquely the S.E. end of Mweenish.

Finish Island.—This island bounds Mweenish Bay on the S.E., and is connected to the mainland at low water by a strand. The rock is an even-grained, to slightly porphyritic, granite.

A mile S. of this island is *Inishmuskerry*, in which the rock is the typical porphyritic granite.

Birmore and Birbeg Islands, and tidal rocks.—Birbeg is situated about a mile S.S.W. of Ardmore Point, and Birmore S. of the latter, the two being connected during low water. The rock is the ordinary porphyritic granite. Four nearly N.E. felstone dykes were observed; that which occurs at the S. of Birmore is of a bluish grey colour, and irregular in its course; the south-east and north-west dykes are also of a bluish grey colour, while the central one is a dirty white splintery felstone, with cubes of iron pyrites. The tidal rocks, viz., *Birbeg Rocks, Horse Rocks, &c.*, are granites of the porphyritic type.

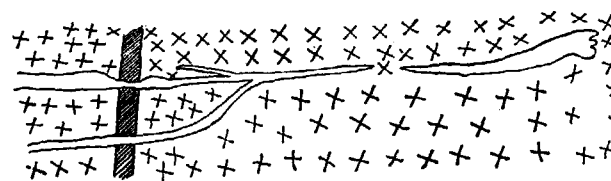
Country about Kilkieran.—The subjacent rock hereabout is granite of the porphyritic type. Along the shore, west of Kilkieran Point, in many places the granite is even grained; but in others, instead of the pink felspar, white is porphyritically developed. Farther S.W., north of Ardmore Point, it contains hornblende as a constituent. About a furlong due west of the house, engraved "Police Barracks" on the map, there is a north and south compact quartz lode. Between Ardmore and Kilkieran Points five greyish blue felstone dykes occur, two of them being porphyritic, and all having a general bearing of about magnetic N. and S. (N. 27° W.) North of Ardmore Point is a felstone porphyry, and N.W. of it a fine grained quartziferous porphyry dyke ranging N.N.W., while a little west of the latter a N. and S. similar dyke occurs. Due north of Finish Island six nearly N.N.W. dykes of a blue or greyish-blue felstone were observed, one being forked.

Between the trig. point Δ 552 and Lough Sallagh the granite varies from even grained to slightly porphyritic, with pink and greenish waxy looking felspar (probably oligoclase). Along the shore of Loughanore, the granite is decomposing *in situ*. In the stream on the west a large nearly N. and S. pink quartziferous porphyry dyke occurs. West of this two granular nearly N. and S. felstone dykes, and still further west a wide compact quartziferous porphyry, with a splintery felstone on its eastern side, were observed. To the southward, on the N.E. of Lough Nasona are five dykes, and nearly due north of that lake a greyish blue felstone, and three miles to the northward Lough Nasona. A little S.W. of the summit of Beal-maum (Δ 741) a large irregular very hard and compact N. 70° E. quartz lode, partly jasper, was noted, and in its strike nearly a mile farther E.N.E. is a large quartz lode which seems to be its continuation. In the

vicinity of Beal-maum several felstone dykes occur, one running nearly N. and S., two having a slight westing, two a slight easting, N. 30° E., and one a grey felstone bearing N. 70° E. The west N. 30° E. dyke is a quartziferous porphyry, with hornblende as an accessory.

Country about Carna and Moyrus.—The granite in this tract is generally of the porphyritic type, although this character is seldom well developed, as it is generally more or less even-grained. Southward of the hamlet of Carna, in the country north of Mweenish Bay, are felstones and quartziferous porphyrys ranging in N.W. directions, too numerous to be all mentioned, but the principal ones are as follows:—A little east and west of Lough Aubrisk, which lies a mile S.S.E. of Carna, are two large pinkish splintery felstone dykes, both having a peculiar platy structure, in some places parallel, and in others oblique to the walls of the dykes, and changing in parts from compact felstones to fine grained quartziferous porphyrys. It seems probable they are the bifurcation of one dyke, being precisely similar, and continuing to approach each other in a northerly direction till they nearly unite at the coast line. West of these dykes on the Carna side of the creek are two very similar ones, one small and irregular at the eastern side of Lough Keeraun, and the other extending along the western margin of this lough, and from thence southward to the sea. The latter is cut by two felstone dykes, the most southerly being an E. and W. branching dyke, granular, in parts of a greyish green colour, while in others, particularly where it cuts the large dyke, it is of a splintery nature, with a platy structure. To the east it terminates in a boss. While passing through the large dyke it is only two feet wide, but immediately outside those limits it is about twenty feet (see Sketch, Fig. No. 2). East and west of the creek on which Carna is situated are other dykes, some being felstones, others quartziferous porphyrys, the latter apparently older than at least some of the felstones, for they were in some cases traversed by the felstones.

Fig. No. 2.



Plan of dykes showing granular felstone cutting quartziferous porphyry.

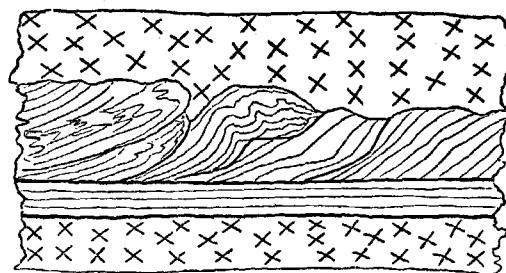
On the west margin of the creek is a massive quartz porphyry that appears to curve towards the N.W. past Carna, while on the west of the creek is one of the apparently newer felstones that seems to run for more than a mile and a half towards the N.N.W., having been observed in detached places as far N. as Lough Keamnacally. North of Lough Atrohaunderg a massive N.E. fine-grained quartziferous porphyry occurs.

The granite of the tract N.W. and W. of Carna (in sheet 104), and also of the strip along the coast to Moyrus (in Sheet 103) is even grained, containing as essentials pink and yellow felspar, glassy quartz, black mica, and hornblende, also in places iron pyrites. In the neighbourhood of Lough Corker, two miles N.W. of Carna, this rock is traversed by numerous quartz strings, having a general bearing of N. 30° E., and by irregular silicified joints, which stand nearly a quarter of an inch above the mass of the granite, while the quartz strings weather evenly with it.

S.W. of Carna and east of Ard Bay are felstones and quartziferous

porphyries that can be traced for a considerable distance in a general N.N.W. direction. North of Ard Bay, on the S.S.E. slope of Cuileen Hill, four felstone dykes of a bluish or purplish grey colour occur, ranging from one to sixty feet wide. One was traced for nearly a mile in a N.N.W. direction from the coast. On the S.W. slope of Cuileen are three nearly parallel N.E. and S.W. dykes, the most southern of which branches on the seashore, while the other two may be branches of a dyke that comes from the N.W., and joins into them at nearly right angles. On the coast line of the Moyrus promontory which lies N.W. of Ard Bay at the junction of Sheets 103 and 104, sixteen N. and S. to N. 30° W., and eight N. 10° E. to N. 35° E., felstone and quartziferous porphyry dykes were noted, the felstones being similar in character to those previously described, and the quartziferous rocks generally more or less compact, containing sometimes crystals of hornblende, felspar, and blebs of quartz. One of these dykes seems to require a further description. It was traced for over two miles in a slight curve from Ard Bay to the N.W. extremity of Lough Bola. On the shore of this lake it is a massive dyke, within its S.W. portion a system of parallel quartz strings giving it a platy aspect, while the N.E. part has an irregular lamination, partly oblique, and partly approaching to the spheroidal. This wall of the dyke is also most irregular, while the S.W. wall is not so. A plan of the dyke, as seen on the east shore, is given in the accompanying woodcut (see Fig. No. 3). The rock is of a greyish colour, and often contains blebs of quartz. From Lough Bola it runs S.W. to Mill Lough, at the N.E. corner of which it seems to bifurcate, one arm running along the N.W. shore of that lake, while the other curves gently to the shore of the north arm of Ard Bay. At Mace Head, the west point of Moyrus (in Sheet 103), a grey quartziferous porphyry was traced inland in an E.S.E. direction nearly to Lough Shemus, north of which it was observed to curve to the north-east. On the west of the previously-mentioned Lough Mill, a boss of fine-grained quartziferous porphyry was observed, and about three furlongs due south of the same lough a trial shaft was sunk on a quartz lode. Other quartz lodes are seen on the east shore of the creek; a little west of Lough Shemus a wild irregular quartz lode occurs; still further west, and about 300 yards N.W. of the Moyrus Parsonage a small branching quartz lode, but none of them seem to be of much importance.

Fig. No. 3.



Plan of part of dyke at N.W. corner of Lough Bola.

Round the margin of Lough Bola, near the west edge of Sheet 104, are numerous irregular dykes; however six seem to bear N.N.E. to N.E., and seven between W.N.W. and N.N.W. Most of these dykes are porphyritic, and many contain black mica and iron pyrites, while epidote was observed in a N. 10° E. quartziferous porphyry extending from the N.E. shore of the lake.

The granite about Knockboy Lough, which lies half a mile N.W. of Lough Bola, also N.E. of it in Sheet 104, to Lough Derreenanearla, and N.W. of it in Sheet 103, is the ordinary porphyritic granite, but, having in local patches, the white felspar porphyritically developed; at the coast line, however, north of the trig. point Δ 102 (in Sheet 103) it is even-grained, but changes rapidly to porphyritic, and a little S.W. of the same point hornblende was observed as a constituent. Several felstone dykes occur about here, the most marked being a continuation of one on the shore N. of the Moyrus Parsonage, and due west of the Holy Well marked on the map. This was observed a little W. of the trig. point, extending in a N.N.W. direction to the shore, from whence it was traced along the coast to Inishtreh.

ERRISAINHAGH.

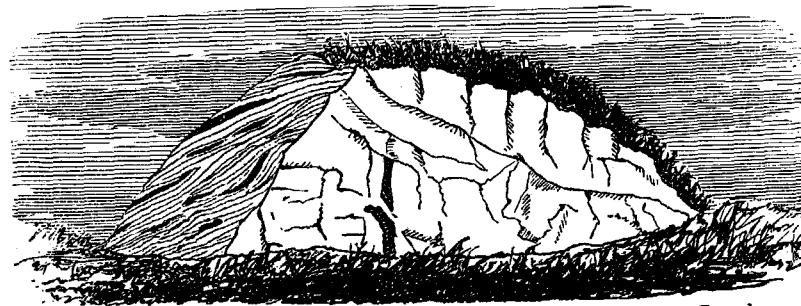
The junction between the metamorphosed sedimentary rocks, and the granite in this area, is continuous with that which is afterwards described by Mr. Kinahan, north of Lough Aheeran, on the southern shore of Bertaagh-boy bay (see page 41.) It then runs in a westerly direction to the coast line, a little east of the creek on the extreme western limits of sheet 104. It is broken in its course by small faults, which shift the boundary slightly to the south.

The boundary reappears on the shore, a quarter of a mile farther west, and then runs in an irregular E. and W. direction, passing about 50 yards to the south of the house marked *Demesne Lodge* on the map, where the junction is remarkably well seen, and continues westwards to about 100 yards north of the trig. point Δ 137.

It then curves gradually to the S.W. and S.E., and running in a gently undulating line, until it leaves the eastern limits of sheet 103 at 53° 21' 28" E. lat., entering the western limits of sheet 104, half a mile S.W. of Lough Derreenanearla.

From this lake the boundary trends in an eastern curve, to near the summit of Knockboy Δ 360°, when it turns to the S.E., and continues in an irregular curve to Dooletter Lough, a little north of which a good section of the junction is seen. (See sketch, fig. No. 4.) At this lake the junction turns to the N.E., and continues in an irregular line, having a general N.E. or E.N.E. bearing, until it reaches Lough Aliggan where it joins into the boundary described by Mr. Kinahan. (See page 49.)

Fig. No. 4.



Junction between hornblende schist and granite north of Dooletter Lough.

Schistose District, east and west of Knockboy.—This tract is composed of metamorphosed sedimentary rocks broken up by numerous pipes and courses of hornblende rock, and along with the adjoining granite cut by faults,

felstone, and quartz porphyry dykes. At the summit of Knockboy, and a little north of it, there is a course of gneiss of a very granitic aspect. It is separated from the granite by a wide band of hornblende gneiss, with angular and rounded pieces of hornblende rock. In this gneiss the foliation is in parts very obscure, and in others nodular, spheroidal, and conglomeritic.

A wide irregular course of hornblende rock occurs at the summit of Knockboy, and runs in a western direction for about a half a mile.

At Lough Derreenarearla two felstone and one quartziferous porphyry dyke occur. A quarter of a mile to the east of the lake, are two classes of dykes, cutting the granite and metamorphosed rocks. Those of one class run about N. 20° to N. 30° W.; while those of the other have a general bearing of N. 10° to N. 35° E. The former are felstones, principally of a greenish gray colour, and compact splintery nature; while those of the latter are quartziferous porphyries, having as essentials a greenish felspar, quartz blebs, mica, and hornblende, with iron pyrites as an accessory. They are supposed to be cut by the felstones, but this could not be proved, owing to the geology being obscured by a coating of bog. A little to the N.W. of Knockboy, four dykes occur. One is a greyish quartziferous porphyry, and of this Mr. Kinahan thus wrote: "This possibly may be a metamorphosed irruptive rock, as at the centre it is a greyish or greenish flaky quartzose felstone, while towards the walls it is of a granitic aspect, containing black mica, and white felspar crystals, besides the blebs of quartz, in a greenish or greyish felspathic matrix."

North of Knockboy hill, in the stream at Lough Knocknagapple, is a N.W. splintery felstone. To the west of this four felstone dykes occur. The most westerly of these was traced in a N.E. direction, until it reached the boundary between the granite and metamorphosed rocks, along which it runs for a short distance. This dyke crosses in its course, one of the faults that displace the granite boundary, without being shifted by it; thus showing that it is more recent than the fault.

A little N.E. of Lough Knocknagapple, is a quartziferous porphyry dyke, branching at Lough Aheeran, and cutting through an irregular mass of hornblende rock.

About a quarter of a mile E.N.E. of Knockboy, there is a dislocation which gradually dies out to the south, but alters the strike of the rocks to the north, as on the west side of the fault they strike in a N.W. direction, while east of it the strike is nearly N. and S. This break runs through Lough Clugacomen, and is afterwards referred to by Mr. Kinahan. (See page 45.)

To the E.N.E. and S.E. of Knockboy, the rocks are principally hornblende gneiss, and schist, nodular, spheroidal, and crumpled, with pipes and irregular courses of hornblende rock, coming up through them.

Country south and east of Glinsk-bridge.—From this bridge to Dooletter Lough, which lies one and a half miles to the S.E., in the direction of Trig. station Δ 512, the principal part of the surface, which is comparatively flat, is covered with bog; notwithstanding which, there are exposures of very hornblende gneiss and schist, often conglomeritic, nodular, and spheroidal; with patches of hornblende rock, which seem to be in many places interstratified with them; but as the rocks are similar to sections already described about Knockboy, they need no particular notice.

At Shannockdonagh hill, there is a large exposure of hornblende gneiss, which in some places might be mistaken for hornblende rock, were it not that in every instance there are appearances of foliation on the wreathed surface, while in some parts that structure is undoubtedly present.

Immediately to the south of the summit of this hill, is an irregular patch of coarsely crystalline hornblende rock; and a little to the east of it, a com-

compact felstone dyke, running from the southern base of the hill for about 500 yards in N.N.W. direction, then turning round to the west, in which direction it was traced to the western base of the mountain, where it was lost in a flat bog.

About a quarter of a mile east of this hill, is a nearly N. and S. quartziferous porphyry, and still further west a granitic felstone, both of which were traced from the granite into the metamorphosed sedimentary rocks. They are afterwards referred to by Mr. Kinahan. (See page 48.)

Country N. and N.E. of Shannadonnell Lough.—This lough lies about two and a quarter miles east of Glinsk-bridge. The rocks N. and N.E. of this lake are hornblende gneiss and schists, very much broken up by dykes, faults, and masses of hornblende rock.

South of the lake, in the granite, is a greenish quartziferous porphyry dyke, which was traced into the metamorphosed sedimentary rocks, in a nearly northern direction, to near the margin of sheet 104, when it dies out. In its course it is shifted by at least two faults; the first one, which is afterwards described by Mr. Kinahan as a slip fault (see page 48), moving it slightly to the east; and the other a fault that comes up through the gut leading to the village of Gowlaghbeg, shifts it apparently about half a mile to the east. This fault is also referred to by Mr. Kinahan. (See page 48.) About a quarter of a mile south of the latter fault, the dyke bifurcates; but one of the arms apparently dies out on the N. of the fault, as it was not recognised on that side. A little east of this dyke, at the "slip fault," is a large coarsely crystalline, irregular granitic dyke; and west of it are two N.N.W. felstone dykes, cut off to the south by the slip fault, and apparently cut off to the north by a N.N.E. fault.

A quarter of a mile N.E. of Shannadonnell Lake, is a branching fault, which shifts the hornblende rocks, and the metamorphosed rocks.

At this lake a large tract of hornblende rock comes in between the granite and the metamorphosed sedimentary rocks. It runs in a N.E. direction for about three miles, ranging from a furlong to half a mile in width, and has in many places enclosed in it beds of the stratified rocks.

Large masses of hornblende rock occur also to the N. of the last mentioned lake. In many places the hornblende rock is coarsely crystalline, and weathers in parts with a pockmarked appearance, due to flakes of a bronze coloured mica, that disintegrates freely. In other places, the rock is nodular, the nodules being coarsely crystalline, and in parts arranged irregularly in a N.E. direction, which in such places is invariably the strike of the surrounding metamorphosed sedimentary rocks. From this it would seem that the hornblende rock is in many places a volcanic agglomerate.

The metamorphosed sedimentary rocks, in the tract of country now described, are similar to those already described to the west. They all have a N.E. strike, ranging from N. 10° to N. 80° E., and dip N. and N.W., at angles varying from 5° to 6°.

Granite along the boundary of metamorphosed sedimentary rocks in Errisaniagh.—Commencing at the extreme north-eastern boundary, on the southern shore of Bertraghboy bay, near Lough Aheeran, the granite is of the intrusive or quartziferous type. Further west, a little W. of the house marked Demesne Lodge, it is evidently of the porphyritic or Galway type, as it contains pink and white felspars, white mica, quartz, and a greenish mineral, apparently chlorite. Farther west, and round the southern boundary to Lough Derreenarearla, the rock is porphyritic, with well developed crystals, sometimes of white, but principally of pink felspar.

At this lake a large tract, over half a mile wide, of the intrusive granite, comes in. It is of a fine compact nature. Its constituents are white felspar, quartz, and flakes of a dark greenish mineral.

This tract turns in a S.E. direction, until at Lough Truskeena, which lies W.S.W. of Dooletter Lough, it is not more than a quarter of a mile thick.

In the hill to the south of Dooletter Lough, the granite is also apparently of the intrusive type, with an excess of pink felspar, very little mica and in parts, a mineral resembling an earthy chlorite. It has a series of fine N. and S. joints, which resemble foliation. This class of granite continues along the boundary for about half a mile N.E. of the last mentioned lake.

A quarter of a mile south of the trig. point Δ 512, the granite is of the porphyritic type, with the exception of a small tongue of the intrusive granite that runs to the margin of Beaghy Lough.

From Shannadonnell Lough, N.E., along the boundary, there are numerous patches and veins of the intrusive granite, breaking up between the porphyritic granite, and the hornblende rock. These veins range from a few inches to about 20 feet, rarely exceeding the latter thickness.

South of this intrusive granite, the rock is the typical porphyritic granite, having as constituents, green and white felspars, quartz, and black mica.

R. J. C.

Rossroe and the granite country about Bertraghboy bay.—Rossroe, or the red promontory, lies on the north of Bertraghboy bay (in sheets 103 and 104). It is composed of granite, as are also a narrow slip on the north of the same bay, Illaungorm islands (north and south) in the same bay, and a hill immediately east of Cashel bay; the boundary between the granite and the metamorphic rocks entering the district on the north at $9^{\circ} 48' 20''$ W. Long. and extending in a S.S.W. direction between the islands just mentioned and the island called Croghnut, to the south coast of the bay, a quarter of a mile east of Carrickleagh, from which it extends in an irregular N.E. and S.W. line, till it joins into the boundary just now described by Mr. Cruise (see page 41), a little north of Lough Aheeran.

On Rossroe the granite is porphyritic and of the *Galway type*. In some places there are well marked systems of N.E. and S.W. joints. On the shore a little south of the hamlet of Rossroe, is an E. and W. quartziferous felstone, while between this dyke and the southernmost joint of the promontory, four blue felstone porphyry dykes were observed; and nearly due west of the hamlet, on the shore of Blackhaven, are two thin gray dykes that are classed as greenstones [dolerite or diabase?] as they fuse readily before the blowpipe. Farther northward, on the shore of Blackhaven, close to the north margin of the sheet line [sheet 103], is a N.E. course of quartziferous porphyry, and cutting obliquely across it [N.W. and S.E.] is a foot wide perpendicular felstone dyke.

In the hill immediately east of Cashel bay the rock is peculiar, being divided into bed-like portions by nearly north and south lines that to the west are vertical, while east of the summit of the hill they dip east at 80° . The note made on these rocks is as follows:—"The character of the rock hereabouts is very confused, for in places it seems to be a porphyritic granite, and in others gneiss. Further south, in the neighbourhood of the trigonometrical point Δ 253 and eastward, the granite seems to be in beds, between well defined lines; for the different divisions appear to be slightly various, some being foliated porphyritic granite, while others are not." Although this was the impression conceived while in the field, yet these lines could scarcely be stratification—at least not a stratification allied to that of the associated gneiss and schist, as the strike of the beds in them are oblique or at right angles to the strike of the lines in the granite. On the margin of the sheet, due north of the trigonometrical point, is an east and west felstone. Lying nearly due south of the same point, extending north from the coast, is a peculiar pinkish-gray slaty felsite,

having developed in the matrix pink felspar crystals, and flakes of a dull purplish glossy mineral; while transverse to this dyke, and a little west of it, is a purplish gray felstone porphyry. The respective age of these dykes in relation to one another could not be proved; however, the latter is supposed to cut the former.

Round the margin of Illaungorm north and south, were observed granites of the *Galway type*, and also to the S.S.W., on the mainland south of Bertraghboy bay, in the neighbourhood of Carrickleagh. However with the latter there seems to be mixed some of the Intrusive granite, as will be seen by the following note made on the ground:—"The major part of this granite is of the *Galway type*, though it is seldom porphyritic. The conspicuous constituents are pink felspar (*orthoclase*), greenish waxy felspar (*oligoclase*), usually white felspar, black mica, and quartz, with locally white mica and pyrite or marcasite. The boundary drawn between the granite and the metamorphic sedimentary rocks, is only approximate, as the adjoining gneiss and schist is transversed and cut up with numerous granite veins, from half an inch to five or six feet in thickness, some being vertical and others nearly horizontal; for which reason the only division apparently practicable was to draw a line so as to exclude all pieces of the metamorphic sedimentary rocks. This irregularity apparently is due to Intrusive granite breaking up in the vicinity of the boundary, and sending veins in all directions, but more especially into the adjoining metamorphic sedimentary rocks."

On Croghnut, the island a little east of Illaungorm south, there is also some granite, forming the stack or rick-like peak in the centre of the island, and extending in a rib to the northward. This to the north is a hornblende granite of the *Galway type*, while to the south, forming the summit, it partakes of the nature of the coarse hornblende gneiss or foliated porphyritic granite. Bounding this foliated granite on the south-west and north-east, are green dyke-like masses, full of quartz strings, that if continued would join a little east of the east shore. These apparently are wild lodes, more especially as to the southward in their strike on the mainland, a similar dyke-like mass was observed cutting across the gneiss and schist. The other rocks on this island are hornblende gneiss and schist, and very coarse gneiss, with near the S.W. point a bed of fine hornblende rock, schistose in places; the rocks in the last-mentioned place dip eastward at from 30° to 50° , while at the north-east of the island they are dipping S.E., N.E., and S., respectively, at 35° , 20° , and 60° .

Metamorphic rock country, east and south-east of Bertraghboy bay.—On the mainland, from a mile to two miles S.S.W. of Croghnut, in the neighbourhood of Lough Clugacomeen, the metamorphic rocks are very much broken up by faults and veins of granite, with other intrusive rocks. In the creek leading to Glinsk-bridge, and from that inland for some distance towards the southward, there is a dislocation or fault; and about half a mile farther west another going through Lough Clugacomeen, bearing N.N.E. to the northward, and N. and S. to the southward of the lake. Moreover a green compact quartziferous porphyry was found to run along the north part from the sea to the lake.

To the west of the Lough Clugacomeen fault, the sedimentary rocks strike rather regular, being nearly E. and W. towards the south, and curving round toward the N.E. at the north, dipping northward at angles varying from 20° to 80° , and north-eastward at angles varying from 30° to 60° . The rocks are principally hornblende gneiss and schist, and coarse gneiss; the first always being more or less concretionary, spheroidal, or nodular, and often conglomeritic. When conglomeritic, the contained pebbles, principally are pieces of hornblende rock; however, in places other kinds

of rock are mixed up with them, and in one locality it was remarked that nearly all the enclosed blocks were felstone. This place lies a few yards north of the bye-road, and a little more than a quarter of a mile due S.W. of the south-west extremity of Lough Clugacomeen. This conglomerate seems very important, for although the matrix is well mineralized, yet the contained blocks apparently are nearly unaltered; the only change visible to the eye when examined under a hand-lens being very fine lines—nearly microscopical—on the weathered surfaces, showing apparently incipient foliation, and thereby proving that felstones although older than the period at which the sedimentary rocks were metamorphosed, still may be so little altered as to be undistinguishable by the eye or a hand-lens from felstone rocks of a much more recent age. They also demonstrate that there must have been felstone existing hereabouts previous to the deposition of the conglomerate.*

Associated with these conglomerates are hornblende rocks in places undoubtedly interstratified with them, and cutting across one and all in various directions are numerous felstones, with some quartziferous porphyries. In one place it was noted that the hornblende rock when weathered had a pock-marked appearance, which evidently was due to small contained pockets of bronze-coloured mica that disintegrated more freely than the other constituents in the rock.

Some of the ingenite felspathic rocks are evidently older than the others, as they are cut and displaced by certain faults across which other felspathic rocks (felstones) can be traced; but as these faults also displace the boundary of the granite, although not very probable it is still possible, that all these felspathic rocks, including the quartziferous porphyries, may be newer than the granite, and therefore, than the period at which the sedimentary rocks were metamorphosed.

At the S.E. corner of Lough Aheeran is a pinkish quartziferous porphyry, and running along its east wall a blue compact slightly porphyritic felstone. Both seem to be cut off to the north by an east and west fault, north of which neither could be recognised. Towards the south in a short distance they separate just immediately before disappearing under a bog. About a quarter of a mile further S.S.E., there is a dyke very like the quartziferous porphyry, but if these two are parts of one and the same dyke the course must suddenly change, or between the two exposures there may be another east and west fault, now concealed under the bog, that shifts the south part towards the east. In favour of this last supposition, it may be stated that a little west of the scutern quartziferous porphyry there is a massive green felstone porphyry N. 40° E. dyke, that disappears suddenly as it is traced northward, on the same east and west line as the quartziferous porphyry. Moreover, in their bearing neither could be found farther north, although across their strike there is a large exposure of rock. These quartziferous porphyries are handsome rocks of a granitic aspect, having from a pinkish to purplish or greenish matrix, in which are imbedded quartz globules and blebs, pink, white, and greenish felspar crystals, and flakes of a greenish mineral supposed to be a mica. The felstone porphyry, situated immediately west of the more southern of these two exposures of quartziferous porphyry, has a green matrix, and contains white felspar crystals, scales of black mica, and a few quartz globules; while all the other felstones noted west of the Lough Clugacomeen fault, are from

* This conglomerate is considered to be a metamorphosed ash or tuff. If this supposition is correct, it follows that it is not necessary that the felstone should be much older than the time at which the conglomerate was deposited; for it is well known that a volcanic tuff may contain pieces of rock only formed a short time previous to the ejection of the debris which form the mass of these rocks.

greenish to grayish or light blue in colour, and from granular to splintery in aspect, with an uneven fracture. Between the Lough Clugacomeen, and the Glinsk-bridge faults, there are many dykes cutting across the sedimentary rocks. Nevertheless the latter are not devoid of system, as the strike radiates from near Glinsk-bridge towards the S.S.W. and N.W. Immediately west of Glinsk-bridge is a pear-shaped exposure of hornblende rock, the latter being interstratified with the derivate rocks; while under and over it are conglomeritic beds, apparently having formerly been the associated igneous breccia or tuff, that dip northward at 30°. South and south-west of this locality the sedimentary rocks dip W. to N.W., at angles varying from 40° to 70°; while towards the north and north-west they are dipping N. to N.E., at from 30° to 40°. A little south of Glinsk-bridge is a tract of splintery felstone* its eastern limits being obscured by a flat bog, while to the N.W., W., and S.W., it breaks into dykes. There are also some dykes of a similar rock to the northward, that apparently are part of the same system, although the connexion between them could not be traced. The tract of felstone is also similar to nearly all the felstone dykes that were mentioned as being observed N. and N.W. of Lough Clugacomeen; but the connexion between them and the tract could not be traced as a flat bog intervenes. This class of felstone seems more recent than the N. and S. fault, as a little south-east of the tract, near Glinsk-bridge, dykes of a similar rock were observed that could be traced across the Glinsk-bridge fault and the dykes west of the Lough Clugacomeen fault, are also supposed to be traceable across it; but for the reason before given this could not be proved. In places in the mass near Glinsk-bridge, a surface structure, having the appearance of foliation was observed, but it seems to have no relations to it, as internally there is no leaf-like arrangement of the minerals.

Country in the neighbourhood of Loughs Naneve, Nagraigue, Aphae-bera, &c.—Lough Naneve is about a mile N.E. of Glinsk-bridge, and a little east of it there seems to run a fault in a nearly north and south direction, for west of the supposed line of this fault the strike of the rocks bears about N. 70° E., the dip being northward at angles varying from 10° to 15°, while east of it the strike suddenly changes to N. 30° E., the dip being S.W. at about similar angles; however, the fault could not be proved on account of the envelope of bog which obscures the geology.

West of this line there are some dykes similar to the felstone a little south of Glinsk-bridge; but on the coast line half a mile N.E. of that bridge is a thin finely columnar nearly E. and W. greenstone dyke. It may be here mentioned that south of the greenstone there is a N. 60° E. wild lode with pyrite.

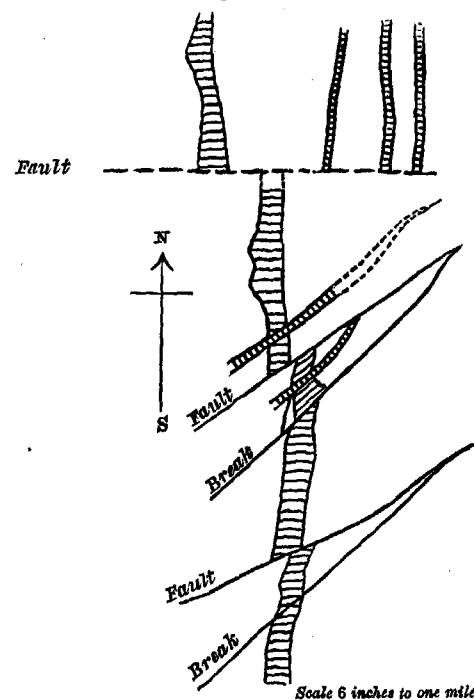
The metamorphic sedimentary rocks, both east and west of the supposed line of fault, are principally coarse hornblende gneiss, often conglomeritic, nodular, and spheroidal, with a few shales, and in places apparently interstratified with them is hornblende rock.

Some of the felstones that were observed south of the Glinsk-bridge seem to extend eastward to the Gowlaghbeg river, but the connexion between the two places is obscured by bog, a coat of which covers the major part of the surface of this flat. On the west of the Gowlaghbeg river, extending

* It seems remarkable that tracts of the felstones and quartziferous porphyries should be so rare in the south part of Yar-Connaught. In the country about Cashla bay, and on Lettermullan and Gorumna, there are some masses of the quartziferous porphyry, but in the rest of the area included in sheets 104, 105, 113, and 114, they were not observed although dykes are frequent. Dykes of felstone are not very common in the district to the east (sheets 105 and 114), but in the area that is now being described they are most numerous; and yet the centres from which they came cannot be determined except in a rare instance like the present one.

north and south from Lough Apheebera, are quartziferous porphyries, they having been observed to the south in the granite, and traced to this place by Mr. Cruise. (See page 43.) A little west of the lake is a purplish to greenish or grayish rock of a very granitic aspect, in which are developed greenish waxy, and pinkish crystals of felspar, pockets of greenish minute scales (mica?), quartz blebs, and a few small crystals of amphibole. These minerals are usually very evenly developed, none being much more conspicuous than the rest, except the amphibole, and perhaps the quartz, as there is very little of the first, and in places the last is largely developed. Near the walls the rock is not of a granitic aspect. These quartziferous porphyries seem newer than the granite, but much older than the splintery and granular felstones. North and south of Lough Apheebera, coming from the south out of the tract described by Mr. Cruise, and extending northward to and beyond the northern limit of the area included within sheet 104, is a massive dyke of similar rock. This dyke, although it can be traced so far, yet is shifted and displaced by nearly east and west faults. The first, going northward, is within a mile of the lake, and seems to be a compound or step fault, having five displacements; however, the main fault seems to lie farther north, and to bear nearly E. and W., as shown in the accompanying plan (see fig. No. 5), reduced from the Ordnance six-inch map. Half a mile farther north the dyke is again shifted by a N. 80° E. fault that has been traced up the gut leading to the village called Gowlaghbeg, and for some distance to the eastward jumping the dyke about a quarter of a mile towards the east, from which it can be traced northward. In the neighbourhood of this quartziferous porphyry dyke, and south of the Gow-

Fig. No. 5.



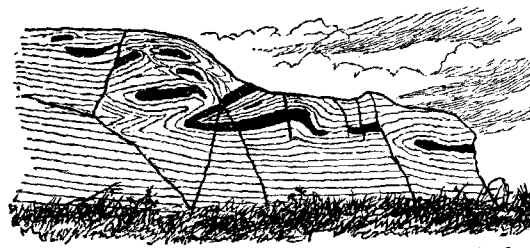
Sketch map of faulted dykes of irruptive rocks in the neighbourhood of Gowlaghbeg River.

laghbeg fault, there are various felstone dykes, some running north and south, or nearly so, while others are oblique to, and appear to cut the quartziferous porphyry.

Country about Owengowla and Invermore River.—On the north of the Gowlaghbeg fault, N.W. of that hamlet, and near the sea, the rocks, principally coarse and hornblende gneiss sometimes conglomeritic, strike about N. 35° W., and dip at from 15° to 45° to the north-eastward; while N.E. of Gowlaghbeg they strike about N. 55° E., and dip north-westward at about 45°. To the north of Gowlaghbeg, in the vicinity of Bunnahown-bridge, there is a large irregular tract of hornblende rock which seems to be intrusive, as it comes up irregularly among the gneiss and schist; and north of the road, a little north-east of the bridge, an unconformable junction is exposed. In the neighbourhood of this junction the intrusive rock extends along the strike of the sedimentary rocks, but further east and south-west it runs across them. A little N.W. of the bridge is a massive felstone porphyry dyke which in places has a platy structure. Further N.W., between Owengowla and the creek full of rock and shoals, there are numerous small exposures of hornblende rock, most of which seems to lie with the stratification; however, there is a small tract close to the shore of the rocky creek that is evidently intrusive. Some of the hornblende rock hereabouts is very felspathic, and other parts are nodular or schistose. Cutting across the last-mentioned exposure of the hornblende rock is a nearly north and south dyke (about N. 20° E.) of a rock that apparently is a metamorphosed felstone, as in it is developed a well-marked oblique foliation.

The bedded rocks hereabouts, if we overlook a few local twists, have a general E. and W. strike, and a dip of from 30° to 40° to the north; however, in one or two places it rises to 50° and 60°. They are principally hornblende and coarse quartzose gneiss, sometimes more or less conglomeritic and nodular; however, in places there are some schists and fine gneiss. The accompanying sketch (Fig. No. 6) shows nodular and lenticular patches of hornblende rock enclosed in coarse gneiss, the foliation of the rock curling round the foreign substances. Of the constituents remarked in the gneiss, this note was made:—"Quartzose gneiss near shore has in it black mica, amphibole, white felspar, some green felspar and quartz." On the coast opposite to Illaunacroghnut, was noted a nearly E. and W. quartz lode (N. 85° W.), with pyrite, the lode being seven inches wide, and the beds alongside contain gaussen.

Fig. No. 6.



Diagrammatic sketch of nodules and veins of hornblende rock in hornblende schist and gneiss, Lehanagh, Co. Galway.

Between the rocky creek and the north margin of the district, the general strike of the gneiss and schist is also nearly east and west; however, bordering on the granite, it is irregular, more especially contiguous to the seashore, where also there are a few small outbursts of hornblende rock.

In this place the rocks dip N. at 10° and eastward at angles varying from 20° to 25°, while away from the margin of the granite the dip is northward at from 40° to 70°. Farther east and south-east, in the vicinity of the Owengowla, the strike of the rocks is east and west or nearly so, the dip being N. at from 10° to 45°, the angle lowering gradually as the north margin of the area is approached. Interstratified with these rocks are some patches of hornblende rock. The gneiss and schist is very similar to that just now described, being principally coarse and hornblende gneiss, with some schist, the structure being often lenticular, spheroidal, curled, nodular, or conglomeritic; when the latter, the contained blocks and fragments are usually pieces of hornblende rock, but more especially in the vicinity of the inliers or intrusions of that class of rock. The above is also the general character of the metamorphic sedimentary rocks farther eastward, to and beyond the Invermore river; moreover, their strike is nearly E. and W., with a north dip varying from 20° to 50°, except at the dislocations and breaks to which, in their immediate vicinity, the strike is generally altered, changing the dips respectively to the north-eastward or north-westward. Here also inliers and patches of the hornblende rock also occur; nevertheless, they are not so frequent, as a little farther south in the county described by Mr. Cruise. A little east of Owengowlagh, there is a group of nearly N. and S. dykes, being the continuation of the quartziferous porphyries met with and described by Mr. Cruise and myself (see pp. 43 and 48), as being traced northward from the granite on the southward of Apheebera and Shannadonnell Loughs. Near the Owengowla these dykes can be traced to and beyond the north margin of the area, while farther east no dyke was observed north of the parallel of Loughanillaun.

Further east, and extending into the Inver and Screeb division of the area, are long tracts of hornblende rock of various sizes, and apparently interstratified with the metamorphic sedimentary rocks. These occur N.W. and N. of Lough Aliggan, and in some of the rock were observed numerous flakes of a silverish-white mineral that appears to be diallage,* or one of the allied varieties of foliated pyroxene.

In the neighbourhood of Lough Aliggan there are at least two faults, one extending about N. 25° W. from the west end of the lake, and the other, which seems to bear nearly N. and S., about half a mile farther west. The last-mentioned fault was observed to displace the boundary of the porphyritic granite, and the former may do so. As, however, the country immediately west of Lough Aliggan is covered with deep drift, this could not be proved. West of the west fault, the rocks dip nearly N. at from 20° to 50°, in one place rising to 70°. Between the faults the dip is also nearly N. at an average of about 70°, while north of Lough Aliggan it is N.N.W. at angles varying from 50° to 80°.

G. H. K.

III.—ROSSMUCK AND GORUMNA DISTRICT.

Inisherik, Dinish, Furnace, Illauncasheen, and Illaumanaroor.—These are tidal, being joined during low water. The rock is principally an even-grained granite of the Galway type. On Dinish the granite is slightly porphyritic, especially towards the N.W.; across the north extremity of the island there is a N. 80° W. blue felstone dyke, eight feet wide; on its western side is a white compact, nearly N. and S., splintery felstone dyke, cutting through an irregular mass of grayish blue quartziferous porphyry,

* Some of these are very similar to the metamorphic igneous rocks associated with the Serpentine of the Lizard, Cornwall, England, and called by De la Beeche "Diallage rock."

the latter occupying the S.W. portion of the island. A little east of this mass is a N. 20° E. felstone porphyry, while at the S.E. shore a wide dyke of pinkish quartziferous porphyry and a narrow felstone dyke were observed. On Furnace, on the western side, the granite in one place has a slight, nearly N. and S. structure, resembling foliation, while on the north of the island the rock is slightly porphyritic, but still more so on the east, until S.E. of the trigonometrical point Δ 96, there is the regular porphyritic granite of the district. On the eastern shore a felstone dyke, in parts slightly porphyritic, was traced, in a S. 35° W. direction, for nearly half a mile; a little south of the latter a similar one was observed running in a rudely parallel direction, and about six furlongs still further south a bluish gray felstone dyke occurs.

R. J. C.

Crappagh and Freaghillaun-beg.—The last of these islands seems to be formed altogether of the porphyritic granite, while a similar rock occupies nearly the whole of Crappagh, but a mass of quartziferous porphyry occurs near its centre; a little N.W. of the trigonometrical point Δ 62, and contiguous to its south and south-east shore, gneiss and schist, that have a strike of about N. 80° W., and dip southward at from 80° to 88°, were observed. Associated with the gneiss and schist are veins and pipes of purple jasper.

The boundary between the metamorphic sedimentary rocks and the granites is very irregular, and in some places these different rocks are so much mixed up together that it would be nearly impossible to separate one from the other, as at their junction a fine granite, that apparently is part of the intrusive or quartziferous granite, breaks up, being partly in the porphyritic granite and partly in the gneiss and schist, besides sending innumerable veins into the latter rocks. Sometimes it is the porphyry and in others the quartziferous granite that is in juxtaposition with the metamorphic sedimentary rocks; moreover, thin skins of the latter rock in some places were observed on the porphyritic granite. On the shore, south of the mass of the quartziferous porphyry, there is a dyke of a similar rock that seems to proceed from it.

Golam.—At the summit of this island, and also extending east and west to the coast, is a wide course of hornblende rock, that is generally compact and finely crystalline; however, in a few places the constituents are better developed, and the felspar appears in distinct crystals. Cutting across the hornblende rock, a little east of the telegraph tower, is a nearly north and south course of gray splintery felstone, that near the north of the island bifurcates, one branch extending towards the eastward; and near the south of the island there is a second bifurcation, that sends a branch S.E. to the coast. A little further east there is a smaller course of similar rock, that towards the north runs N. and S., while its southern part extends in a south-east direction to the coast. On the south shore, S.E. of the tower, are gneiss and schist bounding the hornblende rock, and dipping S. at 80°; and in the hornblende rock west of the tower, but dying out before it reaches that structure, is a thick bed of argillite or argillaceous schist that in places is riband.* On the north of the wide course of hornblende rock are other argillaceous schists or argillite, that dip south towards the hornblende rock at 70°, while further north, forming the low northern portion of the island, is a tract of the intrusive granite. In the island on the north of Golam (*Freaghillaun-more*), are granites, part being the intrusive or quartziferous, and part of the Galway type.

Letter-mullan.—The northern portion of this island, which lies within

* The riband argillites seem similar to the rocks called by Krantz "striped jasper rock."—See Specimen No. 79 in Krantz's Collection.

the south limit of sheet 104, is for the most part formed of some kind of granite; it, however, takes in the boundary between those and the metamorphose sedimentary rocks. The mass of the granite belongs to the Galway type, but, as in Crappagh, contiguous to its southern limits there seems to come up some of the intrusive granite, dividing the porphyritic granite from the metamorphose sedimentary rocks, and in places causing the boundary between these different classes to be very confused and tangled. In the bay formed by the boundary extending into the metamorphose rocks, near the east of the island, the only rock observed *in situ* was the quartziferous granite, and it also occupies the ground N. and N.W. of the old castle on the east shore.* A little north of the castle an east and west dyke of pink and green quartziferous porphyry was observed. The porphyritic granite is usually an aggregate of mica, quartz, and felspar, there being always two kinds of the latter, white and pink, and sometimes a third, green (*oligoclase*). The pink felspar (*orthoclase*) generally gives the porphyritic character to the rock; in some places, however, it is the white that occurs in the large crystals, and in other places, such as the north-east extremity of the island, none of the felspars are prominently developed, all the crystals being of a somewhat similar size.

The metamorphose sedimentary rocks consist almost entirely of argillaceous and mica schist; however, some hornblende schist was noted in the vicinity of the old castle on the east shore. In this neighbourhood was also observed a large pipe-like mass of jasper, and where the shore joins the margin of the sheet line on the south there is a large N. 30° W. perpendicular dyke of blue felstone, in places porphyritic, apparently one of the more modern intrusive rocks. The stratified rocks strike nearly east and west, and dip southward at angles varying from 70° to 85°. In the southern part of Letter-mullan, which lies south of the junction between Sheets 104 and 113, the general rocks are different varieties of schist and gneiss that dip S.S.W. at angles varying from 70° to 85°, besides which, cutting across them or occurring in courses, dykes, and pipes, are rocks which are supposed to be metamorphic igneous rocks; also a few dykes of igneous rocks, that undoubtedly have been injected into the other at a more recent period. On the east shore of the island a typical section of the metamorphic sedimentary rocks is exposed, from which it is learned that the strata at the north margin of the area included in Sheet 113 are hornblende schist and gneiss. Associated with them was observed a small N.W. and S.E. dyke of blue porphyry. Above the hornblende schist is a large thickness of mica schist and argillite, many beds of the latter being riband; there are also a few beds of the gneiss interstratified with the schist, and N.E. of the trigonometrical point Δ 121, is a considerable mass of gneiss. East of the trigonometrical point, forming a small headland, is a mass of yellow mottled felspathic rock, that possibly may be metamorphosed, and in the cove south of this headland are light green quartzose gneiss, or slightly metamorphosed sandstones. At the point south of the cove are schists that are succeeded by green quartzose gneiss, many of which contain calcareous and conglomeritic nodules. Overlying the last are riband schist and gray gneiss, with conglomeritic beds, and forming the S.E. extremity of the island are riband argillite and mica schist, with a few beds of gneiss. From this section it

* Scattered about in this bay are innumerable pieces of quartziferous porphyry, in which some of the pink crystals of felspar are enveloped in green felspar, similar to the porphyry at Lenaboy, near Galway (see *Geol. Memoir Ex. Galway Sheet 105*), and somewhat similar to the rock called Rappakivi granite in Finland; however, no rock similar to these fragments was observed *in situ*, but apparently the debris noted, seems to be near the parent rock.

will be seen, as was mentioned in the *General Description*, that many of the sedimentary rocks are very slightly altered.

In the rocky bay formed by the curved headland at the S.E. of this island, a N. and S. quartz lode was noted. Further west and north of the east end of Dog Island is a nearly N. and S. course of pinkish quartziferous porphyry, and on the shore of the bay N.W. of Dog Island a small felstone dyke was observed. Still further west, north of where the D in Dog is engraved on the one-inch map, there is a gray porphyry dyke, while west and south-west of this dyke are nearly east and west wide courses of compact finely crystalline hornblende rock. The first extends inland from a small cove on the west shore of the island, and the second appears on the south shore a little S.W. of the porphyry dyke, and from that runs towards the west for about half a mile, when it turns to the south-west and joins into another wide course, that extends along the extreme S.W. shore of the island. After these two courses meet they seem to stretch across the sound to join the hornblende rock in Golam. Between these branched courses of hornblende rock appear higher beds of the metamorphic sedimentary rocks than those found on the east coast, consisting of gneiss and schist, with, near the top of the section, immediately south of the north branch of the hornblende rock, schists so calcareous that they might nearly be called limestone, over which are epidote schist and argillite, mica schist and gneiss. Cutting across the hornblende rock at the extreme west point, is a nearly N. and S. dyke of green quartziferous porphyry, that may be a metamorphic felspathic intrusive rock.

On the west coast a good typical section is also exposed, but as the rocks are similar to those enumerated in the last section, it seems unnecessary to again describe them; it shall, therefore, only be mentioned that the remarkable conglomeritic beds were observed in the headland east and west of the small bay that opens northward. Further north-east, on the south shore of the east and west gut here situated, a small tract of quartziferous porphyry was observed.

Gorumna.—A portion of this island is in Sheet 104, and the rest in Sheet 113. The greater part is occupied by granite, the boundary between which and the metamorphose sedimentary rocks extends from Kiggaul Bay, which divides Gorumna from Letter-mullan by Ballinakill Lough, in an irregular line to near the south margin of Lough Hibbert, when it turns southward and leaves the limits of Sheet 104.

The metamorphose sedimentary rocks consist principally of mica schist. Those west of Ballinakill Lough strike E. and W., curving round gradually from N. 80° W. to E. and W., and dip southward at angles varying from 80° to 88°. East of the lake the strike is not so regular, as there are lines of fault that breaks their continuity. At the N.E. portion of the lake there are two nearly parallel faults, bearing about N. 40° or N. 45° E., between which the beds run N. 85° E., and dip southward at 70°. Near the south margin of Sheet 104 there is a fault, its general bearing being E. and W., and branching from it about half way from it between the lake and the boundary of the granite, is another bearing N. 45° W. that was traced as far N.W. as the most southern of the N. 45° E. faults; and in the triangular piece of ground between these faults the strike is about N. 30° W., and the dip S.W. at 85°, while east of the N. 45° W. fault it is the same as that of the beds on the N. of the 45° E. fault, namely, N. 85° E., and the dip S. at angles varying from 70° to 75°. South of the E. and W. fault the strike varies; near the lake it is east and west, while half way between that and the granite boundary it gradually changes to the N.W., the dip being south and south-west at angles varying from 75° to 88°. In this faulted ground there are large veins and pipe-like masses of purple jasper.

Towards the west boundary, and dividing the metamorphic sedimentary rocks from the granites, is a large course of quartziferous porphyry that extends from Kiggaul Bay to the N.E. fault, at the N.E. corner of Ballinakill Lough. At the west side of this fault the quartziferous porphyry spreads over a considerable space, and on the east of it the porphyry also occurs for a short distance; however, here for part of the way there is an outburst of the intrusive granite that separates it from the sedimentary rocks. This quartziferous porphyry is very granitic in aspect, being mineralogically a granite of a pinkish colour. In places it has as a constituent crystal of a green mineral (*epidote*?). To the north of this quartziferous porphyry the granite appears to be of the Galway type, while further eastward intrusive granite seems to intervene between the stratified rocks and the porphyritic granite. The note that was made on the rocks at the east shore, in the vicinity of the trigonometrical point, Δ 128 being "whitish granite apparently part of the intrusive or quartziferous granite."

The island to the northward seems to be porphyritic granite. West of the trigonometrical point last mentioned a N. 40° W. perpendicular vein of rotten very feruginous granite, locally called a *gaussen lode*, was observed. North of this, in the vicinity of the Roman Catholic chapel, there is a system of parallel vertical joints bearing N. 45° E, while to the northward and east of Lough Illauntrasna the granite was noted as "very coarsely porphyritic," and on the shores of Carraveg Bay as "full of quartz strings," while in the gut that extends N.N.W. out of that bay a *gaussen lode* very similar in appearance to that just described was noted, and apparently in its strike on the shore, due west of the Maumeen Pier, is a similar lode on which a small trial shaft was sunk, and copper ore said to have been found. On the shore a little north of Maumeen Pier a small vein of *gaussen* was observed.

To the west end of the island, at the east end of Coosawilleen Bay, a north and south dyke was noted, evidently an intrusive rock, and yet it is foliated, hand specimens being undistinguishable from gneiss. Further N.W. on the coast, due west of the trigonometrical point Δ 134, there is an east and west dyke, also lithologically similar to gneiss, and in its vicinity are two nearly north and south felstone dykes that are porphyritic and quartziferous. The granite on the N.W. shore is even grained, while north of Loughaunwillin it seems to be the intrusive granite, and a little further east, north of the bog marked on the one inch map, there is a considerable tract of white felstone. The south part of the island, that lies in sheet 113, has in a great measure schist and gneiss for its subjacent rocks; however, there is a large tract occupied by the class supposed to be metamorphic igneous rocks, while dykes of more modern irruptive rocks were also observed; at the N.E., in the neighbourhood of the village of Teeranea, there are granites.

The boundary between the granites and the metamorphic rocks is very irregular. This, as previously suggested, may have been caused by an outburst of the intrusive granite, for between the metamorphic rocks and the typical granite of the district the intrusive granite occurs. Beginning at Teeranea on Fearmore or Greatman's Bay, the boundary first extends in a N.W. direction, from which it turns westward, southward, northward, southward and northward, when it finally enters the sheet on the north (Sheet 104) near to the line of 9° 41' W. long. The strike of the metamorphic rocks is oblique to this boundary, and the mass of granite alongside it apparently, has broken up through those rocks. In connexion with this intrusive granite are numerous veins traversing the metamorphic rocks, but many of them so small that it was useless to try and trace them; however, larger ones occur near the village of Teeranea. A little north-east of the trigonometrical point Δ 198 there is a small tract of this

granite, also three nearly east and west veins, near the south-east extremity of the island. In the last locality the schist on "the back" of the southern vein contains pyrite.

Extending across the south part of the island in a general N.W. and S.E. direction is a large tract of hornblende rock. This in the western part is a wide course, but eastward it breaks into an irregular tract which in places is so mixed up with the metamorphic sedimentary rock that it is impossible to define the exact boundaries of each. The rock for the most part is compact and finely crystalline, and often schistose, nevertheless, sometimes the crystalline structure is better developed, and in such places it is not uncommon to find part of the felspar in well-defined crystals.

On the north of this tract of hornblende rock, between Kiggaul Bay and Ballinakill Lough the gneiss and schist strike about W.N.W. and E.N.E. with a southward dip at angles varying from 80° to 88°; at the lake the strike is E. and W., and the dip south at 80°, while a little further east the strike changes from N.W. and S.E. to W.N.W. and S.S.E. at angles varying from 75° to 85°.* This strike and dip with a few local exceptions, continues eastward out to Greatman's Bay, the most marked exceptions being N.W. and S. of the village of Teeranea. In the first-mentioned place a little N.E. of the trigonometrical point Δ 198 there is a dislocation or fault bearing about N. 55° E. on the north of the previously-mentioned small tract of intrusive granite, and south of this fault, close to the margin of the bay there situated, is an anticlinal curve, the beds on the north of which strike N. 55° E., and dip N.W. at 88°. At the southern extremity of the same bay there is a N. 20° E. fault having a downthrow to the east. The beds on the east of this fault rise to the upthrow, changing the bearing of their strike to about N. 25° W. Here it may be mentioned that adjoining the small tract of intrusive granite there is a short E. and W. course of hornblende rock, alongside which the granite seems to have come up; and 200 yards west of these rocks a small E. and W. felstone dyke was observed. South of Teeranea the strike changes to N.W. and S.E. On the north of the boat harbour at this village there is a peculiar yellow rock, which may be a mixture of felspar and epidote, and extending west for a short distance is a quartziferous porphyry alongside a good-looking quartz lode. Connected seemingly with the quartziferous porphyry is a dyke which runs south alongside a granite vein, and in a course that was traced to the seashore in a S.E. direction. At the S.E. shore of the island, and extending for some distance inland, are three large dykes of a blue compact felstone, and on the west of the most southern of them a small patch or pipe of quartziferous porphyry was observed. Westward of the last locality, and W.N.W. of the point called Aillewore, between the hornblende rock and the seashore, a rather large pipe of grey felstone was noted, while further west is a N. and S. dyke of light green porphyry; the latter was traced for some distance into the hornblende rock.

The schist and gneiss on the south of the hornblende rock have a nearly similar strike and dip to those which bound it on the north, as hereabouts, westward of Aillewore, they strike about W.N.W. and E.S.E., while further west, north of Illaunannownim, it changes to E. and W., and further N.W. near the coast it is about W.N.W. and E.S.E. North of Illaunannownim there is a N. 50° W. fault, which gives a local change to the strike of the beds. Near the shore of Kiggaul Bay, immediately south of the course of hornblende rock, two small N. 45° E. dykes of felstone were noted, also a small vein that bears N.W. and S.E., and seems to be almost entirely

* These abrupt changes in the strike seem to be due to the dislocations or faults that were previously mentioned as occurring a little farther north.

a mass of small red garnets. As the metamorphic sedimentary rocks are seemingly identical with those in Lettermullan, it is scarcely necessary to give a further description.

Inishbarra.—The rocks are principally porphyritic granite; to the south, near Cow Island, there are two quartziferous porphyritic felstone dykes, bearing about N. 20 W. A little further west there is a N. 75 E. felstone dyke, and on the west shore a very thin yellowish dyke of a sandy aspect; the latter rock seems to be a diabase. G. H. K.

Ilauoneeragh, during high water, is divided into two by the tide, which then occupies a N. 20 W. fissure towards the east of the island. The granite to the north contains pink and white felspar, quartz and black mica. It is in parts slightly porphyritic, and in other places even-grained to compact. Seemingly there are the representatives of the two types of granite—the intrusive or *Oughterard granite*, and the porphyritic or *Galway granite*. To the west, south, and east the granite is generally compact, and apparently intrusive and quartziferous, while to the north it seems to be of the supposed non-intrusive and oligoclase type. Near the extreme south point, a nodular-like portion in the granite, of a schistose character was observed, and a little east of it a small felstone dyke of a blue colour. There are numerous semiangular blocks, in which compact veins are conspicuous, scattered over the island.

Ilauunmaan.—This is a small island about half a mile W.N.W. of Ilauoneeragh; the rock is coarse-grained granite of the Galway type. Between this and the Kinnelly islands (3 miles to the N.E.) there are some tidal rocks, all apparently of the same class of granite. R. J. C.

Lettermore island, with Ilauunroe and Inchagharun.—Lettermore island consists of two hills, one to the east and the other to the west, with a flat bog between them; the principal rock is the porphyritic granite. Near the west end, half a mile north-west of the hamlet called Ross, is a considerable tract of quartziferous porphyry, very granitic in aspect. To the N.E., north of the trigonometrical point Δ 364, there is a north and south dyke of coarse pink felstone, with quartz globules. To the north, at Cashla Point, the unweathered veins stand up two inches above the surface of the rock. A little east of Cashla Point is a N. 10 E. dyke of quartziferous porphyry, and a little farther east, into which a small bay has been cut by the action of the sea, is a course of rotten granite running nearly north and south. Hereabouts the unweathered portions stand three inches above the mass, while inland, south of this and due east of the trigonometrical point Δ 364, they are only one inch high. At the creek nearly south of Bird Rock is a N. 20 E. dyke of green quartziferous porphyry; and farther east, immediately east of the strand, a quarter of a mile west of the hamlet called Greenagh, is a very wide dyke of a similar rock.

Inishlay and Inchmakinna.—These islands lie S.E. of Lettermore in Fearnmore Bay. The former is joined by a bank to Gorumna during low water, while the latter lies near the east shore. The centre of both is covered with either bog or drift, while round the shore porphyritic granite similar to that on Lettermullan was observed.

Annaghvaan, Inishtravin, Ilauunakirka, Beaghy, Ilauunard, North Island, and the adjacent carrigs (rocks) and carrigeens (small rocks and half-tide rocks). These form a small archipelago at the junction of Fearnmore, Camus, and Kilkieran Bays. They are formed of the porphyritic granite, with here and there dykes of quartziferous porphyry and other intrusive rocks. In the middle of Dangan Pass, which lies between Annaghvaan and the mainland, immediately east of the new cut, a porphyritic felstone, fifteen inches wide, that has a general bearing of N. 10 E., was observed. N.W. of

this, at the west end of the creek, and due south of the trigonometrical point Δ 69, there is a N. 10 E. vertical vein of rotten ferruginous granite. A little west of the N.E. points of Annaghvaan is a N. and S. dyke of pale salmon-coloured felstone. Part of it is in thin plates that dip east at 80° , while ten feet in thickness has horizontal columns; and adjoining this dyke on the east is a course of nodular rock that might possibly be an altered igneous tuff, as it has pebbles like felstone porphyry in it. West of the stone dyke is six feet of rotten granite; the rocks in juxtaposition farther east and west being the ordinary porphyritic granite. The felstone may possibly be a metamorphose rock; however on the north to the north of the sound there is a very similar rock, which seems to be unaltered, that may be the continuation of this dyke. At the nodular rock is a deposit of earthy limonite (*bog iron ore*). A little N.W. of this locality, at the south end of Leighon Island, is rotten granite, and farther west on the north shore of Annaghvaan, the granite is inclined to decompose. A little further S.W. two parallel N. and S. dykes of porphyritic green felstone were observed; they evidently belong to the class of more modern intrusive rocks. Close to the end of Inishtravin a N. and S. dyke of blue felstone was observed, that thins out apparently as it goes south, for at the latter place it was only four inches wide, while to the north on the shore it was two feet. A little west of this dyke, at the end of a coose or small bay, is a north and south perpendicular quartz lode, in which fluorite was observed. Farther west, south of the west shore of Beaghey Island, there is a N. and S. dyke of porphyritic felstone; and a little west of it is a quartziferous porphyry, and still further west, at the south end of the N. and S. creek, is a green quartziferous porphyry. Of *Kinnelly Islands* Mr. Cruise says—"These are tidal islands, and are situated about a mile and a quarter due west of Inishtravin; the rock is the porphyritic granite, with well marked N. 10 E. joints."

Country about Roskeeda, Garrivinagh and Rossmuck.—Of the rocks forming the promontory of Roskeeda the following note was made:—"The rocks are the typical porphyritic granite in which foliation is barely perceptible. All through it are veins of a fine compact variety, that vary from an inch to three or four feet in thickness. These thin veins usually stand up about an inch and a half above the surface of the mass of the granite, approximately registering the amount of weathering by meteoric abrasion since the glacial period. In some places these veins retain the ice polish, but not the striae. The ridges of rock bear about N.N.E. by S.S.W., while the principal joints run nearly east and west. Masses and veins of quartziferous porphyry occur in some places, and also a yellowish red granite, like that observed at Salthill near Galway (Sheet 105), and there supposed to be part of the intrusive granite." On the shore north of the village of Roskeeda there is a thick N. and S. felstone porphyry, while farther east, about half a mile W.S.W. of Salialea, there is a pipe-like mass of green felstone porphyry that may be an altered rock; and a little N.E. of that village there is a N. 30 E. dyke of greenish felstone. On the south coast, a little S.E. of Garrivinagh, there is a thick vein of pale salmon-coloured felstone coming up through the porphyritic granite. This was previously referred to while describing the rocks on Annaghvaan. At the point more than half a mile S.S.E. of Rossmuck, the porphyritic granite is cut up by a system of N. and S. parallel vertical joints. In the sound, west of Clynagh Island, a thick N. and S. dyke of white felstone was observed, that may, perhaps, be an altered rock, and alongside it on the west a course of lumpy granite, that weathers with the appearance of a conglomerate. Among the tidal rocks, at the south of Clynagh Island, a pipe of felstone porphyry comes up, and on the shore at the N.E. of the same island a pipe of white felstone, while all the other rocks observed on this island (Inisheltia), and about the

village of Rossmuck, were the porphyritic granite. Generally the large crystals were pink felspar, but sometimes they were white.

Country about Kilbricken and Turlough.—South-east, east, and north-east of the last-named hamlet there are scattered bosses of the porphyritic granite appearing through an undulating bog.

South of Kilbricken there are remarkable steep ice-dressed cliffs, and to the westward, at the ford into Illaunmore there is a massive green and pink quartziferous porphyry very similar to some of those in the vicinity.

Of *Illauunmore, Illaunneeragh, and Crow Islands*, Mr. Cruise says:—"These are all tidal islands, being joined to the mainland at low water. The rock is porphyritic granite. They are low lying, the highest point being fifty-one feet above high-water mark. On the extreme S.W. end of Illaunmore are three porphyritic felstone dykes. The most eastern and western of these dykes are of a purplish grey colour, with yellowish white globules of felspar porphyritically developed. The centre dyke is of a dark blue colour, very compact, with white crystals of felspar. Some rock bosses appear inland through the bog, and all the rocks are dressed as if by ice."

On the mainland farther north eastward, all about the hamlet called Turlough, porphyritic granite comes to the surface in numerous places, forming a rise of ground in the neighbourhood of the village. In some places, as, for instance, a mile west of Turlough, pyrite seems locally to be an essential of the granite; a little north of the village a nearly east and west irregular dyke of felstone was observed. G. H. K.

IV.—INVER AND SCREEB DISTRICT.

Strip of Metamorphic Rocks north of Inver and Screeb.—Along the margin of the district, and extending in an irregular narrow strip along the north of the area to its eastern limits, are metamorphic sedimentary rocks. These towards the west join into the metamorphic sedimentary rocks, previously described in the *Errisainhagh district*. At Invermore river, immediately south of Lough Bunnahask, and extending for a mile to the eastward, to a little N.E. of the hill called Creggaun, is the continuation of the narrow strip or course of hornblende rock previously mentioned as having been observed on the west of the Invermore river. A little east of the river, the tongue of metamorphic sedimentary rock which runs into it seems to end. Near Lough Bunnahask the hornblende rock is very felspathic, having well developed white crystals scattered through it, while north of Creggaun it is nodular. The associated sedimentary rocks are hornblendic gneiss, with a few beds of schist dipping N. at 50° in the vicinity of Bunnahask and Creggaun, but east of the latter at 70°, breaking up through all these rocks, are a few granite veins; south of these metamorphic sedimentary rocks there is a foliation in the granite parallel to that in the metamorphic rocks, but the dip is vertical, or nearly so.

North of Lough Invernagleragh an irregularity occurs in the boundary between the porphyritic granite and the other metamorphic rocks, which seems to be caused by a mass of intrusive granite breaking through in the neighbourhood of the old road, partly in the former and partly in the latter rocks. East of the road the strike runs regular to Lough Adav, N. and N.E. of which there are at least six steps breaking the continuity of the beds, and apparently being caused by small faults. About 400 yards east of the old road there is a N. 45° W. small dyke of finely crystalline hornblende rock; west of this is a tract of the intrusive granite, and east of this and north of Lough Adav, but separated from that lake by foliated porphyritic granite, is a peculiar mass of hornblende rock, as it is in part a foliated felspathic rock through which are patches and veins of a finely

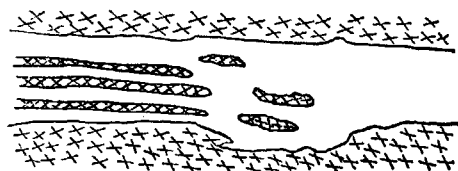
crystalline hornblende rock. It ought also to be mentioned that east of the foliated porphyritic granite north of the east corner of the lake, and south of the east end of the mass of hornblende rock, there is another tract of intrusive granite from which was traced in a N.E. direction a wide vein. Immediately east of Lough Adav and the last mentioned tract of intrusive granite, is a well marked N. and S. fault with a downthrow to the west; and what may perhaps be more remarkable, the wide N.E. vein of granite just mentioned crosses this fault, and as its continuity is not broken apparently, it is newer than the fault. West of this fault the rock dips N.N.E. at 70°, and east of it at 60°. About 300 yards east of the north and south fault there is a break which bears nearly N.E. and S.W., east of which is the foliated porphyritic granite, while west is a small tract of intrusive granite, and breaking up through this was observed a N. and S. dyke of porphyritic felstone; this is also a downthrow to the west. About 400 yards east of the last mentioned break there is another downthrow to the west, which seems to run parallel to it, and between them at the junction with the foliated porphyritic granite there is a course of the hornblende rock, while alongside the last mentioned break and south of the hornblende rock is a small tract of the intrusive granite. East of the last break, but about 50 yards north of the boundary between the foliated granite and the gneiss is a narrow course of foliated hornblende rock which seems to terminate towards the east at a N.E. fault, which follows the course of a small valley about 800 yards E.N.E. of the summit of Knockadav; this is a downthrow to the east; and about 250 yards south-east of it there is another small shift in the same direction, while about the same distance still further east is a considerable downthrow to the west. West of the first-mentioned downthrow to the east, the beds strike about N. 75° W., and dip N. at 85°, while east of it they strike N.W. and S.E., and dip N.E. at from 75° to 60°; east of the last-mentioned downthrow to the west, the strike changes back to nearly E. and W. with a nearly vertical dip. Between this downthrow to the west and the slight downthrow to the east there is a course of hornblende rock which was not observed extending past either of these breaks; however eastward, north of Lough Ahalia, on apparently the same geological horizon there is an irregular tract of it, while farther eastward short courses appear in detached plots adjacent to the boundary nearly as far south-east as Clogher-kinnalougha Lake. North of the last-named lake there is apparently a break which runs in a north-eastern direction, and shifts the boundary towards the north; further east, north of Shannawona, there is a parallel one, east of which the boundary runs regularly about N. 70° W. till it leaves the district. This last break is considerable, as it shifts the boundary nearly a mile, and yet apparently it is caused by a fault. It should be mentioned that immediately east of this supposed fault there occurs a large mass of the intrusive granite.*

Immediately north of the granite boundary there are detached narrow courses of the hornblende rock, those occurring east of the Shannawona fault are not of a typical character, apparently being more an altered igneous tuff than a regular intrusive rock. One of the courses of hornblende rock occurs at the hamlet called Glentrasna, and close to it is a mass of a green intrusive rock. South of this on the N.W. slope of Lackadunna there is a pear-shaped mass of green quartziferous porphyry, breaking up through which is a dyke from two to five feet wide. This dyke in places breaks into strings from two to four inches wide; the accompanying sketch-map (fig. No. 7) represents it in part of its course

* For the reasons supposing these shifts to be faults, see Memoir Ex. sheet 105, pp. 36, 37.

through the porphyritic foliated granite. A mile west of Glentrasna, at the road, are two irregular pipe-like masses of green felstone, and at the waterfall, north of the Salmon hatching house, there is a peculiar pale green intrusive rock (diabasic?) which runs with the strike of the beds. North of this, at the margin of the district, there is a wide course of hornblende rock coming in from the district on the north, and which apparently is on a higher horizon than those just now mentioned; but, perhaps, contemporaneous with some of those near Gowlabeg. Here in places the rock apparently changes into a rock identical with some of the porphyritic granite, and in other places it is an aggregate of crystals of hornblende, feldspar, and quartz; the course extends for about a mile east of the road, east of which small outbursts were observed, on apparently the same horizon.

Fig. No. 7.



Plan of intrusive dyke in granite at Glentrasna from 2 to 5 feet wide

The metamorphic sedimentary rocks near the boundary are principally hornblende gneiss, in which are outbursts of hornblende rock, with some spheroidal hornblende schists, that, as before remarked, are supposed to be metamorphic igneous tuffs; northward of these some micaceous gneiss and schists were observed. The general strike of all the rocks is N. 70° W., with a dip northwards of about 50° to 70°. Half a mile N.E. of the hamlet in Glentrasna on a line of fault is a remarkable gap in the ridge. On the west side, which is also on the downthrow side of a fault, the strike suddenly changes to N. 75° E., rising to the upthrow. At this gap there is a small outburst of intrusive granite coming up alongside a pipe of hornblende rock; east of this a peculiar curled foliation is developed. It should be mentioned that among the metamorphic sedimentary rocks, numerous veins of granite were noted, but more especially near to the patches of the intrusive granite. In the rest of the *Inver and Screeb district* the principal rock is porphyritic granite, and in this description it will be mentioned when peculiar and all the associated rocks described.

Country about Inver.—All about this locality the mass of the rock is porphyritic granite, which is more or less foliated at its northern limits as it approaches the regular gneiss and schist. North of Lough Ailtarra the following note was made:—"Porphyritic granite containing yellowish waxy feldspar, pinkish feldspar, greenish gray mica and quartz." In this neighbourhood, at the junction of the porphyritic granite with the sedimentary rocks, there is an outburst of the intrusive granite. At the end of the gut immediately east of the outlet from Inverbeg Lough, pyrite seems locally to be a constituent of the porphyritic granite.

North of Lough Aroolagh, which lies east of the north end of Kilkieran Bay, a nearly north and south dyke of felstone porphyry was observed coming up through the porphyritic granite, and half a mile to the eastward is a remarkable dyke of white felstone, which also bears in a north and south direction. Further northward, immediately east of Lough Invernagleragh, two felstone porphyry dykes were observed bearing in a general N.E. direction, the more eastern of them having a platy structure and

dipping S.E. at 60°. South of them is a small mass of quartziferous porphyry, which has a slightly granitic aspect. North-east of Lough Invernagleragh, and thence to the east margin of the district, the porphyritic granite as it approaches the known metamorphic sedimentary rocks has a well-developed foliation, which is nearly vertical, or dips at a high angle towards the latter rocks; but the continuity of the beds is broken, as just now mentioned, by numerous small shifts, and outbursts of the intrusive granite.

Country about Screeb.—About the Loughs Ahalia (north and south) the rocks seem all to be the porphyritic granite, but on the north-east shore of the east end of Screeb Bay two N.E. dykes of platy yellow felstone were observed; that to the north-west has alongside it on the S.E. a course of nodular granite, in which a greenish mineral like epidote is apparently an essential; pyrite is also prevalent. At the extreme end of the bay on the stream flowing from Lough Nafurnace are the remains of an old iron furnace, with heaps of slag and charcoal; a large lump of iron was also remarked. When this furnace was worked, and by whom, we were unable to find out, or where the ore was obtained; but it is not unlikely that most, if not all, the latter was imported here on account of the facilities offered for smelting, the neighbouring hills being formerly clothed with wood.

Hills near the north-east of the district.—A mile due east of Lough Nafurnace, and a little north of Lough Nagarrivhan, on the eastern side of a small hill of porphyritic granite, the face of the cliff has a thin covering of quartz, in places presenting a brecciated appearance, being apparently made up of small angular pieces of quartz, cemented together by silica. Especial attention is directed to this, as hereafter will be described a remarkable dyke or vein of a peculiar quartz rock, which strikes in this direction, and perhaps this is its continuation. A little south-west of the peculiar quartz rock, three small irregular patches or pipes of yellow felstone, with numerous quartz strings, occur in the porphyritic granite.

Two miles north of the last locality, and a little north-west of Lackadunna, is the before mentioned irregular pear-shaped mass of quartziferous porphyry; immediately south-east of it, the foliated porphyritic granite which forms the north-west shoulder of Lackadunna is traversed by a peculiar system of parallel joints, which incline to the N.W. and W. at an angle of 75°. Further east, to the north-east of the summit of Shannawona, there is an outburst of the intrusive granite, while to the south-east, about Loughs Aclogher and Enoer, the rocks seem to be the porphyritic granite, as also about Derrynaboha, Carrickillawallia, and Muckanagh. In the vicinity of Lough Nagarrivhan the following note was made:—"Porphyritic granite containing large pink orthoclase crystals in a greenish felspathic paste, glassy quartz and black mica, the latter mineral being hardly distinguishable by the naked eye." In the stream a little south of this lake a N. 30° E. dyke of yellow felstone was observed, and immediately south-east of Lough Damboe the porphyritic granite was noted as very felspathic. Further south, at Lough Nafranka, the porphyritic granite contains pink orthoclase and a bluish green feldspar, while at a bog-lake a mile to the north-west of that just mentioned, it was noted as containing "a yellowish feldspar, some pink feldspar, and much quartz." In a stream half a mile south of the bog-lake, there is a N. 50° E. dyke of splintery yellow felstone, close to and slightly oblique to which, is a greenish granular igneous rock. Unfortunately the bog on the north prevented these dykes being traced to see which intersected the other, and consequently is the newer. Detached in the bog, south of these dykes, was observed a yellow felstone, which appears to be part of a north and south dyke.

Camus.—Between the lakes a mile south-east of Camus Hill, a north and

south felstone dyke was observed. A mile north-east of the hill, on the shore of Screeb Bay, two north-east dykes of yellow felstone were observed. These are likely to be the same as those previously mentioned as observed to the north-east on the other side of the bay. Due north of Camus Hill the granite on the shore is decomposing, and in it was noted an E. and W. dyke of red felstone. On the shore about a quarter of a mile south-south-east of Doonmanus Rock, and south-south-west of the summit of Camus, there are various intrusive rocks coming up through the porphyritic granite. The nearest to Doonmanus Rock is a nearly north and south felstone dyke, a short distance to the south-east of which is a north-east dyke, thirteen feet wide, of a green colour, which seems to be a dolerite. This is succeeded by a large pipe of green quartziferous porphyry, very like some of those near the town of Galway; and further south-east is a north-east dyke, six inches wide, of compact dolerite; south-east of which and parallel is a dyke of green quartziferous porphyry like that just mentioned. Between the two latter dykes there is about four feet of porphyritic granite.

V.—CASHLA OR COSTELLOE DISTRICT.

In this district as in the preceding one the principal rock is porphyritic granite, and associated with it are numerous dykes and patches of various irruptive rocks. Attention may be drawn to where the porphyritic granite was observed to have been peculiar; all the irruptive rocks noted will be described and their localities mentioned.

Country south of Camus Bay.—In the porphyritic granite at Muckanagh Point, and cutting obliquely across the promontory is a dyke of irruptive rock; at the point it is a platy felstone, while at the coose or small bay a little to the S.W. of the point, where it is upwards of forty feet in width, the western part of the dyke is a platy felstone, and the eastern a quartziferous porphyry. At the village of Muckanagherdaunahalia (*the boggy land between the two brackish seas*), which lies half a mile S.S.E. of the point, is a N. 30 E. dyke of platy felstone; west of the village is a N. and S. dyke of gray felstone, and extending obliquely across the strand S.S.W. of same place is a gray quartziferous porphyry in which one of the minerals appears to be pyrite. East of the village on the other side of the gut are pipes of a greenish felstone containing specks of free glassy quartz, and flakes of an earthy looking mineral (chlorite?). Further southward, half a mile N.E. of Lough Atawny, the porphyritic granite contains pale green and pinkish felspar, glassy quartz, and black mica, together with hornblende as an accessory. South of this, at an arm of the gut which runs north-eastward, there is a nearly north and south dyke of felstone; a little west of which is another, and a little south-east of these is a nearly N. and S. dyke of red felstone of a granitic aspect: hereabouts a white felspar has taken the place of the pink in the porphyritic granite, and a little N.E. of the two felstone dykes there seems to be a small outburst of the intrusive granite. At Lough Atawny the large felspar crystals in the porphyritic granite are white or whitish green. West of this, in places, the large crystals in the granite are white, but more generally they are pink, and sometimes pyrite appears to be locally a constituent of the rock. On the west side of Loughauneweey is an irregular grey felstone dyke varying from two to six feet in width, compact, but at the same time full of systems of joints, causing it easily to break up into small irregular pieces; immediately west of this dyke is another or a branch of it. More than a mile S.S.W. at Lough Aughagaddy, also at Lough Atooreen, which lies about a mile further southward, pyrite seems to be a constituent of the rock, and at the shore of Greatman's bay, west

of the former lake, is a dyke of porphyritic felstone which runs N. 40 E., and is upwards of forty feet in width. Hereabouts the unweathered compact fine grained veins in the granite stand up an inch and a half above the mass. A little south of the felstone dyke in the granite there are irregular triangular and pear-shaped patches of fine grey gneissic granite, while a little further S.S.E. is a small patch or pipe of porphyritic felstone, and further south on the shore N.E. from Illaunroe is a course of red granite, apparently different from the associated porphyritic granite, and perhaps a mass of the intrusive granite.

On Rossroe island and the neighbouring shore the granite is very felspathic and of a greenish colour, while on Inchamakinna it seems to be of the ordinary Galway type, except that in three or four places pyrite seems to be a constituent of the rock; S.E. of Rossroe island on the shore is an east and west narrow dyke, about two inches in thickness, which seems to be a dolerite. About two miles E.N.E. of Rossroe island, south of Lough Corraundahy, is a N. 20 W. dyke of whitish yellow quartziferous felstone, and east of Carrafinla Lake are four or five nearly parallel dykes of quartziferous felstone bearing about N. 30 E.; these are either of a red or yellow color,* compact, but at the same time break up into small pieces on account of their being traversed by numerous irregular joints; there is also a N. 20 W. mineral lode, of which more hereafter. West of Lough Haw-naghaneekyne which lies a little S.E. of Carrafinla, is a red felstone seemingly part of one of the dykes just mentioned, and further west is another also likely to be the continuation of one of the others, while a little S.E. of this lake is a wide N.E. dyke of felstone, one side of which is of a red, and the other of a yellow colour. In the cliff a little further southward is a wedge-like mass of white felstone, and further south where the cliff joins the sea are irregular dykes of purple felstones. S.W. of Lough Haw-naghaneekyne at Lough Faddacrusan is a mass of red granite in the porphyritic, that apparently is part of the intrusive granite.

The dyke next adjoining Carrafinla Lake is peculiar, as it is yellowish quartziferous felstone that weathers at the N.E. corner of the lake like a breccia; it seems like the curious quartzite course previously mentioned when describing the rocks further N.E. north of Lough Nagarrivhan, and also to the quartzite or quartz-lode that can be traced for miles towards the S.S.W., from a quarter of a mile south-west of this lake (Lough Carrafinla). As this peculiar course will be better understood by being traced from the beginning to the end, we will now give the notes about it, and afterwards describe the other peculiar rocks in this vicinity.

Remarkable quartziferous course or lode.—As previously mentioned, a little north of Lough Nagarrivhan, five miles to the N.N.E., a course of rock very similar to it was observed, but from that to Lough Carrafinla no rock like it was observed, though possibly existing under the drift, or bog. At Carrafinla the rock just described was observed, and a quarter of a mile S.W. of the south end of this lough the course begins, and can be traced continuously to the small lake a little west of the hamlet called Crumpaun, and thence for half a mile southwards; at this lake and to the south it is more or less felspathic, while to the north it is almost a pure quartzite, and still further N.E. it becomes conglomeritic, and full of quartz strings: the granite alongside of it is also in places full of quartz strings. About a quarter of a mile S.W. of Crumpaun it disappears under a bog, but in the neighbourhood of Garryroe it forms conspicuous

* It may be mentioned that these felstones which are yellow apparently, on being opened, seem in depth, always to be green, while those which seem to be red are in reality purplish.

sharp hillocks, and from thence it is continuous in a slightly curved course for about two miles to Keeraunmore. The following is the note made of it—"At the N.E. end of the hillock, north of Garryroe the quartzite seems gradually to merge into a granite full of quartz strings. The granite to the N.W. of the course is very felspathic, and in places full of quartz strings, while in the others there is a structure like foliation. The course is sometimes pure quartz, but more often felspathic, and full of strings of pure quartz; the upper part is conglomeritic containing round pebbles of pure quartz. N.W. of Glenmore the beds above the conglomerate become a sort of felsite full of quartz strings, while further south the felsite nearly disappears, and the rock becomes an aggregate of quartz strings. South of Knockyflaherty (where the trigonometrical point Δ 228 is engaged on the one-inch map), the rock appears again, and gradually increases in width until at Keeraunmore it is cut off by a fault. The rocks associated with and below the conglomerate at Garryroe dip N.W. at 65° —at Glashnacally they dip in the same direction at 60° , while a quarter of a mile north of Glenmore they dip west at 60° , but at this village, and thence to Keeraunmore West at 78° . At Glenmore these rocks appear to be shifted a little to the east by a slight fault, and south of it they become very cellular, the cavities being coated with crystals of quartz, many of the latter being encrusted with a thin film of a whitish red mineral; however, everywhere they are overlaid by a conglomeritic layer. South of the fault which cuts it off at Keeraunmore, and seems to have thrown it westward, it was again met with and traced in detached portions in a south-west direction as far as Loughauneala; but south of the fault it is apparently cut and broken up by irruptive rocks.

It should be mentioned that due west of Glashnacally it is also cut across by an irruptive dyke. This peculiar course, although often, lithologically a quartzite, would seem to be a peculiar variety of a quartz lode, which has been more or less altered along with the granite, as it appears not to be more recent. Perhaps it may contain productive minerals, though none were observed; other veins somewhat like it, were observed, and will presently be described.

Country between Greatman's and Costelloe Bays.—At the N.W. end of Clynagh Bay is a mineral lode bearing N. 80° W., and south-west of the village of Crumpaun there seems to be a tract of the intrusive granite; further south-west, at the village of Glashnacally, east of Loughaunwillin, there is the dyke previously referred to, of yellowish green quartziferous felstone, which bears N.W. and cuts across the remarkable quartz course. Although compact it is full of minute irregular joints, which causes it to break up into small fragments, and gives it when broken a hackly fracture. In the weathered portions it seems to be a mixture of felspar and an epidotic mineral, full of globules of quartz. At the point south of the village and close to this dyke, is a wedged-shape mass of very similar rock. Immediately N.W. of Loughaunwillin there is a tract of the intrusive granite, and north of this, on the sea-shore is a dyke of bluish green felstone, while close to the latter, and extending for more than half a mile towards the S.S.W., is a quartz lode very similar to the peculiar course just now described. This, in places is felspathic, in others conglomeritic and reticulated with quartz strings. Due west of the widest part of Loughaunwillin it seems to be shifted to the west, and this detached portion is very felspathic and forms a low sloping cliff. A little south-west of the last locality is a pipe of gray quartziferous felstone coming up through the porphyritic granite. Further S.W. on the coast west of Lough Natawnymore is a small gray felstone dyke. Here, between the coast and the lake, the Galway type granite which is not so decidedly porphyritic as in other places, is traversed and cut up by a system of parallel joints which run N. 30° E. and dip

N.W. at 70° , while south of the lake the granites are also affected by parallel joints, but they bear N. 50° E. and dip N.W. at from 60° to 70° . In this locality there is a N. 80° W. mineral lode. Further south, where the coast line joins the margin of sheet 104 and north-west of the Holywell, there is a wide N. 45° E. dyke of red felstone, which is platy near its N.W. wall. On the west side of the extreme southern headland are two courses of striped felstone which, although they could not be traced to a junction, yet seem to be parts or branches of one and the same irruptive rock, as the western one, which runs in a slightly curved N.E. direction was nearly traced to the other, which bears about N. 20° E. and does not seem to cross it; both of them are greenish yellow striped felstones. To the westward of Doleen Harbour much of the granite is affected by parallel jointing, which bears about N. 10° E. and dips west at about 65° . Immediately east of Doleen Harbour there is a rock, of which it is hard to determine whether it is a granite or a quartziferous porphyry, as it looks somewhat like the former, although in it were detected quartz globules. A little east of Doleen is a course of fine red quartziferous felstone. North of Carrickmarian is a nearly N. and S. pink felstone dyke seven feet wide. In the little boat harbour east of the point are strings of quartz containing galenite and called *the Pointa Lode*; but as they occur in such a hard rock it is improbable that they would improve with the depth. The striae on the dressed rocks vary in bearing from N. and S. to N. 10° E. Some of the rocks are beautifully polished. South of Keeraunbeg there is a peculiar fine granite with flakes of a green mineral. It has a platy structure which gives it a marked appearance amongst the associated granite; moreover, it is somewhat like some of the quartziferous porphyries. North of Keeraunbeg, mixed with the Galway type granite, are patches of the intrusive granite, and a quarter of a mile N.E. of the village is a large irregular dyke of quartziferous felstone which runs in a general N.E. direction. Near its S.W. end it seems to bifurcate and enclose a considerable tract of the porphyritic granite. North of this course are two or more irregular dykes of felstone and quartziferous porphyry, before referred to, as displacing and shifting the large quartz lode. To the south-eastward, and east of the village of Pointa is an irregular N. and S. mass of yellow felstone and a little further N.E., amongst the tidal rocks, is a large pipe of a similar rock, while close to it is a N. 30° E. dyke of gray quartziferous felstone, and still further N.E. is a thin irregular vein of felstone.

A little north of the old church is an east and west dyke, four feet wide, of a greenish rock which seems to be a diabase, while further north the granite has a foliated texture, being allied seemingly to a gneiss, and being full of lenticular pieces of a schistose rock. The lines of foliation are vertical and bear about N. 50° E. North of the fault is a third greenish yellow quartziferous porphyry, seemingly the continuation of the dyke N.E. of Keeraunbeg, but slightly shifted by the fault, and alongside of it on the south is a thin dyke of blue platy felstone. Further north, a little south-east of the trigonometrical point Δ 228, is a N. 60° E. quartz lode, the stuff being more like quartzite than vein quartz, and a little north-west of the point is a north and south dyke of yellow felstone, while further north is a N. 45° E. quartz lode.

Country in the neighbourhood of Cashla or Costelloe River.—Northward of Derrynea Lodge at the coast road east of the entrance into Clynagh Bay are irregular dykes and masses of red and yellow felstone and gray quartziferous porphyry. Here close to the hamlet it was remarked that in the granite of the Galway type there are many minute irregular veins of felstone; there are also compact veins of fine-grained granite, which stand up about two inches higher than the mass of the rock. Further north, in the

crag a little south of Derrynea Lough it was observed that along many of the joints in the granite the rock on either side for an inch or more in width is seemingly silicified. This hardened portion weathers less freely than the surrounding mass, so that lines of hard rock stand up from one to two inches higher than the rest. East of these crags near the elbow in the river is a N. 45 W. dyke of reddish felspathic rock, and north of it, due east of Derrynea Lough, is a nearly north and south dyke of similar rock. East of the last-mentioned dyke at the river there were noted "irregular compact veins and peculiar rectangular patches in the Galway granite" while a little further north there are net-works of these compact veins, most of which seem to be coeval, as they do not cut one another; they are from half an inch to four inches in width, but usually do not exceed two inches. Further northward, at the pool east of Loughaunweeny is a N. 20 E. dyke of red quartziferous porphyry, and at the east end of this lake is a N. 85 E. mineral lode, while on the south shore was observed a N. and S. green irruptive dyke, which seems to be a dolerite, and at the western extremity is a mass of red felstone.

On the hill N.W. of Loughaunweeny, the summit of which is marked on the one-inch map by Δ 182, are two dykes of felstone, one red and the other yellow, they run in a northerly direction, the western one of the yellow colour appears at intervals through the bog or drift for upwards of a mile and a half in length, and east of these, near the west margin of Lough Namroughania, is a small N. and S. grey felstone dyke. To the north, north-east, and eastward of this, all about Glenicmurrin Lough, and thence to the east of the district, no rock was observed except the porphyritic granite of the Galway type, save about a mile N.W. of Lough Naskeha, where the granite has seemingly as an essential a greenish mineral like chlorite, and a mile east of the south end of Glenicmurrin, where in places there are crystals of a pale greenish felspar enclosed by orbicular envelopes of white felspar; hereabouts hornblende was observed as an accessory. Further south a little north of Bovroughaun Hill is a N. 35 W. dyke of felstone, and in the hollow half a mile east of this hill, three north and south dykes of felstone were observed, while further south in the high ground west of Lough Naclogh three or four large dykes of quartziferous porphyry were observed, which run in a north-eastern direction, and are generally of a red colour. On the ridge, nearly a mile due south of Bovroughaun, is a mass of platy felstone with a red quartziferous porphyry, and three-quarters of a mile west of this hill, in the southern continuation of the nearly north and south hollow in which the eastern portion of Glenicmurrin Lake is situated, are three or four parallel N. and S. dykes of red quartziferous porphyry and red and white felstone. South-west of these dykes, half a mile W.S.W. and S.S.W. of the trigonometrical point Δ 334 are irregular dykes of red quartziferous porphyry, and in the first locality is an east and west small vein of red felstone, which contains minute quartz globules, while still further S.W. crossing the road obliquely were observed a red felstone changing into a quartziferous porphyry and a small dyke of white felstone.

Country about Rossaveel.—To the south and south-east of Derrynea Lodge is a tract of red granitic-looking quartziferous porphyry; at the river immediately S.W. of the lodge a N. 75 W. course of rotten granite was observed, and north of it the pink crystals in the porphyritic granite are very large, one measured, being two inches in length. South of the Lodge there is a N. 25 E. quartz lode and flying veins with traces of galenite. On the coast W.S.W. of the lodge is a black micaceous foliated granite which seems to gradually merge both ways into the porphyritic granite of the Galway type. Further west at the point there is an east and

west vertical foliation with schistose lenticular patches; this peculiarity dies out in a short distance towards the south. At the point there is a N. 30 E. dyke of purplish slightly quartziferous felstone, cutting obliquely across the foliation; and nearly parallel to this dyke, a ravine being formed along its course, is a dyke of foliated rock lithologically a gneiss but undoubtedly irruptive; its constituents seem to be pink felspar, quartz, and a green mineral like chlorite; a little further south is a N. 80 W. mineral lode, south of which is a N. 70 E. course of chloritic stuff. A mile to the south of this, and a little north of the Tower, there is a foliated black granite with schistose lenticular patches, which is succeeded by a granite in which there are irregular small patches of a black schistose rock which weathers out, leaving holes in the granite; while south of it, at the Tower, the granite is riband red and white, and this is succeeded by the porphyritic Galway type granite. On the east side of the point, south of the Tower, there is a N. 45 E. dyke of red quartziferous porphyry; on the west shore of the gut, a little east of the Tower, there is a tract of quartziferous porphyry changing into granite, a little north of which is a wild N. 20 W. quartz lode; north of which, at the end of the bay, is a quartziferous porphyry, highly granitic in aspect. On the east of the gut, due east of the Tower, is a N. 45 E. dyke of greenish yellow quartziferous felstone.

South-south-west of the Coast-guard station, south of Callowansha Island and north of Foal Island, there is a north-east and south-west course of fine red granite. A little south of the last is a N.E. and S.W. course of a greenish-gray quartziferous felstone; both of these courses occur in a fine gray granite. East and north-east of Foal Island are greenish fine granites, in which are schistose lenticular patches, from the size of a man's head to over a yard in length; they are scattered irregularly through it, in some places thickly together, in others very sparingly; but, as usual, they weather much more rapidly than the granite, and are very conspicuous. To the N.E., south of Loughaughtavalla, there is a patch of the peculiar granite containing quartz globules, and which is supposed to be quartziferous porphyry merging into granite; while a little further east is a fine red granite similar to that forming the course north of Foal Island. The rest of the granite hereabouts is generally a gray granite, though in places there is the pink Galway granite, but rarely porphyritic. Further south and east of the Burial-ground, there is a N. and S. quartziferous porphyry, and on the shore, southward of the same place, a small nearly E. and W. felstone dyke.

Between Curardacrugh and Bunnahown, there are many dykes of igneous rock, some possibly metamorphic, while others are undoubtedly more modern than the granite; on the shore section seventeen of them were observed, as follows, beginning towards the west:—

First.—A quartziferous porphyry course which seems to run in a N.N.E. direction. This could not be traced inland.

Second.—A pinkish green quartziferous porphyry, which on the shore has a similar bearing to No. 1; was traced inland.

Third.—A pink quartziferous porphyry. This was traced to Lough Nagravin.

Fourth.—A white striped felstone with blackish spots. This was observed on the shore north of Coanascalta Bay.

Fifth.—A red felstone, only remarked on the shore of Coanascalta Bay.

Sixth.—A massive quartziferous porphyry. This was traced to the bog on the south of Lough Nagravin.

Seventh.—A felstone, of a gray colour, which seems to have minute globules of quartz scattered through the mass. This rock weathers yellow, the dyke runs oblique to Nos. 5 and 6 which it cuts.

Eighth.—A massive felstone of the same texture as No. 7; it is over thirty feet wide.

Ninth and Tenth.—Similar felstones to No. 7. They seem to be branches of one dyke; the western one is over thirty feet wide, and was traced nearly to Lough Nagravin, a little south of which it seems to turn eastward under the bog there situated.

Eleventh.—A similar rock to No. 7. It was traced to Lough Nagravin. Between Nos. 10 and 11 in the vicinity of the Lough, there is a N. and S. course of quartziferous porphyry which could not be traced southward to the coast.

Twelfth.—A similar felstone to No. 7. Traced to Lough Nagravin.

Thirteenth and Fourteenth.—Similar felstones to No. 7. They seem to be branches of one dyke—the eastern or main branch on the sea-shore is over thirty-three feet wide, and was traced inland east of Lough Nagravin for more than half a mile. Between it and the lough is a small tract, and east of it a nearly N. and S. course of quartziferous porphyry.

Fifteenth.—A small dyke of porphyry, which extends obliquely towards Nos. 13 and 14.

Sixteenth.—A small felstone dyke, parallel to No. 15, which lies on the west shore of Bunnahown. This and No. 15 are supposed to be branches from No. 13.

Seventeenth.—A porphyry observed at the stream flowing into Bunnahown, it was also observed a little S.W. of Blake's Lodge; near this felstone, but immediately west of the mouth of the stream, was observed a course of foliated rock in the granite, having all the appearance of a gneiss; it strikes N. 80 E., and its foliation dips N. at 30°.

On the west shore of Travore Bay is a quartziferous porphyry, and on the north of the bay is a mass of that peculiar rock which looks like a granite, yet as it contains quartz globules, it would seem to be allied to the quartziferous porphyries. A tract of very similar rock was observed east and north-east of Blake's Lodge.

East of Travore Bay a patch of red felstone was observed, and alongside it a gausen lode which bears N. 15 W. Hereabouts the mass of the rock seems to be the intrusive granite. A little S.W. of Cashel House in the granite is a foliated rock, which seems to be the continuation of that previously mentioned as having been observed at Bunnahown; here it also has the appearance of gneiss, with the foliation striking N. 70 E., and dipping northward at 20°. A little west of Cashel House, and extending northward to, and north of the bifurcation in the road, is a large course of quartziferous porphyry. In this vicinity there are also mineral indications and lodes which will hereafter be more fully mentioned. At Castle Point is a dyke bearing N.E. and S.W. It seems to be some variety of basic igneous rocks. In its neighbourhood the rock seems to be the intrusive granite. East of Castle Point is a tract of quartziferous porphyry; it may extend in a wide course towards the north as exposures of a similar rock were observed in that direction. On the coast, south of Cartronkeel and Ballynew, courses of purplish green or gray felstone, which inland weather white, and at the coast red, were observed in eight places. They all seem to extend in a N.N.E. direction, as many of them can be traced to near the road. Very little of the typical porphyritic granite was observed near the coast, as it usually is the finer variety mentioned in the *general description*, or the intrusive granite. Immediately east of the Crumlin river is a granite that weathers with the appearance of a conglomerate, but on being broken is found to consist of a coarse green granite, in a finer granitic matrix.

Northward of Lough Astickeen, in places in the porphyritic granite, there are irregular patches of coarse-grained quartziferous porphyry very granitoid. A mile N.E. of the last-named lake at Loughaunilra, there is a N.E. dyke of porphyritic felstone; while half a mile further north, crossing the road obliquely, was observed a N. 50 W. dyke of similar rock. Further east, in the country east of Lough Nahogo, and west and north of

Lough Adoorau, there are dykes of red quartziferous porphyry, one of which was traced nearly continuous for over two miles; these seem to be the south-west continuation of some of the dykes previously mentioned as being observed on the hill west of Lough Naclogh. A mile north of Lough Adoorau, and a little east of Lough Aglanna, between two of these dykes of quartziferous porphyry, is an irregular mass of felstone, and apparently much newer, as it seems to cut across and displace them.

Further west, in the neighbourhood of Loughs Fadda and Ugga Beg, there are extensive crags of the porphyritic Galway type granite surrounded by mountain bog; and near the south-east corner of the district, in the valley of the Crumlin river is a north and south dyke of felstone; while a mile further west, S.S.E. of Polladooey Loughs, are a nearly north and south dyke of quartziferous felstone, a N. 75 E. dyke of red quartziferous porphyry, and a N. 65 W. small dyke of felstone. South of these lakes is a N. 10 E. dyke of felstone; while west of Lough Nacreggaun is an irregular mass of quartziferous porphyry. Further west south of Lough Naskanniva there is an irregular small tract of similar rock, and in its vicinity were picked up pieces of the intrusive granite containing flying veins of the fluorite. South-west and west of Loughaunevneen, which lies to the westward of the last mentioned locality, are irregular tracts of a red quartziferous porphyry very granitoid, and in one place remarked to contain white mica; still further west, a little east of the Coast-guard station, another patch of similar rock was observed, and S. of the Coast-guard station were picked up fragments of a red granite with strings of fluorite.

DRIFT AND OTHER SUPERFICIAL DEPOSITS.

In this area there is very little of the true *Boulder-clay-drift* found. The glacial-drift that does occur seems to be altogether the local Boulder or Moraine-drift, consisting of a sandy or clayey mass, full of small and large fragments of local rock, often several tons in weight. The rock fragments are usually angular or semiangular, sometimes round, often more or less striated, but rarely having a fine polish; although the rock surface on which they lie, is always more or less planed, grooved, striated, and polished, sometimes to a wonderful degree. Associated with this drift, in a few places, is a drift in which there are more or less rounded blocks in a sandy-clayey-matrix. This last-mentioned drift, in some localities, merges into a clayey gravel or sand; moreover, in some places adjacent to the mouths of some of the glacialised-valleys are deposits of the silicious subaerial sand, locally known as "*Blown Sands*."

The Bogs are of two kinds—the low-lying, flat, or peat bogs, which are often of considerable depth, and the mountain bogs that frequently grow on steep slopes. In both kinds of bogs the roots (*corkers*) and stems of trees are found, but more especially in the former. They are usually the fir, holly, and sallow, though in places the yew and oak are not uncommon. In many of the low bogs are often found thin layers of silt or even gravel, which seemingly during floods were driven in on the peat previously formed, and subsequently were covered by a new growth of bog. In places this class of bog appears to prove that the land has sunk since its formation, for on the sea shore it (the bog) will be found, below low water of spring tides, sometimes at least ten feet thick. The mountain bogs rarely have layers of silt or such foreign substances on them, except when they occur in a hollow in the hills, and from the adjacent highlands such substances can be swept down on to them. The peat forms an envelope, of a greater or less thickness over nearly all this area, thereby preventing in a great measure denudation by subaerial agencies. In places where there were

large blocks of stone scattered over the surface of the ground, previous to the envelope of peat having grown, the blocks have often a most deceptive appearance, for where there were overhanging blocks the bog has grown under and surrounding them, giving them the appearance of being newer than, and of resting on the bog. However, after a careful search and examination, in no place could the bog be proved older than any of these blocks or hillocks of drift.*

After this general description, we may now proceed to describe all localities in which anything particular about the drift, bog, &c., was observed, beginning at the S.E. of the district, and afterwards proceeding northwards and westwards, and concluding with a table of the etching, scratches, and grooves so prevalent here as well as in the rest of Yar-Connaught.

The drift that occurs on the south parts of Lettermullan and Gorumna (Sheet 113) is in such small patches as to be scarcely worthy of notice, more especially as it seems to be local, that is, made up of blocks, fragments, and the *débris* of the underlying rocks; nevertheless it seems to be of glacial origin, as the rock surfaces under it are beautifully polished, etched, and planed. In general the surface deposits are of a peaty nature, being from a few inches to from six to ten feet in depth.

On the Killeen and Carrowroe promontory, the drift and surface deposits are very similar to those on Gorumna.

On the land east of Cashla Bay, much of the surface is clothed with peat or heather. Most of the heathery coat grows on a peculiar rocky drift composed of blocks and fragments of the underlying rocks; some of the blocks are of large dimension, and all are angular or semiangular; here the drift also seems to be of glacial origin, as it conceals ice-dressed rocks, the surfaces of which, if newly uncovered, show a fine polishing. This seemingly is not the case when the drift is not glacial, for if it consists of the drift-gravel and similar materials the rock-surface may be rounded and scratched, apparently by ice, yet the polishing may all have disappeared, either from weathering or the friction of the gravel.†

This rocky moraine-drift seems to be the rock *débris* contained in the glaciers immediately previous to their final disappearance. Besides this rocky-drift, there are a few patches of what may be true boulder-clay-drift, the most considerable being a small nearly north and south hill, on the slope of which is the site of Blake's Lodge; others, but smaller patches, occur in the vicinity of Cashel House, and to the east thereof. In this boulder-clay-drift the blocks and fragments are rounded, polished, and scratched, and many seem to have travelled considerable distances, as pieces of gneiss, schist, and other metamorphic rocks chiefly seem to form the boulders and fragments in it; moreover, although no pieces of limestone were remarked, yet it seems to be of a limy nature, as parts of it freely effervesces with acid. To the ice coming from the northward may be due the excavation of the Loughs Nagravin and Tully, and the previously mentioned hummocks of dressed rocks, as they all have a nearly similar bearing (varying from N. and S. to N. 20 E.); also the boulder-clay-drift in the neighbourhoods of Blake's Lodge and Cashel House, as this drift contains blocks and fragments of the rocks forming the hills to the northwards; while the rocky moraine-drift

* In the area contained in Sheet 105 there were proofs found, that previous to the formation of at least part of the drift, bogs existed. (See *Memoir Geol. Survey, Sheet 105, p. 44.*) On this account a careful search was made to find the remains of these older bogs in the hills of Yar-Connaught, but as yet without success.

† The gravels here referred to, are the sharp-gravels that are supposed to owe their origin entirely to water action. Besides these there are clayey gravels, or gravelly clays, that often occur in the mountainous districts; these latter are probably of glacial origin, and under them sometimes are found polished rock surfaces.

which occurs in the country where the N. 25 W. striæ are found, may be the residue left by the ice that formed these striæ.

Here it may be mentioned that a register of the amount of weathering of some of the granites since the ice disappeared from this country, would seem to be recorded by the veins which traverse these kind of rocks; as these veins are usually unweathered, retaining their glaciated surfaces, and stand up above the mass of the rock; near the coast being usually from two to three inches high, while more inland they only average 1.5 inches in height. This weathering would seemingly also suggest that in the neighbourhood of the sea, the atmospheric influences are different to those inland, not only in the amount of work done, as shown by the greater height of the veins near the sea, but also in respect to the colouring matter in some of the rocks, for, as previously mentioned, the purplish gray or greenish felstones near the sea weather red, while the same rock inland weathers a dull yellowish white.

On the sea coast, about a quarter of a mile south-east of Foal Island, there is a remarkable kitchen-midden about fifty feet in diameter, fifteen feet in height, and forming a flat-topped conical hillock. It seems to be nearly altogether formed of the shells of the *patella vulgata* and the *litorina litoræa*; no excavation was made into it. There seems to be added to it yearly a few more shells, by the people who visit the site of a church and two holy wells dedicated to Saint Columbkil, which are in its vicinity.

About three and a half miles W.N.W. of the south-east corner of the district, the bog immediately east of Lough Astickeen slopes northward and southward, and on this low flat watershed there are three or four bog-pools, or *loughauns*, as they are locally called, so insignificant as not to be marked on the one-inch map, and yet remarkable, as their margins are considerably higher than the surrounding bog. These, and all similar *loughauns*, seem to be supplied by springs over which the bog does not grow; therefore, as the latter gradually rises, it forms around the spring, a small deep lake which usually has perpendicular sides, or sides which cave in; in the latter case, it seems likely that eventually the bog must grow over it, leaving a hollow underneath full of water.*

When these *loughauns* are in low places, there is usually a morass around them, but when they are highly placed, more especially on a watershed, as in the instances now recorded, there seems to be a drainage through the bog, and the margins of the lakes are well defined, being often higher than the surrounding bog; as, during the summer's extreme heat, and the winter's hard frosts, the vegetation continues adjacent to those waters, while elsewhere it may be dormant. When these springs are not perennial, and the *loughaun* is full only in the winter, its sides are not perpendicular, and it has more the nature of a boggy pool. This class of lake is very common in the wilds of Yar-Connaught.

North-west of the last locality, in the vicinity of Rossaveel Lough, there are hillocks of rocky drift lying on rounded and dressed rock masses. Fur-

* That this does sometimes happen seems proved by the *swallows* in the bogs, which are most deceptive, being seemingly a solid surface, but having water or mud underneath; and, as they are clothed with a mantle of green in the spring of the year, they are very dangerous to the cattle. At this season while the grass is scarce, the cattle, but especially the horses, are tempted to venture in on them, when they go down bodily, and often only the heads of the horses remain uncovered. Might we not in this way account for the skeletons of the *Megaceros Hibernicus* so frequently been found in isolated small bogs, as these patches may have been similarly formed to the *swallows*, and the deer tempted on them, would be destroyed in a similar manner to the horses of the present day in Yar-Connaught. It would also account for their heads being found separate from the rest of their bones, as the heads being above or near the surface may have been removed in a variety of ways.

ther south-west, close to the coast, in the vicinity of the Ordnance Tower, a very large block, about 20 feet high, was observed. This formerly was perched on its end, but now its weight has split it into two pieces.

Fig. No. 8.



Large boulder—Keeraunbeg.

On the west of Cashla or Costelloe Bay, in places over the whole of the promontory between it and Greatman's Bay, are hummocks of very rocky drift, in, and upon which, or where absent, scattered about on the crags, are erratic blocks of various sizes, up to tons in weight. One, very large, of which the accompanying figure, No. 8, is a sketch, is alongside a good-sized house, the block being larger than its west gable. The scattered blocks when resting on crags are very picturesque, especially in the country north-west of Loughaunwillin, as seen from the hill south-west of Glenmore.

On the coast of this promontory there are banks of recently formed shell sand, which ought to be a good fertilizer for the adjacent lands, if the latter were only drained, but otherwise as all the soil hereabouts is so impregnated with iron, it would be most injurious.

West of Greatman's or Fearmore Bay, on the north part of Gorumna and on the islands to the west, there is very little drift, but erratic and perched blocks are more or less numerous. Further north on Lettermore, and the other islands in the Archipelago there is also very little drift. On Lettermore, west of the Coast-guard station, south of a cliff, about half a mile from the coast, there are irregular hillocks of drift which range N.N.E. and S.S.W., while in the north-west part of the island, south-west of Cashla Point, there is a small amount of drift banked against the hill slope. The mainland to the east of the sound called Dangan's Pass, which bounds Lettermore and Annaghvaan Islands on the east, is principally covered with bog, but perched blocks and hillocks of rocky drift are not uncommon; and at Muckanaghederdaunaulia, the north and south promontory east of Camus Bay, there is an irregular north and south ridge of rocky drift. Further east, in the valley, all about the lakes called Muckanagh, Naskeha, Glenicmurrin, and Cloonadon, the rocky drift occurs in more or less quantities, but much of it is now covered with bog. The islets in these lakes are often dressed domes, on some of which are perched blocks, as represented in the accompanying sketch, Fig. No. 9 (*Frontispiece*), of a perched block in Glenicmurrin Lake. Of the drift on the north and south promontory in the centre of Muckanagh, the following note was made—"Fine, sandy,

clayey drift, containing semi-angular and rounded boulders; over this is a thin coating of peat, in other places rocky drift protrudes in the peat."

The rocky drift of the valley of these lakes will also be found up the valleys to the east by Lough Formoyle, and south-east towards Lough Naclogh; west of this latter lake there is a well marked mound or drumlin of drift which ranges N. 30 W. In the valley of the Cashla River by Lough Formoyle, and north-eastward in the two branches of the valley which run W. and S.E. of the hill called Cloghermore, to and beyond the margin of the district, there is a deep drift in undulations, hillocks, and banked against the hills. It is usually rocky, but in the north-east branch of the valley, it is more of the nature of a clayey gravel. It may here be mentioned that the two branches of the Cashla river valley descend from the table-land mentioned in the description of the country further east, and on which a *mer-de-glace* or sheet of perennial snow is supposed to have existed, and fed the glaciers coming down these valleys, as also other glaciers occupying valleys which open northward, eastward, and southward,* and what seem to favour this theory, are the long banks of blocks which occur at places in lines near the foot of the slopes of the hills bounding these valleys, and which were probably portions of lateral moraines; good examples of these may be seen on the slopes of the hills in the vicinity of Lough Aclagher. At the N.E. of the district, north of Lough Aclagher, there is a higher valley which has a slight fall into the undulating table-land, at and east of the margin of this district; its general bearing is about N.W. and S.E., and it is full of hummocks of drift which form irregular ridges with a similar lie to the bearing of the valley. In fact any mounds of drift in these highland valleys, if in the bottom of the valleys, have their longest axes coinciding with the fall of the valleys; but if on either of the slopes, their bearing is similar to a line representing the general fall of the slope.

At the north margin of the district on the north slopes of the hills which bound Glentrasna on the north, there is a coating of bog over deep sloping undulating drift, while in Glentrasna and the valley south of the hill called Lackadunna, and from that westward down the valley of Lough Nafurnace and Screeb Bay, are many hillocks and patches of rocky drift, with the accompanying large erratic blocks protruding through the envelope of bog.

Camus hill and the country thereabouts is mostly covered with bog except at the heads of the bays to the south, where there is very rocky drift with innumerable blocks; and to the north and north-west where there is a fringe of deep drift along Screeb Bay. The large promontory further west on which are situated the villages of Turlough, Kilbrickan, Salialea, Garrivinagh, and Rossmuck, is partly covered with rocky drift, and partly bog, the latter predominating; while the country north of Screeb Bay and thence to Inver is very similarly circumstanced, except that it is higher and more undulating ground, and a few of the hills, especially that to the west of Lough Adav, is nearly bare rock, over which scattered profusely are erratic and perched blocks, one very remarkable being figured. S.W. and S.E. of Lough Adav, bounding the lake, are masses of undulating drift. In "Frost and Fire,"† Mr. Campbell gives sketches of perched blocks, and of the icedressed rocks in this neighbourhood.

The promontory called Errisainagh has, for the most part, an envelope of peat of a greater or less thickness, through which in places are protru-

* See Memoirs, Geological Survey. Ex. Sheet 105, pp. 48-50.

† "Frost and Fire," By J. F. Campbell, Vol. ii., pp. 7, 10, 25, 29, &c.

sions of rock or moraine-drift, or erratic blocks. S.W. of Lough Aliggan, at the base of the hill slope, there is a large accumulation of drift banked against the hill or occurring in mounds; and Mr. Cruise has noted a similar drift, farther S.W., in the neighbourhood of Lough Awee; and in the vicinity of Loughs Glennaun and Pribrum he observed "drift more or less covered with peat," and of it noted, "It is in part banked against the hills and in other parts occurs in small round hillocks. The drift contains large and small boulders of granite and felstone." Near the shore of Kilkieeran Bay, in places, there are accumulations of rocky-moraine-drift. Here as well as many other places in the district, erratic blocks protude through the bog envelope, while in others they are lying or perched on the crags.

G.H.K. & H.L.

Ice Striae and dressed rocks, with notes on the associated perched blocks and drift.—As in the rest of Yar-Connaught, the rocks here, in general, are moulded, planed, and often grooved, striated, and polished, as if by sheets of ice charged with stones and other rock debris passing over and denuding them. This is supposed to be due to the ice which glaciated the central plain of Ireland, and to local glaciers originating amongst the adjoining mountains. In this district the ice-tracks seem principally to be those left by the ice sliding into Galway Bay; besides these there seem also to be a few marks left by the primary ice and by the ice of a glacier which may once have filled the valley of Galway Bay. The ice sliding into Galway Bay had tributary streams when the land was of sufficient altitude, which have also left their tracks; and to the north-east of the district, on the northward slopes of some of the hills, there may be the tracks of some of the tributaries of the glacier of the Oughterard valley (a branch of the Lough Corrib glacier), which lies in the country to the north and north-east. In the accompanying table a classification of the different systems of striae has been attempted. The striae supposed to belong to the primary glaciation appearing in column A, those of the Galway Bay glacier in column B, and those of the main tributaries of the Galway Bay glacier in column C; while in column D will be found, the striae cut by the branches of the last named tributaries, and also by the branches of the tributaries of the Lough Corrib glacier. Towards the end of the table, while recording the striae in the vicinity of Cashla and Greatman's Bays, a peculiar system of local striae are also noted. These were undoubtedly cut by ice sliding into Galway Bay, but as it is a much more recent ice than most of the rest, and in these localities the recording of them does not interfere with other systems, they have been placed in column D, with special notes mentioning the system to which they belong.

TABLE OF SUPPOSED ICE STRIAE.

Inch Map.	County Map.	Townland and Locality.	Striae A.	Striae B.	Striae C.	Striae D.	Remarks.
103	Galway, 50/4.	Rosroc, on west coast,	-	-	-	N. 75 E.	The striae in column D may possibly belong to the primary striation, as they agree with the axes of the dressed-rocks, the bearing of the bays, and other features of the country; but as they coincide with the fall of the ground, into Bertraghboy Bay, they have been considered as if cut by the ice of that branch of the Roundstone Bay branch of the Galway Bay glacier. It is not evident what caused the N. 10 E. striae, but perhaps it may be due to ice moving south. The E. and W. striae are supposed to be due to the Galway Bay glacier when it was of huge dimensions, or perhaps they may be of the same system as the striae in column D, deflected by some local cause. However, as will be hereafter seen, there are other sets that seem also to belong to this east and west system.
104	-	Rosroc, on east coast,	-	-	-	N. 60 E.	
-	Galway, 51/3.	Canower, on sea-coast,	-	-	-	N. 50 E.	
-	-	Lehanagh, south, on the rocky bay to the S.E.	-	-	-	N. 45 E.	
-	-	Lehanagh, South, on many places near the road.	-	-	-	N. 55 E.	
-	-	Bunnahown, close to the E. end of the bay.	-	-	N. 10 E.	N. 45 E.	
-	-	Bunnahown, a little S.S.W. of the last.	-	E. & W.	-	-	
-	-	Bunnahown, in many places between the river and the sea-shore.	-	-	-	-	
-	Galway, 51/4.	Bunnahown, at Gowla River,	-	-	-	N. 50 E.	
-	-	Gowla, at the river,	-	-	-	N. 60 E. to N. 55 E.	
-	-	Gowlan, east,	-	-	-	N. 50 E.	Rocks dressed by ice going S.W. Nearly all the islands in this lake are "torn," or dressed hummocks, bearing N. 30 E., or thereabouts, which is also the bearing of the major axis of the lake. In the country to the north, north-west, and west of this lake the rocks are well rounded and dressed. Mr. Campbell resided at Inver Lodge while collecting information in Yar-Connaught for "Frost and Fire," in which work will be found many interesting speculations respecting this country, together with faithful sketches of ice-planed and dressed rocks.—"Frost and Fire," Vol. II., p. 18, et sequi.
-	Galway, 52/2.	Lough Invernagleragh, west shore,	-	-	N. 28 E.	-	
-	-	Lough Invernagleragh, Inver Lodge Island.	-	-	N. 28 E.	-	
-	-	Turloughmore, Creggaun,	-	-	N. 30 E.	-	
-	-	Turloughmore, at the N.E. boundary,	-	-	N. 28 E.	-	
-	-	Turloughmore, at Lough Bunnahask,	-	-	N. 10 E.	-	
-	-	Turlough, at Lough Ailtarra,	-	-	N. & S.	-	
-	Galway, 52/4.	Knockadav, Lough Invernagleragh,	-	-	N. 15 E.	-	
-	-	Knockadav, hill west of Lough Adax,	-	-	-	-	
-	-	Knockadav, further west on old road.	-	-	N. 16 E.	-	

TABLE OF SUPPOSED ICE STRIÆ—continued.

Inch Map.	County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
164	Galway, 62/4.	Knockadav, immediately north of the lake.	-	-	-	N. 75 E.	To the N.N.W. of Lough Aday bosses of rock crag to the S.W., but there are blocks of the porphyritic granite north of the boundary, seemingly proving that the last ice of the country was going northward,* from this it is supposed the N. 50 E. striæ were cut by ice going to the N.E. to the Oughterard Valley. The N. 75 E. striæ at the lake could scarcely be due to this ice, but may possibly have been cut by ice sliding down the hill on its way to join the ice of the Galway Bay valley.
-	-	Knockadav, half a mile E.N.E. of the lake.	-	-	-	N. 50 E.	
-	-	Knockadav, hill north of Lough Ahalia.	-	-	-	-	
-	Galway, 63/3.	Ilenny, in the vicinity of Lough Aughawoolia.	-	-	N. & S. to N. 10 E.	-	
-	-	Glentrasna, at the old road, N.W. of hamlet.	-	-	-	-	The north side of this hill is dressed, forming a slope, while the south consists of crags looking southward. Beautifully cut "tors," or dressed hummocks, which tail northward and crag southward. It is not improbable but that this valley was occupied first by the primary and afterwards by the secondary ice, as the former might be deflected into it by the hills on either side.
-	-	Ilenny, south-east corner.	-	-	-	-	
-	-	Leam West, N.E. slope of the hill (1,088), north-east of the village of Glentrasna.	N. 56 E.	-	-	N. 30 E.	On the slope of the hill, bounding the glen to the north, from 700 to 1,088 feet in altitude, the rocks are all dressed and crag southward. The striæ seems due to ice on its way to Galway Bay. On the northern side of the hill there are dressed hummocks, bearing N. 65 W.; there is also a deep fissure cutting the ridge at N. 25 E., the sides of which are planed and dressed.
-	-	Leam East, hill (846) north of Lough Nahoulurtia.	-	-	-	-	The N. 56 E. striæ may possibly be part of the primary striation, as it is on high ground which opens to the N.E. The N. 5 E. striæ seems to have been cut by ice going northwards to the Oughterard valley. On the N.E. face of the hill there are well marked cliffs at heights of 720 feet, 750 feet, 1,063 feet, and 1,094 feet, looking northward; they seem to be recent compared with the dressed hummocks, in fact blocks are falling from them at the present day. May they not have been cut by marine action?—more especially as cliffs, at nearly the same heights, occur in the barony of Burren, county Clare, &c., at distances from this of 20 and 40, &c., miles.
-	Galway, 63/4.	-	-	-	-	-	The dressed hummocks or "tors," on this summit run nearly N. and S., but they crag to the south-east. In the valley to the S.E., in the vicinity of Loughs Naphaghin and Nabroughdon, there are hummocks of drift which form irregular N.W. and S.E. ridges, coinciding with the general bearing of this valley.

To the east of the lake the axes of the tors run N. W. and S. E., agreeing with the bearing of the ridges of the drift mentioned in the preceding note. In the valley, to the N. W. of the lake, there are irregular lines of hummocks of drift, which coincide with the fall of the valley (N. W. and S. E.), also the slope to the south of this valley is covered with large heaps of rocky moraine drift.

These are supposed to be due to the glacier of Bertraghboy Bay.

Rocks planed and dressed.

103	Galway, 63/2.	Shannadullaghau, east of Lough Shannawona.	-	-	-	N. 40 E.	These N.E., and nearly N.E. striæ, are supposed to have been cut by the ice going to Bertraghboy Bay; however, as before observed, they may be due to the primary ice. Here, it will be observed, that, as well as in Bunnahown, there is a nearly E. and W. system of striæ which may be distinct from the other as in one locality (Gowlingbeg Bridge), the two systems were found on one rock surface. However, it is possible that all might have been cut by the one glacier, certain local peculiarities deflecting the ice in some particular places. In other localities there are striæ, separated from the rest, that run nearly N. and S. (N. 20 E.); these, possibly, may be due to ice going nearly south to Galway Bay. Nevertheless, here also, local irregularities may have deflected the ice, as must have been the case on the N.W. slope of Knockboy, where the ice of the Bertraghboy Bay valley went in a S. 25 W. direction. In Moyrus, near the Boat-harbour, the rocks are dressed, but no striæ were observed. At Dooletter there is a drift escarpment at about 150 feet level; and near the shore of Kilkieran Bay, in the townland of Kylesalia, there is, in places, an undulatory rocky drift.
104	Galway, 63/4.	Inishnee, east shore, } Letterard, } At junction of } Glinak, } townland.	-	-	-	N. 50 E.	
103	Galway, 63/4.	Moyrus, near the boat harbour.	-	-	-	-	
104	Galway, 63/4.	Moyrus, north of Lough Cam, Glinak, immediately S. of Lough-sunnadown.	-	-	-	-	
-	-	Glinak, on the S. W. slope of Knockboy.	-	-	-	N. 45 E.	These N.E., and nearly N.E. striæ, are supposed to have been cut by the ice going to Bertraghboy Bay; however, as before observed, they may be due to the primary ice. Here, it will be observed, that, as well as in Bunnahown, there is a nearly E. and W. system of striæ which may be distinct from the other as in one locality (Gowlingbeg Bridge), the two systems were found on one rock surface. However, it is possible that all might have been cut by the one glacier, certain local peculiarities deflecting the ice in some particular places. In other localities there are striæ, separated from the rest, that run nearly N. and S. (N. 20 E.); these, possibly, may be due to ice going nearly south to Galway Bay. Nevertheless, here also, local irregularities may have deflected the ice, as must have been the case on the N.W. slope of Knockboy, where the ice of the Bertraghboy Bay valley went in a S. 25 W. direction. In Moyrus, near the Boat-harbour, the rocks are dressed, but no striæ were observed. At Dooletter there is a drift escarpment at about 150 feet level; and near the shore of Kilkieran Bay, in the townland of Kylesalia, there is, in places, an undulatory rocky drift.
-	-	Glinak, a little S. of Knockboy.	-	-	-	N. 25 E.	
-	-	Knock, at the north margin of Lough Bola.	-	-	-	N. 40 E.	
-	Galway, 64/1.	Ilauingorm, South.	-	-	-	N. 45 E.	
-	-	Croaghau, west shore.	-	-	-	N. 35 E.	These N.E., and nearly N.E. striæ, are supposed to have been cut by the ice going to Bertraghboy Bay; however, as before observed, they may be due to the primary ice. Here, it will be observed, that, as well as in Bunnahown, there is a nearly E. and W. system of striæ which may be distinct from the other as in one locality (Gowlingbeg Bridge), the two systems were found on one rock surface. However, it is possible that all might have been cut by the one glacier, certain local peculiarities deflecting the ice in some particular places. In other localities there are striæ, separated from the rest, that run nearly N. and S. (N. 20 E.); these, possibly, may be due to ice going nearly south to Galway Bay. Nevertheless, here also, local irregularities may have deflected the ice, as must have been the case on the N.W. slope of Knockboy, where the ice of the Bertraghboy Bay valley went in a S. 25 W. direction. In Moyrus, near the Boat-harbour, the rocks are dressed, but no striæ were observed. At Dooletter there is a drift escarpment at about 150 feet level; and near the shore of Kilkieran Bay, in the townland of Kylesalia, there is, in places, an undulatory rocky drift.
-	-	Gowla, west of the bridge.	-	-	-	N. 70 E.	
-	-	Gowla, farther west.	-	-	-	N. 70 E.	
-	-	Callanacruk, north of Callaherick Lough.	-	-	-	-	
-	-	Callanacruk, on hill N. W. of Callaherick Lough.	-	-	-	-	These N.E., and nearly N.E. striæ, are supposed to have been cut by the ice going to Bertraghboy Bay; however, as before observed, they may be due to the primary ice. Here, it will be observed, that, as well as in Bunnahown, there is a nearly E. and W. system of striæ which may be distinct from the other as in one locality (Gowlingbeg Bridge), the two systems were found on one rock surface. However, it is possible that all might have been cut by the one glacier, certain local peculiarities deflecting the ice in some particular places. In other localities there are striæ, separated from the rest, that run nearly N. and S. (N. 20 E.); these, possibly, may be due to ice going nearly south to Galway Bay. Nevertheless, here also, local irregularities may have deflected the ice, as must have been the case on the N.W. slope of Knockboy, where the ice of the Bertraghboy Bay valley went in a S. 25 W. direction. In Moyrus, near the Boat-harbour, the rocks are dressed, but no striæ were observed. At Dooletter there is a drift escarpment at about 150 feet level; and near the shore of Kilkieran Bay, in the townland of Kylesalia, there is, in places, an undulatory rocky drift.
-	-	Callanacruk, Lough-na-graigue, Beagha, at the N. of the townland.	-	-	-	N. 45 E.	
-	-	Glinak, at the bridge.	-	-	-	N. 50 E.	
-	-	Glinak, south of Lough Clingacomeen.	-	-	-	N. 60 E.	
-	Galway, 64/2.	Gowla, half a mile N.E. of Corrakin-knock Loughs.	-	-	-	N. 45 E.	These N.E., and nearly N.E. striæ, are supposed to have been cut by the ice going to Bertraghboy Bay; however, as before observed, they may be due to the primary ice. Here, it will be observed, that, as well as in Bunnahown, there is a nearly E. and W. system of striæ which may be distinct from the other as in one locality (Gowlingbeg Bridge), the two systems were found on one rock surface. However, it is possible that all might have been cut by the one glacier, certain local peculiarities deflecting the ice in some particular places. In other localities there are striæ, separated from the rest, that run nearly N. and S. (N. 20 E.); these, possibly, may be due to ice going nearly south to Galway Bay. Nevertheless, here also, local irregularities may have deflected the ice, as must have been the case on the N.W. slope of Knockboy, where the ice of the Bertraghboy Bay valley went in a S. 25 W. direction. In Moyrus, near the Boat-harbour, the rocks are dressed, but no striæ were observed. At Dooletter there is a drift escarpment at about 150 feet level; and near the shore of Kilkieran Bay, in the townland of Kylesalia, there is, in places, an undulatory rocky drift.
-	-	Loughavee, west of Lough Awee.	-	-	-	N. 20 E.	
-	Galway, 64/3.	Knockboy, at the road N.W. of Black Lough.	-	-	-	N. 25 E.	
-	-	Dooletter east and west, north of Loughanalyzer.†	-	-	-	N. 40 E.	
-	Galway, 64/4.	Kylesalia.	-	-	-	-	-

* These blocks might possibly have been brought from the tract of granite a little north of Lough Aughawoolia, in the district to the north (Sheet 94).

† This Loughanalyzer is not that which is marked on the one-inch map, but is an east and west lake that lies half a mile to the W.S.W. of it.

TABLE OF SUPPOSED ICE STRIÆ—continued.

Inch Map.	County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
104	Galway, 65/1.	Turloughmore, east of Inverbeg Lough.	N. 30 E.	-	N. 15 E.	-	The ridges of rock range N. 30 E., but crag to the S.E.
-	-	Turloughmore, at the mouth of the Inverbeg river.	-	-	N. 10 E.	N. 30 W.	These are on the one rock surface, but not on the same part of it, so that their relative ages could not be determined; however, the N. 30 W. striæ seems to have been cut by a tributary glacier to the ice flowing down Kilkieran Bay.
-	-	Turloughmore, sea shore of bays south of Inverbeg, in numerous places.	-	-	N. 15 E.	-	-
-	-	Turloughmore, south of Invermore Lough, in different places.	-	-	N. 15 E.	-	-
-	-	Derryrush, south of Lough Avally, 931 Δ.	-	-	N. 20 E.	-	The first set of striæ recorded are near the point of the north-east shoulder of the mass of hill called Slieve Moirdaun, and above them (to the S.W.) the slope is covered with large blocks, one of which is very remarkable, standing overhanging on a cliff W. and is figured in "Frost and Fire," Vol. II., page 29. The eastern face of Derryrush hill is very steep, but it is covered with innumerable dressed hummocks, which slope to the N.N.E. and crag to the S.S.W. The striæ occur in numerous places up to the summit, the altitude of which is 931 feet.
-	-	Derryrush, on south slope, Derryrush, on E.S.E. face of the hill.	-	-	N. 20 E.	-	-
-	-	Derryrush, on S.E. face of the hill.	-	-	N. 10 E.	-	-
-	-	Derryrush, on sea shore, half a mile S.E. of the last.	-	-	N. 25 E.	-	-
-	-	Derryrush, on sea shore, half a mile N.E. of the last.	-	-	N. 25 E.	-	-
-	-	Gortmore, north of Lough Aroolagh.	-	-	N. 20 E.	-	The ridges of rock run N. 25 E., but they seem since their formation to have been dressed on the west side, causing them to crag to the S.E. They may originally have been cut by ice coming from the N.W., and their form been afterwards modified. One of these dressed hummocks is sketched in "Frost and Fire," Vol. II., page 7. The hill to the north-east of this is dome shaped and is dressed to its summit (463 feet).
-	Galway, 65/2.	Turloughmore, south of Lough Aroolagh.	N. 55 E.	-	N. 15 E.	-	The N. 55 E. striæ seem to have been cut by ice from the N.E. on its way down Kilkieran Bay, but whether it was part of the primary ice or a more recent glacier was not proved; the newer striæ, N. 15 E., occur in different places.
-	-	Glencob, at road north of sea shore,	-	-	N. 10 E.	-	-
-	-	Derravonna, in several places on the sea shore.	-	-	N. 20 E.	-	-
-	-	Canusoughter, west shore,	-	-	N. 20 E.	-	Dressed hummocks sloping to the N.N.E. and cragging towards the S.S.W.

Galway, 65/3.	Kilbricken,	-	-	-	N. 25 E.	-	-	-
-	Turloughbeg,	-	-	-	N. 15 E.	-	-	-
-	Roskeeda,	-	-	-	N. 10 E.	-	-	-
Galway, 65/4.	Rossmuck, on the east shore,	-	-	-	N. 15 W.	-	-	-
-	Clynagh Island, on the W.S.W. shore,	-	-	-	N. 10 E.	-	-	-
-	Canusoughter, on the west shore,	-	-	-	N. 10 W.	-	-	-
-	Canusoughter, a little S.S.W. of last,	-	-	-	N. 15 E.	-	-	-
-	Canusoughter, N. of village in several places,	-	-	-	N. 5 E.	-	-	-
Galway, 66/1.	Derravonniff, N.W. of Lough Nafunnace.	-	-	-	N. 20 E.	-	-	-
-	Lettermore, on the S.E. slopes of Lackadunna.	-	-	-	-	N. 30 E.	-	-
-	Shannawona, N.W. of Loughaunierin,	-	-	-	-	N. 35 W.	-	-
Galway, 66/1.	Shanally, Shannaweeleen, 879 Δ feet.	-	-	-	-	-	-	-
-	Shanally, S.W. of the hill summit,	-	-	-	-	-	-	-
Galway, 66/2.	Lugganaffrin, summit 905 Δ feet,	-	-	-	N. 5 E.	-	-	-

All the striæ here enumerated seem to have been cut by the ice going southwards into Galway Bay. Those in Rossmuck have a westerly agreeing with the course of the sound between Rossmuck and Clynagh Island. Those on Clynagh Island are on the east and west slopes of a small hummock of rock. Those in Canusoughter agree with the winding of the sound to the west, while those in Canusoughter agree with the fall of the hill.

On the northern and southern slopes of Lackadunna (1,060 feet) there are small dressed hummocks forming steep sides to the hill, but the whole mass falls to the N.W. On the N.W. shoulder the dressed hummocks bear about N. 35 E., and crag to the S.W. On Lettermore hill, which lies immediately S.W. of Loughaunierin, there are crags and cliffs, the faces of which are dressed and look E. and N.E. in the valley between this hill and Lackadunna the striæ bear N. 30 E., while N.E. of this hill they run N. 35 W. Both systems seem due to the ice coming from the high ground on the north (Shannawona, 1,138 feet Δ), part of which went westward, down the valley of Lettermore, and part eastward on its way to the Cashla river valley. The cliffs are evidently older than the last ice in the country; there are no heights marked on them, but they slope from and are a little below ground 331 feet high. From this it would appear that they must be on the same level as some of the cliffs in Leam West, previously mentioned; the latter are supposed to be of marine origin, but are being modified every day. These may also be of similar origin, and after the land rose the newly-exposed ground was re-covered with ice, and the rocks forming these cliffs dressed.

This hill is more or less dressed and planed on its northern and western sides, but it has small crags looking to the south-east.

On ground about 200 feet high. The hill of Lugganaffrin bounds the valley of the Cashla river on the west. To the N.E. of the summit, at a height of about 600 feet, there is a line of cliff (quere water formed?), and on the south slope of the hill, between the heights of 450 and 600 feet, the ground is covered with large erratic blocks.

TABLE OF SUPPOSED ICE STRIÆ—continued.

Inch Map.	County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
104	Galway, 66/2.	Cloghermore, summit 298 Δ feet.	-	-	-	-	Knockaclogher has a nearly N. and S. bearing. The northern end is a boggy slope, which seems to overlie drift. To the N.W. and W. between the heights of 450 and 550 feet, the slope is covered with large erratic blocks: the space occupied by them being about three-quarters of a mile in length and at least 100 yards in breadth. Perhaps these may be the remains of the lateral moraine of the glacier that last occupied this valley.
-	Galway, 66/4.	Lugganimagh, summit 718 Δ feet.	-	-	-	-	The mass of this hill forms a "crag and tail," bearing about N. 25 W. and taling N.N.W., but north of the summit of the hill there are dressed hummocks of rock bearing N. 30 E., and sloping towards the N.E. On the eastern side of the hill, at about a height of 650 feet, there are cliffs looking N.E., E., and S.E., but these are supposed to have been formed by water.
-	-	Formoyle, { At the village to the S.W. of the hill, on a steep slope to the S.W. }	-	-	N. 20 E.	-	The hill of Formoyle (509 Δ feet) is planed and dressed into a large "crag and tail," which tails to the N.E. and crags to the S.W. The axis of the hill bears about N. 40 E. The escarpment or crag to the S.W. is covered with large perched blocks. On this hill the striæ are weathered off, but they were observed to the S.W. of the crag.
-	Galway, 76/4.	Mason Island, { } Duck Island, { } Formoyle, { A little west of the former, on less steep and lower ground, }	-	-	N. & S.	-	The rocks are rounded and dressed, but no striæ were noted by Mr. Cruise.
-	-	Duck Island,	-	-	N. 35 E.	N. 45 E.	These are recorded by Mr. Cruise as "on one rock surface, the N. 45 E. being nearest." The N. 30 E. might possibly belong to the primary striations; however, it is more probable that both sets were cut at different periods by a glacier coming out of Kilkeran Bay.
-	Galway, 77/1.	Rusheenynulligan, on the sea shore.	-	-	N. 20 E.	-	These were observed on the point, south of the village of Carna, and seem due to ice going into Galway Bay.
-	-	Armore, at the trig. point 355.	-	-	N. 30 E.	-	These are supposed to have been cut by the ice coming down Kilkeran Bay; but possibly they may be due to the primary ice.
-	Galway, 77/2.	Kilkeran, north of Loughanmore.	-	-	N. 25 E.	-	These are supposed to be due to the ice coming southward into Galway Bay. The north and west sides of Lettercallow slope gradually from the hill-top to the sea. On the south side of the hill, north of the hamlet called Ross, are small cliffs or crags that face to the south-south-east.
-	Galway, 77/4.	Kilkeran, on the shore south of the pier.	-	-	N. 25 E.	-	
-	-	Ilannakirka,	-	-	N. 15 E.	-	
-	-	Lettercallow,	-	-	N. 15 E.	-	

Galway, 78/1.	Inishtravin, N.E. corner.	N. 70 E.	N. 15 E.	-	-	-	The striæ in column B are undoubtedly older than those in column C, as the latter always cut the former, and sometimes nearly obliterate them. The ice which cut the first seems to have come from the eastward, and may have been part of the mass coming down Galway Bay; or it might possibly have been the primary ice deflected and coming down Camus Bay, but the first suggestion appears most probable. The two sets of striæ running N. 40 E. are on the faces of cliffs looking N.W., which accounts for the variation in the bearings. The striæ in column C are supposed to be due to the mass of ice sliding into Galway Bay and the variation in their bearing is due to the sides of the dressed hummocks on which they are preserved. At the west end of the island the "tors" or dressed hummocks tail to the N.N.E.
-	Inishtravin, a little south of last.	N. 70 E.	N. 15 E.	-	-	-	The exposed rocks in this townland are all planed and dressed, but usually the striæ are weathered off. The ice seems to have come from the N.N.E., as the "tors" tail in that direction. At the west coast in the granite are fine veins varying from an inch to three or four inches in width which, generally stand up about an inch and a half above the rest of the rock.
-	Inishtravin, a little south of last.	-	-	-	-	-	Unweathered veins two inches in height.
-	Inishtravin, on the E. coast of the N. bay into island.	N. 40 E.	N. 15 E.	-	-	-	On this line of coast it is strikingly apparent that the small bays and cooses run with the bearing of the striæ, while the joints in the rock are all transverse to these bays, showing that the structure of the rock hereabouts has nothing to do with their formation.
-	Inishtravin, at S. end of the north bay.	-	-	-	-	-	The rocks forming the coast line have a glacial surface but no striæ were observed; inland there is an irregular N. and S. ridge of rocky moraine drift, and the promontory has a similar general bearing.
-	Inishtravin, at N.W. end of the island, in two places.	N. 40 E.	-	-	-	-	About Lough Atinnyadda and the north coast the rocks were planed and dressed, but the striæ are now weathered off. The axes of the hummocks run about N.E. and S.W., with crags to the S.W.
-	Inishtravin, on coast a little S.S.E. of last.	-	-	-	-	-	On this island the hummocks slope to the N.N.E., and crag to the S.S.W. A line of escarpment runs for over half a mile rudely parallel to the southern coast line, and about a quarter of a mile from it; south of this escarpment there are irregular hillocks of rocky drift with a general bearing of N.N.E. The hill on the north, the summit of which is 388 Δ feet, is dressed into a dome, except on the southern side. East of the village of Ross the unweathered veins in the granite stand up one inch, while at the north of the island, east of Gasha point, they are three inches in height; however, in this latter locality the associated rock is of a very loose character.
-	Inishtravin, at the S.W. corner of the island.	-	-	-	-	-	
-	Garrivagh, west coast.	-	-	-	-	-	
-	Garrivagh, west of harbour.	-	-	-	-	-	
-	Garrivagh, east of harbour.	-	-	-	-	-	
-	Garrivagh, east coast in two places.	-	-	-	-	-	
-	Lettermore Island, Cashla Point.	-	-	-	-	-	
-	Lettermore Island, immediately E. of Point.	-	-	-	-	-	
-	Annaghvaan, south shore.	-	-	-	-	-	
Galway, 78/2.	Rosnuck, coast of Camus Bay, in different places.	-	-	-	-	-	
-	Muckanaghderaulia.	-	-	-	-	-	
-	Bealadangan.	-	-	-	-	-	
-	Carrowroe North, Lough Alawny.	-	-	-	-	-	
Galway, 78/3.	Lettermore Island, N.W. shore in five places.	-	-	-	-	-	
-	Lettermore Island, north shore.	-	-	-	-	-	
-	Lettermore Island, a little E. of the Coastguard Station.	-	-	-	-	-	
-	Lettermore Island, a little W. of Coastguard Station.	-	-	-	-	-	
-	Lettermore Island, a mile further west.	-	-	-	-	-	

TABLE OF SUPPOSED ICE STRIÆ—continued.

Inch Map.	County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
104	Galway, 78/4.	Carrowroe West, Lough Augha-gaddy.	-	-	N. 10 E.	-	The porphyritic granite has been scooped out, forming a dressed, grooved, and striated rock basin for this lake. On the coast, half a mile W.S.W. of this lake, the unweathered veins stand up one and a half inches.
-	-	Carrowroe West, on the coast half a mile to the S.W. of last.	-	-	N. 10 E.	-	The N. 5 E. striæ seem to have been cut by the mass of ice from the Yar-Connaught hills on its way to Galway Bay. The striæ with a westing appear to belong to a local system occurring in the neighbourhood of Greatman's and Cashla bays more fully described hereafter in the notes on Sheets 90 and 91. The large westing of the striæ N. 35 W. may be due to the ice being deflected by the comparatively high ground to the south and north of the village of Crumpaun.
-	-	Carrowroe North, S.W. of Carradilla Lake.	-	-	-	N. 35 W.	
-	-	Lettermuckoo, north end of Carradilla Lake.	-	-	-	N. 15 W.	
-	-	Derryneen, Lough Hawinghaneekyne.	-	-	-	N. 10 W.	
-	-	Derryneen, sea coast.	-	-	-	N. 15 W.	
-	-	Clynagh, Crumpaun.	-	-	N. 5 E.	-	
-	Galway, 79/1.	Muckanaghkillew.	-	-	-	-	
-	-	Fornoyle.	-	-	-	-	
-	-	Glencolumbkille.	-	-	N. 10 E.	-	In these townlands, along the valley of the Cashla river, there are hillocks of rocky moraine drift with large blocks. In Glencolumbkille, the rocks and islets are formed of dressed hummocks, the axis of which run N. 10 E. On some of the former are perched blocks.—See fig. No. 9 (<i>Frontispiece</i>).
-	-	Knockadough.	-	-	N. 10 E.	-	
-	-	Derrykyle.	-	-	-	-	
-	79/2.	Lettermuckoo.	-	-	-	-	
-	-	Glencolumbkille and Shanapleasteen.	-	-	-	-	
-	Galway, 79/3.	Derryneen, Cashla River.	-	-	N. 10 E.	-	Hummocks of rocky boulder drift occupying the south slope of the valley of the Cashla river.
-	-	Derrykyle, at mountain road north of parish boundary.	-	-	N. 10 E.	-	The N. 30 W. striæ are evidently newer than the others, which seem due to the ice sliding into Galway Bay.—(See notes on Sheets 90 & 91).
-	-	Derrykyle, S.W. of the last, on the slope of Knockadough.	-	-	N. 15 E.	N. 30 W.	Their extreme westing might possibly be due to the deflection caused by the valley on the S.E.; or perhaps they may not belong to the system hereafter mentioned, but be the result of a different ice stream sliding down from the northwest.
-	-	Derrykyle, on road further S.W.	-	-	-	N. 30 W.	A large split block, from which the lake takes its name. Its pieces are 20 by 14 by 14 feet, and 20 by 14 by 9 feet. On the slope of the hill to the west are hummocks of rocky drift with large perched blocks, one of which measured 15 by 15 by 9 feet.
-	Galway, 79/4.	Keeran-na-gark North, Lough-na-clogh.	-	-	-	-	These seem to have been cut by ice coming westerly down the valley of one of the tributaries of the Cashla river, and north of the hill, the summit of which is 478 Δ feet; or perhaps they ought to be in column B, being due to the ice of the Galway Bay glacier.
-	-	Bovroughaun, Lough Crockallenalee.	-	-	-	N. 70 W.	
-	Galway, 89/2.	Inishbarra, west coast.	-	-	N. 10 E.	-	
-	-	Inishbarra, east coast.	-	-	N. 10 E.	-	
-	-	Knock, north shore.	-	-	N. 15 E.	-	

Galway, 89/4.	Lettermullan, north-west shore.	N. 30 E.	-	-	-	-	The rocks on Lettermullan are more or less dressed and striated, but the polish is invariably weathered off. The N. 10 E. striæ seem due to ice sliding into Galway Bay. The N. 30 E. striæ may possibly be part of the primary striation; however, it is not impossible but that they were formed by the same ice as the others, but have a greater easting, the ice stream being deflected by the high land in Gorumna Island.
-	Lettermullan, north shore.	N. 30 E.	-	-	-	-	
-	Gorumna Island, north-east shore.	-	-	-	N. 10 E.	-	
-	Gorumna Island, N. of Ballynakill Lough.	-	-	-	N. 10 E.	-	
-	Gorumna Island, east of Ballynakill Lough.	-	-	-	N. 10 E.	-	
-	Gorumna Island, west coast.	-	-	-	N. 10 E. to N. 20 E.	-	
Galway 90/1.	Gorumna Island, north-east shore.	-	-	-	N. 20 E.	-	The striæ west of Rossaveel Lough (Sheet 90/2), which bear N. 80 E., may possibly have been cut by the glacier that came down Galway Bay; yet it is not impossible but that they may be due to another ice stream being deflected by Rossaveel Hill; however, this hill is so low (176 Δ feet) it does not appear probable. The striæ which bear N. 30 E. on the summit of Knockduff (Gal. 91/2) have been classed with the primary striæ, as there seems nothing against their belonging to that series. If they belong to the other, why should there be such a difference between their bearings? On Gorumna Island, and also in part of the country east of Cashla Bay, the rocks are well rounded and dressed, many surfaces being beautifully polished, more especially on the quartziferous porphyry which seem to be more silicious than the thence to and beyond the east margin of the district, a newer set of striæ exist, which always bear west of north. These, as a general rule, have a greater westing the more east they are situated, and are newer than the rest except in two localities at the east margin of the district (Coranona, Gal. 91/2). In these two localities this might be accounted for by two ice streams, both flowing into Galway Bay, advancing and retreating across each others track. The N. 10 E. striæ, that are newer than those in column D, may have been cut during a severe season when the land ice protruded into the ocean. It appears remarkable that both here and in all places in the neighbourhood where this striæ with a westing occur they are on low ground, and not on the high ground. All the nearly N. and S. striæ seem due to the ice sliding into Galway Bay. In column C, will be found one set of striæ which bears N. 5 W. (Coranona). This has been classed with the striæ having an easting as it is in the small valley of the Crumlin River, and might have been deflected by it. In the neighbourhood of this valley all the striæ of the other series have a large westing. In the townland of Keeranagark some of the rocks are beautifully polished and etched.
-	Gorumna Island, south-east shore.	-	-	-	N. 20 W.	-	
-	Carrowroe South, S.W. of Lough Natwynmore.	-	-	-	N. 30 W.	-	
Galway, 90/2.	Carrowroe South, on sea shore.	-	-	-	N. 10 W.	-	
-	Carrowroe South, a little S.S.W. of the last.	-	-	-	-	-	
-	Barraderry, Loughaunwillin.	-	-	-	N. 10 E.	-	
-	Barryderry, Lough Aleandillure.	-	-	-	N. & S.	-	
-	Barraderry, on the sea shore in two places.	-	-	-	N. 10 E.	-	
-	Rossaveel, on the sea shore N. of the lake.	-	-	-	-	-	
-	Rossaveel, west of the lake.	-	-	-	N. 20 W.	-	
-	Tonacrick.	-	-	-	-	-	
-	Ballindera, on the sea shore.	-	-	-	N. 10 E.	-	
-	Ballindera, a little south of the last.	-	-	-	N. 5 E.	-	
Galway, 90/3.	Gorumna Island, vicinity of Lough Awalla.	-	-	-	N. 10 E.	-	
-	Gorumna Island, vicinity of Lough Hibbert.	-	-	-	N. & S.	-	
-	Gorumna Island, east coast.	-	-	-	N. 5 E.	-	
Galway, 90/4.	Keeranbeg, east coast, a little north of Templeishmackauv church.	-	-	-	N. 10 E.	-	
Galway, 91/1.	Derrooga S., at road in various places.	-	-	-	N. 10 E.	-	
-	Ballindera, N.W. of Lough Asickkeen.	-	-	-	N. 10 E.	-	
-	Ballindera, N.E. of Lough Asickkeen.	-	-	-	N. 10 E.	-	
-	Cloghnore North, at the road.	-	-	-	N. 30 W.	-	
-	Bauragibbaun N., Knockduff 507 Δ .	-	-	-	N. 25 W.	-	
Galway, 91/2.	Glennaun, a little N.W. of Lough Ugga Beg.	-	-	-	N. & S.	-	

TABLE OF SUPPOSED ICE STRIÆ—continued.

Inch Map.	County Map.	Townland and Locality.	Striæ A.	Striæ B.	Striæ C.	Striæ D.	Remarks.
104	Galway, 91/2.	Cornarona, Lough Uggá Beg, Cornarona, south west of last, Keerannagark, a little east of the Coastguard Station.	-	-	N. 10 E. N. 10 E. N. 5 W.	N. 45 W. N. 35 W. N. 20 W.	(See last note.)
-	Galway, 91/3.	Banraghbaun, Loughaunneen, Banraghbaun, a little south of the last.	-	-	N. 5 E.	N. 15 W. N. 20 W.	Nearly all the rocks on this island are planed and scratched, but usually the polishing is weathered off. The bearing of the striæ agrees with that of the other primary striæ in the district. In favour of their belonging to the third set is the fact that the rocks on which they occur are similar in appearance to those on Lettermullen; also that these latter striæ, as will be seen in this table, have a greater easting, as they are noted further towards the west.
-	-	Banraghbaun, N. end of Lough Na-gravin.	-	-	-	N. 25 W.	On Lettermullen the rocks are dressed, planed, and striated, often being beautifully polished. The crags look towards the S.S.W. by S., and slope N.N.E. by N. As remarked in the preceding note, the striæ at the west of the island have the greatest easting.
113	Galway, 89/3.	Golan,	-	-	N. 5 E.	-	Observed on numerous rock surfaces. When two sets of striæ are on one rock surface, the N. 30 E. striæ are always the oldest. Hereabouts the dressed hummocks crag to the S.S.W. by S. Scattered erratics and porphyritic granite numerous.
-	Galway, 89/4.	Lettermullen, S.W. extremity, Lettermullen, south-east part, Lettermullen, south-east part,	-	-	N. 30 E.	-	The rocks on this promontory are all rounded and dressed; but as they are granites they are more weathered than most of the rocks on Gorunna and Lettermullen.
-	-	Gorunna, west part,	-	-	N. 10 E. N. 15 E. to N. 10 E.	-	
-	-	Gorunna, near Illaunanowrim,	N. 30 E.	-	N. 15 E. to N. 10 E.	-	
-	Galway, 90/3.	Gorunna, near west margin of sheet, Gorunna, on coast of Callownalecka, Gorunna, east portion,	- N. 30 E. -	-	N. 15 E. to N. 10 E. N. 5 E.	-	
-	Galway, 90/4.	Carrowroe, near south point, Keerannagark, in various places,	-	-	N. & S. N. 10 E.	-	

-	-	Keerannagark South, in various places,	-	-	N. 10 E.	N. 15 W.	
Galway, 91/3.	-	Keerannagark South, on sea coast,	-	-	N. 10 E.	N. 15 W.	
-	-	Banraghbaun South, in different places,	-	-	-	N. 15 W.	
-	-	Clogmore South, at west coast,	-	-	N. 20 E.	-	
-	-	Lough Nagravin,	-	-	N. & S.	N. 25 W.	
-	-	Clogmore South, at Coanascalka Bay,	-	-	N. 10 E.	N. 25 W.	
-	-	Ballynahown, a quarter of a mile N.W. of Blake's Lodge,	N. 30 E.	-	-	N. 25 W.	
-	-	Carton, on shore,	-	-	N. 5 E.	N. 30 W.	
-	-	Tully, east of Tully Lough,	-	-	-	N. 25 W.	
-	-	Tully, at Roman Catholic chapel,	-	-	-	N. 20 W.	
-	-	Minna, on sea shore,	N. 50 E.	-	-	-	
-	-	Minna, at Castle Point,	-	-	N. 10 E.	-	
-	Galway, 110/3.	Inishmore, 500 yards N.W. of Dunengus,	-	-	N. 15 E.	-	
-	Galway, 110/4.	Inishmore, south of Cowrugh, and S.E. of Nalhea,	-	-	N. & S.	-	

Rocks planed, rounded, and scratched; planing force coming from the northward; a new system N. 15 W. crossing obliquely the dressed hummocks. The half tide rocks are an old glacial surface, showing that although in other places the sea is yearly destroying the granite, yet here its work has been a minimum since the glacial period; or this may be due to the tide only recently having removed a coating of rocky boulder drift off this surface, as by other facts, as previously mentioned, it is proved the coast line is lowering. When two systems occur on one rock surface, the striæ with a westing cut, and consequently are newer than the others.—(See previous notes on the striæ in Sheets 90 and 91.)

On the summit of the sea cliff there is a patch of true boulder-clay-drift about 30 feet wide, 300 feet long, and 1.5 feet deep, lying on polished and striated limestone.

On the summit of the sea cliff, immediately S.E. of the small promontory called Nalhea, there is a patch of boulder-clay-drift, about 40 feet wide, 400 feet long, and 2 feet deep, the carboniferous rock under it being well planed, polished, and etched.

MINES AND MINERAL LOCALITIES.

NOTE.—Names printed in italics are localities at which trials have been made.

County Map.	Townland.	Minerals.	Proprietor.	Agent.
Galway, 74/2.	Ard.	Lead.	Law Life Society,	Mr. Robinson.
	COSTELLOE BAY MINES.			
Galway, 78/4.	Lettermuckoo (<i>Carrafinla</i>).	Lead and sulphur.	Do.	Do.
-	Clynagh (Crumpaun).	Lead.	Do.	Do.
Galway, 79/3.	Derrynea (<i>Loughaunweeny</i>).	Lead, copper, and sulphur.	Messrs. Regan and Cottingham.	—
-	Bovroughaun.	Tumblers of lead.	Law Life Society,	Mr. Robinson.
Galway, 91/1.	Derroogh South.	Lead.	V. Blake, esq.	Mr. Morris.
Galway, 90/2 & 91/1.	Rossaveel.	Lead, sulphur, and copper.	Do.	Do.
Galway, 91/3.	Inverin.	Do.	Messrs. Blake, and Rudd.	Do.
Galway, 91/3 & 91/4.	Minna.	Do.	Do.	Do.
-	Tully.	Lead?	V. Blake, esq.	Do.
	GREATMAN'S BAY MINES.			
Galway, 90/1.	Carrowroe South.	Lead.	H. Lambert, esq.	Mr. Robinson.
-	Maumeen.	Copper and sulphur.	C. St. George, esq.	—
-	Teeranea.	Gaussen lode (copper and sulphur?).	Do.	—
Galway, 90/3.	Do.	Sulphur and copper?	Do.	—
Galway, 90/4.	Keeraunbeg (Pointa).	Trace of lead.	Law Life Society,	Mr. Robinson.

Ard.—At the junction of Ard east and west, a trial shaft was sunk by the late Colonel Martin, between the years 1800 and 1810, but the lode was found unproductive. Mr. Cruise considered it to be the continuation of "a wild quartz lode seen on the sea shore about half a mile to the south-west." If this supposition be correct, the lode must be shifted by a fault, or crosscourse.

COSTELLOE BAY MINES.

Lettermuckoo [*Carrafinla Lode*].—This is a N. 60 W. lode hading S.W. at 80°, from one to three feet wide, and containing galenite, pyrite, and a little chalcopryite in a quartzose killas gangue. On the lode a shaft ten fathoms deep was sunk, but abandoned without further trial. Some good stones of galenite were raised, and the lode stuff on the bank seems to contain a good per centage of that ore. Captain Floyd, the agent who superintended the sinking of this shaft for the proprietors, has a very good opinion of the lode. The "country" in which it occurs is a friable felspathic rock.

Clynagh [*Crumpaun*].—This is a N. 80 W. lode, two feet wide, containing galenite in a vuggy spar. It was discovered while raising stones in a garden at Crumpaun, but no trial has been made on it, and very little is known about it.

Derrynea [*Loughaunweeny Lode*].—This is a N. 85 E. lode that hades

south at 80°, and contains galenite, pyrite, and chalcopryite; it occurs in hard granite, and is only from nine to twelve inches wide. A small trial shaft was opened on it by a Mr. Henry Crockford some years ago.

Bovroughaun.—East of the parish boundary, where the new road crosses the stream, tumblers of galenite were discovered in a hillock of rocky moraine drift; as this, the last locality, and the Carrafinla lode all lie in the same strike, these may possibly point to a mineral lode somewhere hereabouts.

Rossaveel and Derroogh South.—In the first named locality a N. 80 W. vertical lode, one to three feet wide, is seen on the shore of Costelloe Bay, there being galenite, pyrite, with a trace of chalcopryite, in a hard killas full of quartz strings. A small trial was made on it a few years ago by a miner named Patrick O'Brien, of Clynagh, under the direction of Mr. Henry Crockford. The lode also appears in Illaunawehichy, a small island off the shore. A little south of this lode is a N. 75 E. course of "peachy stuff" [*chloritic*], that has a slight hade to the S.S.E. At the east of the townland, south of Derrynea Lodge, a trial was made on flying veins of quartz with galenite and fluorite, while north of this, at the stream that divides this townland from Derroogh south, is a N. 25 E. perpendicular quartz lode, near which, while building the boat pier there situated, tumblers of galenite were found. Nearly a mile and a half east of this last locality, at the east village in Derroogh south, tumblers of galenite were observed in moraine drift.

Inverin and Minna.—This lode bears N. 45 W., and at the surface hades S.W. at 70°. Near Cashel House shallow workings were carried on some years ago by the then proprietor of the land, Mr. Blake. On the east of the lode, in the townland of Minna, a pump shaft, said to be twenty fathoms deep, was sunk and joined to the lode by levels. Two levels, one at eight fathoms, and the other at sixteen fathoms, were carried along the lode for about one hundred fathoms towards the N.W. The ore occurred mostly near the north wall. The lode stuff is vuggy, with strings of gaussen through it, and contains galenite, chalcopryite, and pyrite, a little barite, fluorite, calcite, &c., in a quartz gangue. Along both walls there seems to be floccan courses.

South-east of the working, on the sea shore, seemingly in the course of the lode just described, a lode containing vuggy quartz with fluorite was observed; and west of this lode, at the old castle, there is a gaussen lode bearing N. 10 W. North-west of the working, near Cashel House, on the course of the lode, a trial three fathoms deep was made. At this locality the lode near the surface is two feet wide, and has a course of lead, two inches wide, along the south wall with minerals scattered through the rest of the gangue. From the working near Cashel House it is said that "seven hooker loads of ore were shipped, most of which were of lead, but a few of them of copper ore. The lead ore is the variety called 'steel ore.'"

Besides this lode, indications were observed in other places. A little north of the junction of the road from Cashel House with the road from the sea to the main road, strings of galenite were observed; and about two hundred yards due south of the Police Barracks, there is a flying lode that bears N. 45 W., and contains fluorite with traces of pyrite and galenite.

Tully.—On the east of Tully Lough, and in the strike of the Inverin lode, are traces of a lode consisting of vuggy quartz with fluorite.

GREATMAN'S BAY LODES.

Carrowroe South.—The lode in this townland occurs near the east shore of Fearmore, or Greatman's Bay, a little south-west of Loughtawny-more. It is seemingly nearly perpendicular and bears N. 80 W. On the lode close to the new road to the boat haven, a trial was made, and Mr. H. Crockford is said to have raised out of it some large bunches of lead; however, there does not seem to have been any extensive works, as very little spoil lies at the mouth of the shaft. A quarter of a mile N.E. of this trial, tumblers of galenite are said to have been found under the garden at the Police Barracks.

Maumeen.—A little west of Maumeen pier, a nearly perpendicular N. 40 W. lode was noted. It is made up of rather gaussey granitic stuff in which are veins and strings of quartz with some pyrite, marcasite, and chalcopryite. A small open trial about seven feet deep was opened along part of the lode and only a small quantity of ore found.

Teeranea.—On the west shore of Greatman's Bay, and a little north of Trabaun point, there is a N. 45 W. nearly perpendicular lode; the gangue being a rather gaussey granitic stuff, with quartz strings, and indications of marcasite and chalcopryite.

Teeranea [Church Lode].—South of the village of Teeranea, at the ruins of Oilther Church, there is a wide E. and W. quartz lode of a good appearance, as it is soft, much stained with gaussey, and contains specks of pyrite. At the boat harbour this lode seems to be shifted a little to the north, while towards the west it was traced for about a hundred yards to a north and south granite vein, which possibly alter its course, or cut it off, as the lode was not observed west of this vein. There is a gaussey back to the N. and S. granite vein, while farther west, at a pond or small lake, in the strike of the quartz lode, there is a second granite vein with a gaussey back; this, however, seems to run nearly E. and W. It should also be mentioned that in the strike of the N. and S. granite vein, on the south shore of the island, a nearly N. and S. quartz lode was noted. The "church lode" seems to occur at the junction of the metamorphic sedimentary rocks with a tract of the intrusive granite.

Keeraumbeg [Pointa].—At the boat harbour, south of the hamlet called Pointa, strings of galenite in a hard granite, were pointed out. The rock is of such a hard character that it is highly improbable anything but strings or flying veins of the mineral could occur, and the locality has only found a place in this list because there is an idea in the neighbourhood that the strings indicate the existence of a lode.

G. HENRY KINAHAN.

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