Memoirs of the Geological Survey.

EXPLANATIONS

TO ACCOMPANY

SHEETS 114, 122, AND 123 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTIES OF CLARE AND GALWAY,

By F. J. FOOT, M.A.

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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.

In referring to the sheets of the six-inch map, they are commonly supposed to be divided into quarters, 1 being the N.W., 2 the N.E., 3 the S.W., and 4 the S.E. quarters: so that $\frac{25}{3}$ means the S.W. quarter of sheet 25 of any county.

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This district was surveyed by Mr. F. J. Foot, who has also drawn up the following descriptions.—J. B. J.

LIST OF THE ILLUSTRATIONS IN THIS EXPLANATION.

EXPLANATION

TO

ACCOMPANY SHEETS 114, 122, AND 123

OF THE MAPS OF THE

GEOLOGICAL SURVEY OF IRELAND.

General Description.

These Sheets of the Map contain the north-western extremity of the county of Clare, lying on the south side of Galway Bay, with small strips of the county of Galway on the northern and eastern edges of Sheet 114, and the island of Innisheer, the smallest and most easterly of the South Isles of Arran, on Sheet 122.*

They include the coast line from the southern shore of Liscannor Bay to the head of Galway Bay. The principal places of note are the small towns of Ennistimon and Corrofin, with the villages of Lehinch, Liscannor, Roadford, Lisdoonvarna, and Kilfenora, in Sheet 123; and the village of Ballyvaughan, in Sheet 114.

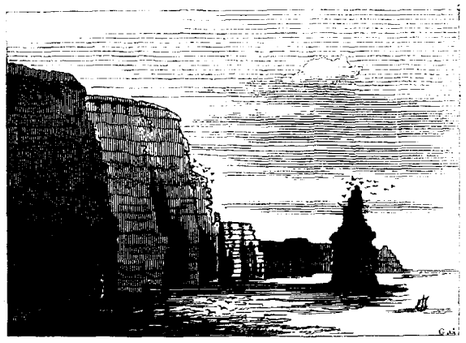
1. *Form of the Ground.*

The southern part of the district, about Ennistimon and Corrofin, although hilly, or at least abruptly undulating, does not present any very striking features. The loftiest hills are the ridge just W. of Corrofin, one point of which is 629 feet high, with a steep escarpment to the east, at the foot of which lies Inchiquin Lough. There are many eminences of 400 to 500 feet still further west.

To the north of Liscannor Bay, in the promontory of Hags Head, the ground also rises to heights of 500 and 600 feet, especially along the coast, which exhibits a line of magnificent precipices nearly three miles long, and rising at one part, quite perpendicularly, to a height of 668 feet; these form the well-known Cliffs of Moher.—(See fig. 1).

* This Island, and the small strip at the north side of Galway Bay on Sheet 114, will be described in the Explanation of Sheets 104 and 105.

Fig. 1.



The Cliffs of Moher.

To the S.E. of Corrofin, the ground is much lower, and a low tract, occupied very largely by lakes, runs thence towards Gort, through the district lying east of our present one.

To the northward of a line running through Corrofin, Kilfenora, and Roadford, however, a great change takes place in the aspect of the country. The ground rises higher as we proceed to the northward, till it attains, at several places, to an elevation of over 1,000 feet, and at one, Slieve Elva, to that of 1,109 feet above the sea.

The hills of which Slieve Elva forms the summit have rounded forms, and are covered with peat and heather; but the rest of the ground consists of hills of bare rock, with terraced sides, ending in all directions, except the south, in steep escarpments with numerous precipices.

One escarpment, of a very bold and striking character, rises about two miles N. of Corrofin, and runs thence unbroken, but greatly indented, to a point four miles west of Kinvarra, on Galway Bay, where it turns to the W. round the shores of that bay, and after sweeping round several deep valleys which stretch up from the bay into the hills, forms the promontory of Black Head, which rises to a height of over 1,000 feet within a mile of the shore; thence it gradually lowers as it runs S. along the coast, till it dies away near Fisherstreet. This continuous, but greatly winding escarpment, is the steep slope of a great plateau, the summit of which inclines gently to the S., and is intersected by many deep valleys and gorges, which cut it up into numerous hills; these hills are, for the most part, of bare rock, and their sides are, as it were, hewn into gigantic steps formed by a succession of small cliffs, with nearly flat terraces of rock at their bases and summits. The lines of cliff and terrace may be traced along and around the sides of the hills for many miles, and were it not for the gentle dip of the beds to the S., they would form actual contour lines.

The summits of the hills into which the upper part of the plateau is divided generally consist of an irregularly-shaped flat or gently sloping tablet of bare rock, ending all round in a little cliff, with other

small cliffs outside it, and lower down, so that some of the hills look like great citadels surrounded by fortification walls.

The bareness of the rock and its pale gray colour, contribute to give the ground an artificial appearance, while the extent of the cliffs and terraces as they sweep round the recesses of the valleys, or jut out upon the promontories, produce often the most singular and striking effects.

This rocky ground forms almost the whole barony of Burren, and is one of the most remarkable districts of Ireland. Its highest points are Slievecarran (near the S.E. corner of Sheet 114), 1,075 feet above the sea; Capanawalla, to the W. of Ballyvaughan, 1,025 feet, and the two nameless hills to the N.W. of that, which are 1,044 and 1,041 feet, respectively.

The principal valleys which intersect this portion of the district are, that of the Caher River, S. of Blackhead; the valley of the Rathborney River, at the mouth of which is the village of Ballyvaughan; the valleys of Turlough and Carran, which extend continuously from Bell Harbour (in Sheet 114) to Castletown (in Sheet 123), and the remarkable valleys of Glencolumbkille and Glenquin, which indent the eastern escarpment.

The River Fergus is the most important river of the district, and its course is rather singular. It rises in Lough Fergus, between Corrofin and Ennistimon, at an elevation of about 350 feet above the sea, flows eastward and northward for two miles and a-half, when it receives the Clooneen River; thence it takes an easterly course for a mile and a-half, when, on entering the limestone ground, it suddenly disappears in a swallow-hole or vertical cavity in the rock. Half-a-mile to the east it again emerges to the light, from a cavern called "Poulnaboe," from which it flows down into Inchiquin Lough, and thence into Lough Atedaun. No visible river flows out of this lough, but the Fergus is supposed to have a subterraneous course in a direction of about E.S.E. to Dromore Lough (in Sheet 124), whence it flows southward, now above and now below ground, to Ennis, and thence to the Shannon. The next most important river is the Inagh, which, entering the map at its southern edge, under the name of the Cullenagh River, at an elevation of about 150 feet, flows through the town of Ennistimon, where it forms a picturesque cascade, at the foot of which it becomes tidal. The Dealagh River is a small brook, also flowing into Liscannor Bay; and the Aille is a similar one, flowing from the high ground near Lisdoonvarna out to Fisherstreet.

The drainage of the northern and eastern portion of the district is, for the most part, effected by subterranean channels. The only visible stream courses are the Caher River, which flows into the sea at Fanore, and the Rathborney River, which flows into the head of the valley of Ballyvaughan, and disappears in a swallow-hole a little east of the R. C. chapel, whence it takes an underground course to to the sea *

After heavy rains the low ground is, in many places, inundated by floods, which come up through funnel-shaped apertures in the surface;

* This stream seems to discharge a considerable amount of water into the sea at all times, the latter being brackish for some distance from the shore, sufficiently so, indeed, for animals to drink it.

the temporary loughs or pools thus formed are called *turloughs*. Springs are frequent at the feet of the cliffs, many being perennial, but a considerable number of them are dry after drought; at one side of the spring there may generally be seen a little semicircular ridge or mound of earth, formed of the detritus accumulated after heavy rains. At the bases of many of the cliffs also are the mouths of caverns, some of which can be traversed for a considerable distance, and which, after rain, discharge large volumes of water, and sometimes flood the little valleys beneath. By this means, small alluvial flats, consisting of rich, fine, dark brown earth, are formed in several places; but they are useless for tillage, as the next flood would be liable to uproot and destroy the crop.

In some parts of Burren, the inhabitants, after long drought, suffer much inconvenience, having often to drive their cattle several miles to water; and at Ballyvaughan, under similar circumstances, water has to be procured, for drinking and culinary purposes, from a perennial well at Gleninagh, three miles distant.

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

Aqueous Rocks.

	Name of Rock Formations.	Colour on Map.
	Bog, Alluvium, &c.,	*Pale sepia.*
	Drift,	*Engraved dots.*
d^5	Coal Measures,	*Indian ink.*
	Black Lines—Coal Crops.	
	Blue Lines—Calcareous Bands.	
d^4	Upper Limestone,	*Prussian blue.*

d^4 *The Upper Limestone.*—The limestones of this district vary in colour from pale or dull bluish to dark gray; in texture they are generally compact or finely crystalline, but sometimes coarsely so. In thickness the beds vary from a few inches to ten feet or more.

Frequently, when large surfaces of bare rock are exposed, the limestone weathers into loose flaggy fragments, which emit a metallic sound when struck with the hammer; sometimes these fragments are so nicely balanced, as to quiver in the breeze with a tinkling noise, which, in very retired situations, has a strange effect. The rock is traversed by several sets of joints, which cut it up into blocks of various form and size. In exposed situations and near the surface, these joints are worn by the action of the rain and the weather, into open fissures, which are often several inches or a foot or more in width, and several feet in depth; they afford shelter to many rare plants which cling to their sides, or grow on the fine soil at the bottom.* The joints will be hereafter treated of in detail.

The limestone abounds locally in the ordinary Carboniferous fossils,

* Among numerous others, there occur in Burren, *Helianthemum canum*, *Spiræa filipendula*, (the only known Irish station), *Dryas octopetala*, *Potentilla fruticosa*, *Arbutus uva-ursi*, *Pyrola media*, *Gentiana verna*, *Ajuga pyramidalis*, *Orobanche rubra*, *Adiantum capillus-veneris*, *&c.*, *&c.*—(See "Distribution of Plants in Burren," by F. J. Foot, "Transactions of the Royal Irish Academy," vol. 24.

and seems generally to be almost completely composed of minute crinoid fragments.

It is also locally more or less magnesian, and then sometimes weathers into curious rounded knolls or bosses; this magnesian character, however, is never traceable for any great extent, though in one place a band of rusty brown dolomite, varying from three to eight feet in thickness, can be traced for several miles.

Small mineral veins, hereafter to be noticed in detail, were observed in several parts of the district.

Chert occurs both in bands and nodules, the latter often containing crinoids and corals.

The total thickness of as much of the limestone as is visible is upwards of 1,500 feet.

d^5 *Coal Measures.*—The beds immediately above the limestone are a set of black fissile shales, about eighty feet thick, abounding in fossils, principally Goniatites. These beds seem to be identical with the Upper Limestone shale of Derbyshire. Above these the beds consist of alternating grits, flags, and shales; the latter are generally fossiliferous, and in some places contain thin seams of coal and calcareous bands and nodules, which abound in fossils. The surfaces of some of the flags are covered by curious track-like marks,* evidently caused by some animals crawling on the sand, which, at that period, formed the ocean bed. These flags are applied to many domestic uses, such as roofing, flooring, and fencing, &c., and are quarried to a considerable extent; they are easily worked, the pickaxe and crowbar being found sufficient implements; they are to be had from one foot to several yards square.

The total thickness of Coal measures included within the limits of these sheets is about 960 feet.

Drift.—Excepting in the valleys the limestone may be said to be completely uncovered by drift or soil, all the vegetation springing from the chinks and open joints in the rock; but in the valleys there are sometimes considerable accumulations of drift, principally composed of a mixture of limestone gravel and granite pebbles and boulders.

In the fertile valley of Ballyvaughan, there are numbers of large and small boulders and blocks of porphyritic granite, identical with that which occurs *in situ* to the north of Galway Bay.

Near the boundary of the limestone and Coal Measures, and often extending for some distance over the latter, there is usually a considerable amount of limestone gravel, and the most productive land generally occurs along this line. A large patch of limestone gravel extends over the Coal Measures N. and N.E. from Liscannor, and near that village the limestone boulders are in such numbers as to be burned for manure.

Alluvium.—The principal alluvial lands are the flats at the head of Liscannor Bay, and also S.E. of Ennistimon, and those of the River Fergus, and those round the chain of lakes E. and N.E. of Corrofin. Beneath the alluvial flats, and also beneath the peat bogs, shell marl is frequently seen.

In the bed of Inchiquin Lough the heads and horns of the red deer and of oxen have frequently been found.†

* For figures and descriptions of these tracks, see Explanations of Sheets 141 and 142.
† Tradition tells us of the wild-ox frequenting Burren.

3. *Relations between the Form of the Ground and its Geological Structure, and general account of the latter.*

The high ground occupying the northern and eastern part of this district S. of Galway Bay, with a strip on the western side, extending southwards along the coast as far as Fisherstreet, is formed of the rocks of the Upper Limestone.

That extending from a point about one mile W. of Corrofin to Hags Head, and taking in Slieve Elva on the N., consists of the beds of the

Fig. 2.

Section from Galway Bay to Slieve Elva.

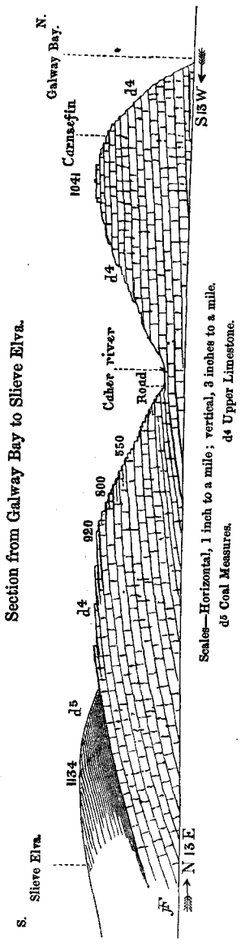
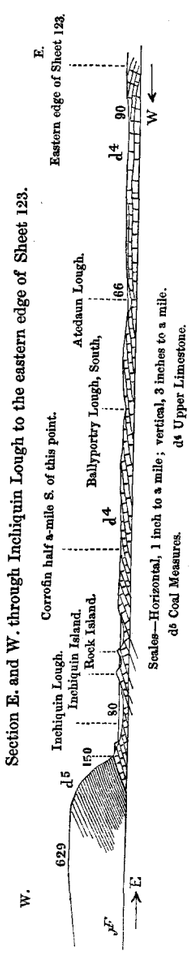


Fig. 3.

Section E. and W. through Inchiquin Lough to the eastern edge of Sheet 123.



Coal Measures, an *outlier* or isolated portion of which formation, also caps the hills between Lisdoonvarna and Ballyvaughan.

As is usually the case, the boundary between the limestone and Coal Measures is, for the most part, a prominent feature of the district, the denuded edges of the beds of the latter forming an abrupt escarpment over those of the former. In some places this escarpment is much bolder and more strongly marked than in others; but, generally speaking, it at once strikes the eye. The richest and most productive land is usually to be found along this line, being composed of a mixture of the *debris* of the rocks of both formations, the Coal Measure shale supplying the necessary alumina to the limestone. It is not improbable that, in ancient times, this strongly-marked natural line formed a political boundary, as numerous old castles (evidently strongholds) are ranged along it.—(*See Explanation of Sheets* 131 *and* 132, *page* 13).

In most districts in the S. and S.W. of Ireland, composed of the same rocks as that now being described, the limestone occupies the low ground or plain, while the Coal Measures form the high; but here the limestone tract of the N. and N.E. rises to elevations little less than the highest point (Slieve Elva) of the Coal Measures, while the mean height is much greater (see fig. 2). The S.E. corner of the map, lying E.S.E. and N.E. of Corrofin, follows the usual rule, and consists of low broken ground (see fig. 3).

The general facts as to the lie of these two formations, are few and simple. The limestone beds of the northern part dip almost invariably south, at a very gentle angle, not exceeding 1° 30′ on an average. A few local undulations occur in the beds, which will be noticed in the detailed descriptions. Towards the south the inclination of the beds becomes a little more westerly, so that the general dip is about S.S.W., and occasionally at angles of as much as 10°. The limestone accordingly becomes buried deeper and deeper in that direction, under an increasing thickness of Coal Measures. By following the coast section still further south, we get a total thickness of Coal Measures amounting to 3,500 feet.—(*See Explanations of Sheets* 131 *and* 141.)

It is obvious, then, that these beds, having been all deposited horizontally, have been lifted up rather more on the N. than on the S., and that the present surface of the ground has been formed across the beds by the removal of large parts that at one time spread far to the northward of their present terminations (see fig. 2).

Much of this removal has been caused by the wearing action of the sea, when the land stood at a lower level. The escarpment which runs round the foot of the limestone hills is as much like an old sea coast on the east side as on the west, where the sea is still beating on it.

The action of the sea on the high Coal Measure land may be well observed still going on at Hags Head and the Cliffs of Moher, the waves eating away the lower part of the cliff, and constantly causing fragments of the upper part to fall for want of support. This action is considerably assisted by the great vertical joints which, traversing the rock, divide it into blocks, rendering the work of destruction a far easier matter than it would otherwise be.

The best instance of this is at Aillenasharragh, at the Cliffs of Moher. A steep and winding pathway leads the explorer to the foot of this magnificent cliff, and the most casual observer cannot fail

of being struck by the immense accumulation of *debris* which forms a talus on the beach, huge masses of grit, shale, and flagstone lying piled together in wild confusion. Here the cliffs are constantly decreasing in altitude, inasmuch as the ground slopes inland from the coast; wherever, on the other hand, the slope of the surface is seaward, the height of the cliff is increasing.

There is a tradition among some of the peasantry, that at one period Hags Head was connected with the southern shores of Liscannor Bay by dry land, and that about midway stood the church of *St. Scoitheen;* that by means of an earthquake land and church suddenly disappeared; and on clear days, when the sea is calm, it is said that the ruins of the church are sometimes visible at the bottom.*

But in addition to the broad action of marine denudation, atmospheric action has had much more effect than might be supposed.

The first elevation of the rocks into dry land is probably of very ancient date; and they may have stood as dry land, and suffered from atmospheric erosion accordingly, during many geological periods. The country was probably depressed again, together with the rest of Ireland, during the glacial period, and suffered, therefore, during that period, both from marine and atmospheric erosion. The smooth polished cliffs over Gleninagh seem to be ice-worn, whether by the grounding of icebergs or the slipping of glaciers; little subsequent atmospheric action, therefore, can have affected them there, but on the hill tops and more gradual slopes, every block is obviously grooved and furrowed by the rain, and looks as if it were melting away.

In the neighbourhood of Lisdoonvarna are numerous deep ravines and narrow glens, where the basal shales of the Coal Measures have been cut through by the streams down to the limestone, so as to expose the latter to our view. Now the water is wearing away the limestone, and the ravines will be both deepened and widened, unless, indeed, the water sinks through the joints of the limestone, and finds a subterraneous channel, and thus commence the undermining of the very hills themselves. The subterraneous rivers and caverns which traverse the limestone in many places have all been evidently formed in this way; the now dry caverns were, doubtless, the former channels of subterranean streams that have taken a different course, and many of them are even still occasionally being worn and acted upon by the torrents which issue from their mouths after heavy rain, although such action is as nothing compared to the constant wearing away of the rock by a little brook.

The deep troughs or hollows which are frequent in the limestone (see fig. 4), are most probably caused by the falling in of the roofs of subterranean caverns or river-courses; and the "swallow-holes" in the basal shales of the Coal Measures, near the boundary line, are evidently due to the same cause. The rain acting along the joints of the limestone in the high ground, where large surfaces are exposed, has worn them into deep vertical fissures, often more than a foot in width (see page 8); and sloping surfaces are frequently worn and fretted in the most curious and fantastic manner by the numerous little channels which the rain has eaten into them. These channels generally occur close together, parallel to each other, at right angles

* I am indebted for this tradition to the late Professor Eugene O'Curry. It is alluded to in the "Annals of the Four Masters," translated by him. F. J. F.

to, and running into, a large open joint. Fossils, such as large Productæ and some corals, are often removed from the surface of the rock by the action of the rain, and the small hollows or depressions thus left, often resemble the foot-tracks of animals (see page 17).

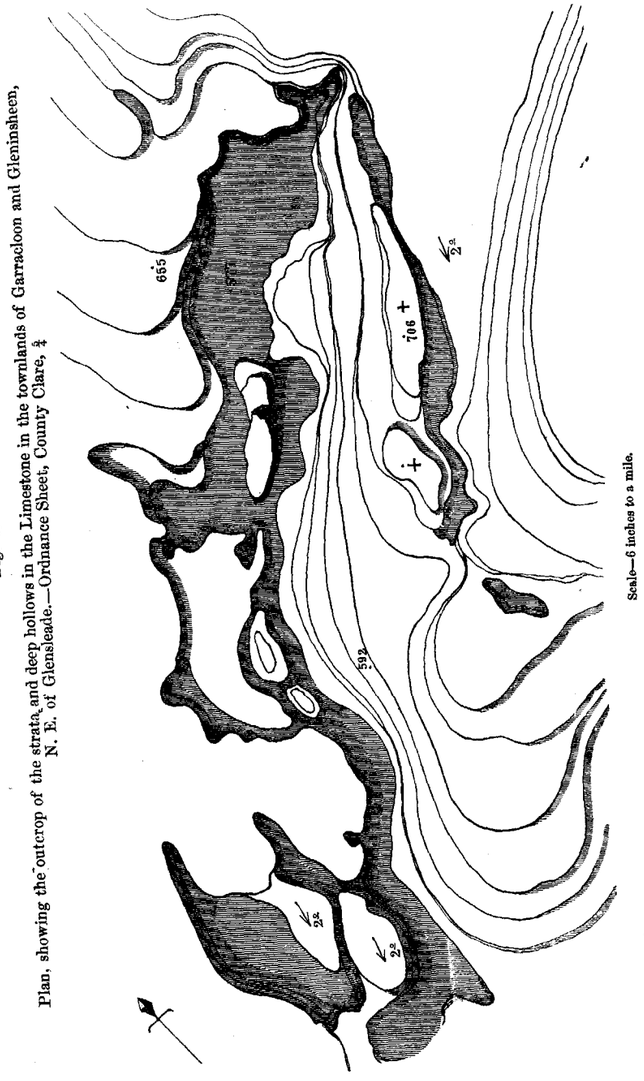


Fig. 4.
Plan, showing the outcrop of the strata, and deep hollows in the Limestone in the townlands of Garracloon and Gleninsheen, N. E. of Glensleade.—Ordnance Sheet, County Clare, 4

Detailed Descriptions.

4. *Position and Lie of the Rocks.*

The Corrofin District.—At the S.E. corner of Sheet 123, to the S. and S.E. of Corrofin, the limestone appears in extensive patches of bare rock or crags, the beds lying nearly horizontal, or undulating at low angles. South of Lough Reagh the dip is W. or W. 10 N., at 5°; North of Ballycullinan Lough the beds dip S., at from 5° to 15°; and near Roxton House E. at 10°. These beds are dark or sometimes pale gray crystalline or compact limestone, containing Productæ and Crinoids in abundance. In some cases the surface of the rock is reduced to a state of debris, so as to completely obscure the stratification. East of Loughs Atedaun and Cullaun the beds undulate to N.W. and S.E. at angles varying from 3° to 10°.

To the west of Corrofin, along the boundary between the limestone and Coal Measure, several good sections are to be seen. A little south of Adelphi the upper beds of the limestone form a steep and picturesque cliff, capped by the Coal Measure shales; the limestone and shales may also be seen in conjunction along the hilly road, at the west side of Inchiquin Lough, and at the entrance of Vigo Cave, the shales abounding in fossils.

Vigo Cave is a fine example of a cavern in the limestone, its course extending westward for a considerable distance, and its roof being in some parts so lofty as to be hardly visible even by the aid of several lights.

Westward, on the high ground towards Lickeen Lough, also S.W. to the southern edge of the Sheet 123, the flags, grits, and shales, above the lower shales, are exposed in numerous quarries, stream courses, and crags.

At and about Gortbofarna Bridge, near the middle of the southern edge of the map, are olive gray flags, dipping to the S., at from 5° to 10°; some of their surfaces are beautifully ripple-marked.

S. of Willbrook (three miles W. and S. of Corrofin), on the side of the hill over Cloncarragh, bluffs of rock crop out, composed of strong olive grits, flags, and sandy shales, dipping N.W. and S., at 5°; and at the Waterfall, close to Willbrook House, may be seen olive grits and flags, lying horizontal.

To the N.W., at Ballynacarhagh Lough, are some fine bold cliffs, showing beds of strong olive quartzose grits, lying horizontal. A little E. of Kiltoraght Glebe House, where the River Fergus sinks, the shales and limestone are seen close to each other, though not in actual contact; and westward the shales are exposed in the bed of the river, lying horizontal. Fossils were observed here, such as fragments of plants, Posidonomya, Pecten papyraceus, and Goniatites.

The high limestone ground, consisting of the hills with terraced sides, may be said to commence at the north-western end of Inchiquin Lough; here, also, the Coal Measure escarpment is peculiarly bold and well-marked, and forms a striking feature in the general landscape.

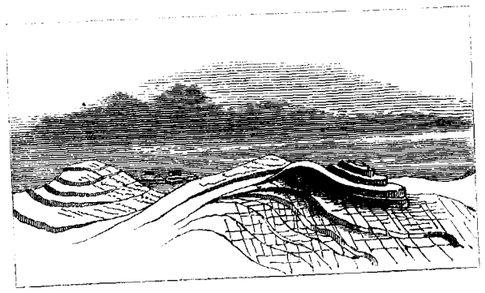
From the eastern end of Inchiquin Lough to the edge of the sheet at Ballyeighter Lough there is a steady strike to N.E., the beds dipping N.W., at from 3° to 8°. These are, for the most part, dark gray thin-bedded limestones, with occasional bands of chert, containing corals and crinoids. These cherty beds are also largely exposed further north, between Glenroe and the eastern edge of the sheet. Sometimes the surface of a bed is one mass of chert, but as frequently the latter appears in rough

nodules, varying in size; a closer inspection will show these nodules and bands of chert to be made up of corals.*

Here the beds of limestone undulate, and dip N.W. and S.E. at various angles. A little S. of the Trig. pt. 623 there is a dip to S.E. of as much as 40°, and the undulating bare surfaces of gray limestone give a most singular and impressive aspect to the spot.—(See fig. 5.)

Fig. 5.

Sketch of the tops of the Hills in Glenquin.



Ordnance Sheet, Co. Clare, 19

From the eastern edge of the map, due E. of Glenroe, to the hamlet of Castletown, the beds undulate to the N.W. and S.E., at angles varying from 5° to 30°, thus forming alternate synclinal and anticlinal folds. Besides minor ones, there are altogether five well-marked parallel axes of elevation in this space; this is the only part of the district where there are undulations of any consequence, the strata in the other parts of it being for the most part horizontal, or nearly so.

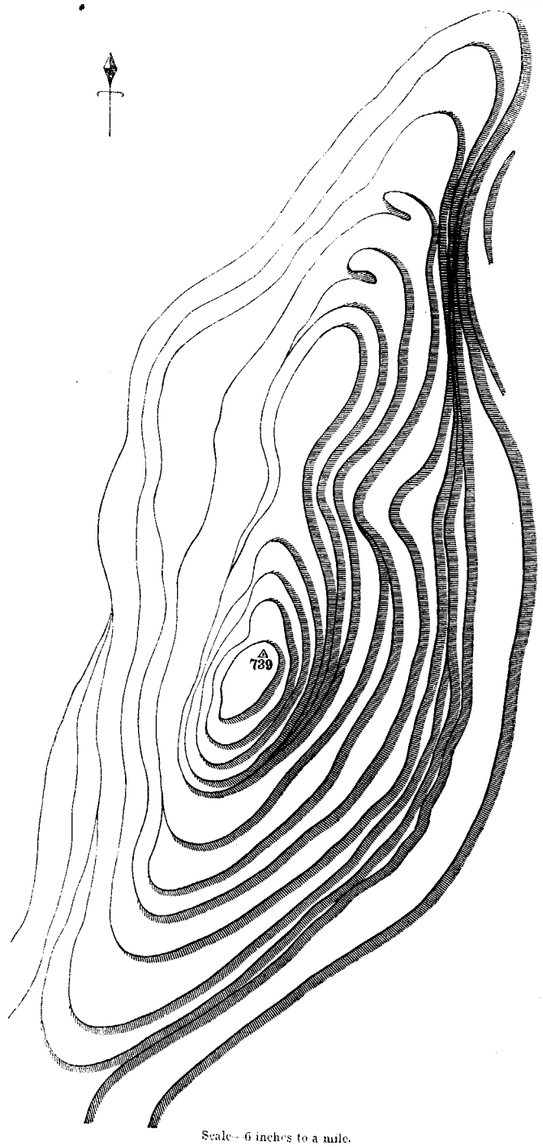
Certainly, the most remarkable part of this wild district is the singular and picturesque valley of Glencolumbkille, which indents the eastern edge of the high ground of Burren, extending in a direction nearly N. and E. from Columbkille Cottage (Sheet 123) to a point on the eastern edge of 114, due east of Slievecarran. The hills on its eastern side form beautiful examples of the *step-like succession* of cliffs, and terrace of bare rock, before mentioned (see fig. 6). The beds here are generally horizontal. Near the northern end of the valley, and forming the eastern side of Slievecarran, is the magnificent cliff of *Kinallia*, or the Eagle's Rock, sheer 500 feet in perpendicular height.

The cherty coralline beds, mentioned above as occurring east of Glenroe, are here also to be met with; a large, flat, bare surface of limestone, near the foot of the cliff, is closely covered by curious marks, resembling

* The following species, identified by Mr. W. H. Baily, were obtained from this neighbourhood, and occur, also, in other parts of this district:—*Alveolites depressa, Lithostrotion affine, L. striatum, L. junceum, L. irregulare, L. basaltiforme, L. Portlocki.*

Fig. 6.

Plan of the beds in the hill on the E. side of Glencolumbkille.—Ordnance Sheet 4.



Scale—6 inches to a mile.

the tracks of quadrupeds, caused by the weathering out of the coral; *Alveolites depressa.**

The most striking view in Burren, and the one giving the best idea of a typical "Mountain Limestone" district, is that from the new road which winds up the steep hill westward from Columbkille Cottage. Beneath you lies Glen Columbkille, its green fields and dark wood contrasting finely with the bare rocky terraced hills of gray limestone; while stretching away in the background, may be seen the hills in the neighbourhood of Gort, formed of Silurian and Old Red Sandstone.

In this neighbourhood there are many curious gorges, hollows, and "corries," among which may be mentioned, as the most remarkable, Glenulla, the Glen of Clab, Poulavallan, and Poulaloughan, all marked on Sheet 123. To the S. and S.W. of Castletown are numerous small mineral veins, some of which are being worked by a company; at Glenulla, south of Doomore, near the N.E. corner of Sheet 123, a small copper vein was unsuccessfully worked some years ago; these will be hereafter described under the heading *Mines and Minerals.*

The Ballyvaughan District.—The same beds which we hitherto have been describing may be traced uninterruptedly without apparent break or fault, N.W. from Slievecarran, forming the escarpment which has been mentioned above as bounding the high Burren plateau on the east, along both sides of the much indented Turlough Valley, where they form precipitous cliffs, the beds lying nearly horizontal. From this they sweep round the hills of Moneen and Ballyconreagh, when, turning south, they form the escarpment of the valley of Ballyvaughan; from this, with wonderful regularity, having somewhat the appearance of the courses of a mighty wall of cut stone, they run in a direction W.N.W., sweeping boldly round Black Head, and then southwards, till they are lost beneath the Coal Measures at Fisherstreet.

In all this course the beds show a dip to the south averaging 1° 30′.

About one mile south of the point of Black Head a band of decomposing brown dolomite, with veins of calc spar, is exposed to view; thence it may be traced along the roadside round the Head for a distance of two miles, when it is lost in a patch of drift which obscures the rocks. It varies in thickness from three to eight feet.

Between this and Ballyvaughan, the rocks on the beach, just where this band would probably occur, are covered by a coating of silty mud or by seaweed, so that the dolomite, though probably present, is not recognisable.

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* These marks on the rocks have given rise to the following legend, still firmly believed by the imaginative peasantry of the neighbourhood:—

At the foot of the Eagle's Rock there may be still seen the ruins of an ancient chapel and altar, situated beside a perennial spring. Here dwelt St. M'Duagh, having for a companion a faithful servant or clerk. Five miles distant, and near the town of Kinvarra, stand the ruins of Dungory Castle, where at the same time lived the chieftain Gooragh, who was a brother of St. M'Duagh. Now, it happened one day that the clerk complained to the Saint that he sorely felt the pangs of hunger, and could find no food in that lonely spot. The far-seeing eyes of the Saint at that moment descried his brother in the castle with a party of guests and all his retainers, with whom he had just returned from the chase, weary and famished, sitting down to a sumptuous banquet. He immediately offered up a prayer that the feast should be removed from Dungory Castle to where he and the clerk then stood, and the prayer was instantly granted. The astonished and delighted servant saw before him a repast far surpassing any that he had ever witnessed, and immediately prepared to appease his hunger. But the chieftain and his followers, not willing to give up their feast so easily, immediately mounted their horses, called out their hounds, and gave chase; and presently the Saint and his terrified attendant saw them approaching at full speed. The former again offered up a prayer to Heaven, when instantaneously men, horses, and dogs were transfixed to the spot; and the traces of their feet may be seen to this day.

It again, however, becomes visible on the shore at Clareville House, close to the village of Ballyvaughan, whence it may be traced with little interruption as far as the ruined castle on the west side of Muckinish Bay, a distance of about two and a-half miles. It may also be seen at the edge of Lough Rask, a pool of water east of Ballyvaughan, to which the tide has access by a subterraneous channel.

The fossiliferous cherty beds above mentioned are well exposed on the eastern and northern sides of the Abbey Hill, which lies between the bays, or rather muddy creeks, of Muckinish and Corranroo. These creeks, as also the Bay of Ballvaughan, are famous as producing the well-known Burren oysters.*

In this part of the district are many curious trough-like hollows in the limestone, the most remarkable being those at and east of Glensleade (see fig. 4), four miles south of Ballyvaughan, and at Ailwee, one mile east of Ballyallaban.

About half a mile S.E. of the summit of Moneen Mountain is a deep cleft in the side of the hill, named Scalp-na-sheshia, probably caused by the weathering away of the rock between the east and west joints. Some of the peasantry have a tradition that it is artificial, and that from it the stones were quarried to build Corcomroe Abbey, situated one mile and a-half to the N.E.

Close to this, and a little westward, in the sloping side of the hill, are several holes in the surface of the rock; one of these is believed to be a natural shaft to a subterraneous channel which communicates with the sea near Muckinish House, a distance of more than a mile. Dogs guilty of the crime of killing sheep have been thrown into this abyss, and it is said that their bodies were afterwards seen floating at sea near Muckinish. These hollows are situated along a vein of calc spar, hereafter to be mentioned under *Mines and Minerals.* It is not improbable, therefore, that they are artificial shafts, the work of miners in old times, and that this one (if indeed it be true that it communicates with the sea), happened to be sunk over a subterraneous channel or cavern, the roof of which has since fallen in; there is, at all events, no doubt as to its being of very great depth.

The caves of Kilcorney, situated in a beautiful little valley, scarcely six miles south of Ballyvaughan, are good instances of subterranean channels in the limestone; one of these can be explored for a considerable distance. After heavy rain it discharges great floods over the adjacent fields, and in the course of time has produced a fine alluvial deposit. The peasantry have a legend that after one very heavy flood, a herd of wild horses issued from the cave and overran the country.

An outlier of the Coal Measure shales before mentioned may be seen marked on the map between Ballyvaughan and Lisdoonvarna; the boundary has been drawn along the foot of a distinct and sharply marked escarpment. Along this escarpment are ranged at irregular intervals, numerous conical hollows or "swallow-holes," caused by the soft decomposing Coal Measure shales sinking through cavities in the limestone, like the sand in an hour-glass.

The shale may be seen in numerous places along this line of boundary; the best exposures are those in the small ravines of the stream courses

* This coast, from its variety of character, having both rock-pools and muddy bottoms, presents a fine field to the marine zoologist, abounding in *Mollusca, Crustacea, Echinodermata, Actinozoa,* &c.

The *Echinus lividus* swarms in the pools, and of the *Actiniæ* twelve species occur, of which, as the most remarkable, may be mentioned *Bunodes Ballii and Sagartia parasitica.*

bounding the townlands of Cullaun and Gragans West, and between Ballyconnoe North and Doonyvardan, at the north side of the Lisdoonvarna road; here the bare limestone, perforated by numerous cavities, may be seen forming the flooring of the ravine, and the Coal Measure shales, abounding in fossils, the side walls.

At the south side of, and not very far distant from, the road the shales and limestone may also be seen in conjunction, in the townland of Cahermacnaghten, and further east at the escarpment at the west side of the Ballyvaughan and Kilfenora road.

The Kilfenora and Lisdoonvarna District.—The village of Kilfenora stands on a flat, formed of the uppermost beds of the limestone, and enclosed on the N., W., and S. by the superincumbent Coal Measure shales, which form high ground. The limestone is nearly horizontal, or dips gently N. and S. at 2° or 3°. Along the boundary line or escarpment are many exposures of the shales, and sometimes they are seen in conjunction with the limestone. The best sections are in the bed of the stream on the east side of Tullagh fort, one mile E. S. E. of Kilfenora, near the road S. W. of Fanta Glebe-house, and in the stream course a quarter of a mile N. of Ballyshanny House, where the shale may be plainly seen resting on the limestone, both abounding in fossils. The following is the vertical section at the place :—

	Ft.	In.
5. Dark bluish gray and black soft (sometimes flaggy) finely laminated shales, full of Goniatites, and having gray calcareous and iron-stone nodules, containing fossils in iron pyrites and carbonate of lime, with small lumps of pyrites, . . .	60	0
4. Hard dark blue flaggy limestone, . . .	0	6
3. Bluish black calcareous shale, with fossils, . . .	3	0
2. Dark blue compact flaggy limestone, beds from two to eight inches thick, containing Orthoceratites, . . .	3	0
1. Dark blue compact limestone, beds from one to three feet thick,	—	

There is also a good junction, showing a nearly similar section in the stream course at the west side of the road, about one-third of a mile N.W. of Lismoher House. But in no part of the district, or, perhaps, indeed, in no other part of Ireland, is the junction between the two formations so beautifully exhibited, and on such a large scale, as in the numerous ravines about Lisdoonvarna, in many of which the observer may walk for miles in dry weather, having beneath his feet the uppermost bed of the limestone, and on each side of him, perpendicular walls of shale.

It is along this junction that the spa wells, for which Lisdoonvarna is celebrated, occur. These wells will be described under the heading *Mines and Minerals.*

On the high ground S. and S.W. of Kilfenora, the superincumbent grits and flags of the Coal Measures may be seen in numerous localities, either lying horizontal, or dipping gently to the S. At Doon fort, about one mile S.W. of Kilfenora *Goniatites reticulatus* has been observed in olive gray flags.—(*Sir R. Griffith: see Dublin Quarterly Journal of Science, No.* 1, *January,* 1861, *page* 91).

The Coast Section.—The almost continuous section along the coast exhibits the structure of the whole district. W. of Lisdoonvarna, the beds of limestone and superincumbent shales, which northwards occur at a height of more than 1,000 feet above the sea, are brought by the southerly dip to the sea level, and as we go south-west along the coast, higher and higher beds are seen. The basal shales, here about eighty feet in thickness, pass upwards into sandy flags; and about three quarters of a mile from Fisherstreet, strong olive grits and flags may be seen at the top of the cliff, which is about seventy feet high, the beds dipping S.E. at 5°. At

Faunmore, the shales and flags beneath these grits are curiously contorted, as if by some great lateral pressure, which did not affect the beds above and below them. These contortions may be seen for more than half a mile along the cliffs.

A little S. of Luogh Point, and less than one mile from Faunmore, the strong grits and flags which lately occupied the top of the cliff, above the contorted shales, are brought by the southerly dip to the sea level at the base of the cliff, and above them are thick black shales, about 260 feet in thickness, or the same as the height of the cliff, as the beds are nearly horizontal.

Proceeding southward the cliffs increase in height, and at the top olive gray flags are seen resting on about 300 feet of shale; further S.W. are more flags above these, alternating with shale bands; these are the track-marked flags previously mentioned. They are extensively quarried in this neighbourhood, and being easily worked, as the width of their joints render them capable of being procured of any size, are in great demand. They are largely exposed in crags, inland, in the townlands of Luogh South and Caherbarnagh.

Above these flags, and forming the top of the Cliffs of Moher, is a bed of black shale, more than forty feet in thickness. This is the highest bed of the district included within these sheets. Between the flags and this shale is a calcareous band from three to five inches in thickness, full of fossils, and exhibiting, in a beautiful manner, the singular structure known as *cone in cone*. The axes of the cones are perpendicular to the planes of the stratification. This band is traceable along the cliffs for upwards of a mile.

From the Stokeen cliff the ground slopes gradually to Liscannor Bay; and as the general dip of the beds is less than this slope, in proceeding southwards or S.W. along the shore, we come on the lower beds, which we have been hitherto describing.

Inland, about Knockaunnavar, there are many extensively-worked quarries in the track-marked flags. At Hags Head, in the shale beneath the flags, are numerous nodules and small grit bands; and S. of the telegraph, two or three small faults were observed. The cliff S. of Moher House affords the following interesting section:—

	Ft.	Ft.	In.
9. Gray shale,			
8. Olive grits and flags,	6 or	7	0
7. Gray shale, with nodules and bands of iron-stone, calcareous nodules containing fossils, and occasional strings of coal,	15 to	20	0
6. Kelvy shale and coal,		0	4
5. Gray indurated clay,		1	0
4. Olive grit, with occasional stigmaria and plant stems,	2 to	4	0
3. Bluish gray sandy flaggy shale,	0 to	3	0
2. Olive and gray rippled flags and irregular grits, with shale bands,	0 to	55	0
1. Gray flaggy shale,			

But for the inaccessibility of the cliffs to the N., the same section would probably be seen at Carrickatrial. Here, at the foot of the cliff, and among the great masses of debris fallen from above, stems of plants and ferns were observed, as also fragments of calc spar, with small pieces of coal. S. of Moher House the seam of coal is traceable for nearly half a mile, the dip being S. from 5° to 15°.

At the opposite side of Liscannor Bay, on the shore north of Rinneen House, the same beds may be seen, the rock being nearly horizontal, or dipping S. at 3°. The following is the vertical section:—

	Ft.	In.
9. Flags, with annelid tracks,		
8. Gray shales, with iron-stone bands, and calcareous fossiliferous nodules,	100	0
7. Coal and Kelvy shale (wanting at N. side of the Bay),	1	0
6. Indurated clay, full of plants,	1	0
5. Olive and blue sandy indurated clay, with large Stigmaria,	3	0
4. Olive grits and flags,	15 to 10	0
3. Bluish sandy shale, with iron-stone bands,	15 to 10	0
2. Coal and Kelve,	4 in. to 0	6
1. Grits and flags,		

Some years ago the coal was worked here on a small scale, and adits were run in the direction of Rinneen House.

The track-marked flags form a steep escarpment along the east side of the road leading to Lehinch; they are also freely exposed about Moy Castle, and on the high ground at the south side of the road leading from Lehinch to Ennistimon, the general dip being to the S. at 5°.

At the waterfall of Ennistimon may be seen alternating flags and shales lying horizontal, as also westward, in the bed of the brook that flows from Kilmanaheen Glebe through Ennistimon len.

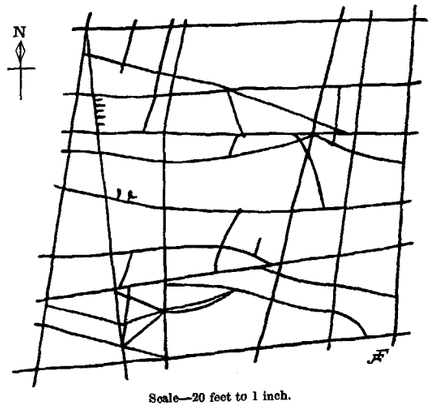
5. *Joints.*

The vast area of bare rock exposed to our view in Burren renders it a most advantageous place for the study of joint structure. (*See The Students' Manual of Geology, p.* 211.)

The vast surfaces of limestone are traversed by different sets of joints, which cut up the rock into blocks of various form and size. The accompanying plate (fig. 7), is an accurate plan of a portion of one of these surfaces in the townland of Carran, on the W. side of the road leading to Corrofin, and seven miles S. of Ballyvaughan.

Fig. 7.

Plan of portion of jointed surface of a flat bed of Limestone, in Townland of Carran, seven miles S. of Ballyvaughan.



Scale—20 feet to 1 inch.

The main joints in this district range between N. 45° W. and N. 45° E., the most prominent being those from N. 5° E. to N. 10° E. These may often be seen running in perfectly straight lines for several miles. Sometimes the piece of rock between two of these is traversed by numerous small parallel joints, extending for the same distance, and cutting up the rock into vertical laminæ; the action of the weather on these will in time

wear away this intervening piece and cause a deep open fissure. Sometimes the main joints assume curved instead of straight courses.

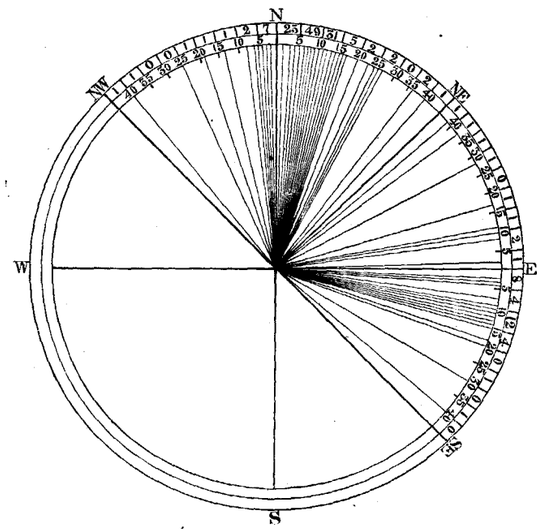
The cross joints range from E. 45° N. to E. 45° S., the most common being probably about E. 20° S. They are not nearly so well marked as the main joints, never being traceable for any considerable distance, and seldom running even for this short length in straight lines. In many places there are no visible cross joints.*

As we go westward in this district, it would appear that the main joints have more of E. in their bearing. In the Island of Innisheer the main joints are most beautifully marked, running across the island, and bearing constantly N. 17° E.† There are also numerous main joints bearing W. of N., and cross ones N. of E., but they are never traceable for any great distance.

The following is a table of observations of the direction of well-marked joints accurately taken with the prismatic compass in different parts of the district. First are given the main joints bearing E. of N., then those W. of N., with their accompanying cross joints. At the end is an abstract, showing the number of observations that were made of each joint, this being taken as a fair measure of prominence or frequent occurrence. Fig. 8 is a diagram, showing at a glance the relative frequency in each five degrees.

Fig. 8.

Diagram of observations of joints in Burren.



The radii representing the bearings of all joints observed. The outer numbers—number of observations of each 5 degrees.

* It is possible that the gentle southerly dip (or, more accurately, S. 5° or 10° W.) is the cause of the north and south main joints (or, more accurately, those bearing N. 5° to 15° E.) being the most prominent. The dip of the surface is the direction in which water will flow; any joint or crack in the rock, therefore, lying in this direction will be more exposed to the mechanical action of the rain than one which does not lie in it. In the first case, the water has its maximum velocity; in the second, it will either lie stagnant, or flowing slowly, will exert less mechanical force.

† The general dip of the surface on Innisheer is S. 15° to 17° W., and the most prominent open joints bear N. 17° E.

TABLE OF OBSERVATIONS OF JOINTS.

Main Joints bearing E. of N.

Observations.	Main Joints.	Cross Joints.	Townland, Locality, No. of Quarter Sheet, &c.
1	N	E 40 S	Doonyvardan, E. side of townland, sheet 5/3.
2	—	E	Ailwee "lead and silver mine," sheet 6/1.
3	—		Lissylisheen, N. side of Kilcorney road, sheet 9/1.
4	—		Do., S. side of same road, sheet 9/2.
5	—	E. E 2 S	Cragnarooam, near W. edge of sheet 9/2.
6	—		Poulawack, S.W. corner of townland, sheet 9/2.
7	—	E 7 S	Fanygalvan, near E. edge of sheet 9 4.
8	—		Turloughmore, N.W. of Racecourse, sheet 10/2.
9	—		Clooncoose crossroads, sheet 10/3.
10	N 1 E	E 10 N. E 17 N. E 11 N	Carran, W. side of road, N.W. of Lough Aleenaun, sheet 9/4.
11	—	E 11 S	Ballyganner North, E. side of *Cahernaspeekee*, sheet 9/4.
12	—	E 13 S	Boundary between Carran and Ballyganner North, sheet 9/4.
13	N 3 E	E 2 N	Poolbaun, near trigonometrical point 808, sheet 5/4.
14	—		Cragballyconnoal, E. of trigonometrical point 697, sheet 5/4.
15	—	E 15 S	Cappagh, one mile N.N.E. of *Cappagh Castle*, sheet 6/4.
16	—		Boundary between Baur N. and Baur S., sheet 9/2.
17	N 4 E		Poulbaun, N.W. edge of sheet 6/3.
18	—	E 11 S	Ballyganner N., near "*Cahernaspeekee*," sheet 9/4 (see No. 11).
19	—		Clooncoose crossroads, sheet 10/3 (see No. 9).
20	N 5 E	E 3 S	Kilweelran, S. of trigonometrical point 1,008, sheet 5/2.
21	—	E 12 S	Cappagh, half a-mile E. of Cappagh Castle, sheet 6/4.
22	—		Cahermakerilla, near E. edge of sheet 9/2.
23	—	E. E 2 S	Cragnarooam, near W. edge of sheet 9/2 (see No. 4).
24	—	E	Lissylisheen, S.W. corner of townland, sheet 9/2.
25	—	E 10 N. E 17 N. E 11 N	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see No. 10).
26	N 6 E		Coolmeen, E. side of townland, sheet 4/2.
27	—		Boundary between Poulbaun and Boloona, N.E. edge of sheet 5/4.
28	—	E	Ailwee "*lead and silver mine*," sheet 6/1 (see No. 2).
29	—	E 35 N	Coolnatullagh, S.W. corner of sheet 6/2.
30	N 6 E		Cahermacnaghten, N.E. corner of sheet 9/1.
31	—	E. E 2 S	Cragnarooam, near W. edge of sheet 9/2 (see No. 5).
32	—		Clooncoose crossroads, sheet 10/3 (see Nos. 9 and 19).
33	—		Funshinmore, near county boundary (Galway), sheet 121/1, 2, 3, 4.
34	N 7 E		Ailwee, near E. edge of sheet 5/2.
35	—		Boundary of Dangan and Kilweelran, E. edge of sheet 5/2.
36	—		Gragans West, N. of *Carricklahan*, sheet 5/3.
37	—		Cragballyconnoal, E. of trigonometrical point 697, sheet 5/4 (see No. 14).
38	—		Pullagh, W. side of townland sheet 6/4.
39	—		Lissylisheen, N. side of Kilcorney road, sheet 9/1 (see No. 3).
40	—		Cahermakerilla, E. side of sheet 9/2 (see No. 22).
41	—	E 10 N. E 17 N. E 11 N	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see Nos. 10 and 25).

TABLE OF OBSERVATIONS—*continued.*

Observations.	Main Joints.	Cross Joints.	Townland, Locality, No. of Quarter Sheet, &c.
42	—	E 11 S	Ballyganner N., near *Cahernaspeekee*, sheet 9/4 (see Nos. 11 and 18).
43	N 8 E	E 40 S	Doonyvardan, E. side of townland, sheet 5/3 (see No. 1).
44	—		Pullagh, W. side of townland, sheet 6/4 (see No. 38).
45	—	E 20 S. E 15 S.	Ballyconnoe South, E. edge of sheet 8/2.
46	—		Lissylisheen, N. side of Kilcorney road, sheet 9/1 (see Nos. 3 and 39).
47	—		Boundary between Baur North and Baur South, sheet 9/2 (see No. 16).
48	—	E 10 N. E 17 N. E 11 N	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see Nos. 10, 25, 41).
49	—	E 11 S	Noughaval, near *Caherwalsh*, sheet 9/4.
50	N 9 E	E 12 S	Ballyconry, half a-mile S.S.E of *Cappanawalla*, sheet 2/3.
51	—	E 15 S	Moneen and Muckinish, N. of trigonometrical point 862, sheet 3/3.
52	—	E 2 S. E & W	Blake's Mountain, half a-mile N.N.W. of Blake's Bridge, sheet 4/4.
53	—	E 9 S. E 10 S	Lislarheenmore, S. edge of sheet 5/1.
54	—		Dangan, half a-mile N. of trigonometrical point 1,008, sheet 5/2.
55	—		Gragans West, N. of *Carricklahan*, sheet 5/3 (see No. 36).
56	—		Gleninsheen, E. side of townland, sheet 5/4.
57	—	E 14 S	Turlough, near E. edge of sheet 6/1.
58	—	E 15 S	Coolnatullagh, N. corner of townland, sheet 6/4.
59	—		Pullagh, W. side of townland, sheet 6/4 (see Nos. 38 and 44).
60	N 9 E	E 15 S	Cappagh, N.N.E. of Cappagh Castle, sheet 6/4 (see No. 15).
61	—	E 20 S. E 15 S.	Ballyconnoe South, E. edge of sheet 3/2 (see No. 45).
62	—	E 11 S	Noughaval, near *Caherwalsh*, sheet 9/4 (see No. 49).
63	N 10 E		Newquay, N. of Lough Murree, sheet 2/2.
64	—	E 10 S	Killoghill, W. of trigonometrical point 853, S.W. edge of sheet 3/3.
65	—		Ballyelly, a little N. of Coalmeasure boundary, sheet 4/2.
66	—		Faunarooska, S. of trigonometrical point 843, sheet 5/1.
67	—		Dangan, half a-mile N. of trigonometrical point 1,008, sheet 5/2 (see No. 54).
68	—		Ballymacahill, near trigonometrical point 771, sheet 5/2.
69	—		Gragans West, N. of Carricklahan, sheet 5/3 (see Nos. 36 and 55).
70	—		Lislarheenbeg, W. side of townland, sheet 5/3.
71	—		Gleninsheen, E. side of townland, sheet 5/4 (see No. 56).
72	—	E 14 S	Turlough, E. edge of sheet 6/1 (see No. 57).
73	—	E 30 S	Commons, S. side of old road, sheet 10/1.
74	—		Turloughmore, N.W. of Racecourse, sheet 10/2 (see No. 8).
75	N 11 E		Murrooghtoohy North, *Caherdoonfergus*, sheet 1/2.
76	—	E 12 S	Ballyconry, half a-mile S.S.E. of Cappanawalla, sheet 2/3 (see No. 50).
77	—		Ballynahown, W. side of road, sheet 4/4.
78	—	E 9 S. E 10 S.	Lislarheenmore, S. edge of sheet 5/1 (see No. 53).
79	—	E 40 S	Doonyvardan, E. side of sheet 5/3 (see Nos. 1 and 43).

TABLE OF OBSERVATIONS—*continued.*

Observations.	Main Joints.	Cross Joints.	Townland, Locality, No. of Quarter Sheet, &c.
80	—		Gleninsheen, E. side of townland, sheet 5/4 (see Nos. 56 and 71).
81	—		Rannagh East, E. corner of townland, sheet 6/3.
82	—	E 20 S. E 15 S	Ballyconnoe South, E. edge of sheet 8/2 (see Nos. 45 and 61).
83	N 12 E		Murrooghtoohy North, *Caherdoonfergus*, sheet 1/2 (see No. 75).
84	—		Aghaslinny South, half a-mile W. of trigonometrical point 1,044, sheet 2/3.
85	—	E 29 N	Aghaslinny North, a quarter of a-mile N. of trigonometrical point 1,044, sheet 2/3.
86	—	E 11 S. E 20 S	Ballyconry, E. of Salt Hill, sheet 2/4.
87	—		Faunarooska, S. of trigonometrical point 843, sheet 5/1 (see No. 66).
88	—		Lislarheenbeg, W. side of townland, sheet 5/3 (see No. 70).
89	—	E 38 N	Ballyallabaun, N. edge of sheet 5/4.
90	N 12 E		Gleninsheen, E. side of townland, sheet 5/4 (see Nos. 56, 71, 80).
91	—		Coskeam, near Poulkimsey, sheet 6/3.
92	—		Cahermacnaghten, N.E. corner of sheet 9/1 (see No. 30).
93	—		Poulanine, near N. edge of sheet 9/2.
94	—	E 30 S	Carnaun, Carnaun Hill, N.W. corner of sheet 25/1.
95	N 13 E	E 15 S. E 18 S	Fanore More, S. edge of sheet 1/3, 4.
96	—		Newquay, N. side of Lough Murree (see No. 63).
97	—	E 11 S. E 20 S	Ballyconry, E. of Salt Hill (see No. 86).
98	—		Ballyelly, half a-mile N. of Coalmeasure boundary, sheet 4/2.
99	—		Coolmeen, N. end of townland sheet 4/2.
100	N 14 E	E 45 S	Formoyle, N.E. corner of sheet 4/2, near trigonometrical point 996.
101	—	E 10 N. E 17 N. E 11 N.	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see Nos. 10, 25, 41, 48).
102	N 15 E		Aghaslinny South, near trigonometrical point 1,044, sheet 2/3.
103	—		Ballyelly, half a-mile N. of Coalmeasure boundary, sheet 4/2 (see No. 98).
104	—	E 9 S. E 10 S.	Lislarheenmore, S. edge of sheet 5/1 (see Nos. 53, 78).
105	—	E. E 2 S.	Cragnarooam, near W. edge of sheet 9/2 (see Nos. 5 and 31).
106	N 16 E		Coolmeen, E. side of townland sheet 4/2 (see No. 26).
107	—		Doolin, S.W. corner of sheet 8/1.
108	—	E 8 N	Creehaun, N.W. of Rockforest, sheet 10/4.
109	N 17 E		Ballyelly, half a-mile N. of Coalmeasure boundary, sheet 4/2 (see Nos. 98, 103).
110	N 20 E	E 42 N. E 18 S. E 4 S.	Parknabinnia, one mile E. of Leamaneh Castle, sheet 16/2.
			Do. Do. (see No. 110).
111	N 23 E	—	Do. Do. (see Nos. 110, 111).
112	N 25 E	—	
113	N 26 E	E 15 S. E 18 S.	Fanore More, S. edge of sheet 1/3, 4 (see No. 95).
114	N 27 E	E 42 N. E 18 S. E 4 S.	Parknabinnia, one mile E. of Leamaneh Castle, sheet 16/2 (see Nos. 110, 111, 112).
114	N 36 E	E 12 S	Ballyconry, half a-mile S.S.E. of Cappanawalla, sheet 2/3 (see Nos. 50, 76).
			Do. Do. (see No. 114).
114	N 40 E	E 12 S	Ballyallaban, E. and S. of Ballyallaban House, sheet
114	N 45 E		5/2, 4.

TABLE OF OBSERVATIONS—*continued.*

Main Joints bearing W. of N.

Observations.	Main Joints.	Cross Joints.	Townland, Locality, No. of Quarter Sheet, &c.
115	N 2 W	E 7 S	Fanygalvan, E. edge of sheet 9/4 (see No. 7).
116	—		Cappaghkennedy, S.W. of Glencollumkille Cottage, sheet 10/2.
117	N 3 W	E 10 N. E 17 N. E 11 N	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see Nos. 10, 25, 41, 48, 101).
118	N 4 W	—	Do. Do.
119	N 5 W	—	Do. Do.
120	—		Turloughmore, N.W. of Racecourse, sheet 10/2 (see Nos. 8 and 74).
121	—	E 8 N	Creehaun, N.W. of Rockforest, sheet 10/4 (see No. 108).
122	N 6 W	E 10 N. E 17 N. E 11 N	Carran, W. side of road N.W. of Lough Aleenaun, sheet 9/4 (see Nos. 10, 25, 41, 48, 101, 117, 118, 119).
123	N 8 W	E 25 N	Slievecarran, S. end of townland, sheet 6/2.
124	N 14 W		Commons, S. of crossroads, sheet 10/3.
125	N 19 W		Formoyle East, half a-mile E. of Caherbannagh, sheet 2/3.
126	N 25 W		Coolmeen, S.E. end of townland, sheet 4/2.
127	N 40 W		Fanore More, near trigonometrical point 821, sheet 1/3, 4.
128	N 45 W		Do. Do.

ABSTRACT OF THE ABOVE TABLE.

Main Joints.				Cross Joints.			
E. of N.	Number of Places where the Joint appeared as most prominent.	W. of N.	Number of Places where the Joint appeared as most prominent.	S. of E.	Number of Places where the Joint appeared as most prominent.	N. of E.	Number of Places where the Joint appeared as most prominent.
N	9	N 2 W	2	E	4	E 2 N	1
N 1 E	3	N 3 W	1	E 2 S	2	E 8 N	1
N 3 E	4	N 4 W	1	E 3 S	1	E 10 N	1
N 4 E	3	N 5 W	3	E 4 S	1	E 11 N	1
N 5 E	6	N 6 W	1	E 7 S	1	E 17 N	1
N 6 E	8	N 8 W	1	E 9 S	1	E 29 N	1
N 7 E	9	N 14 W	1	E 10 S	2	E 35 N	1
N 8 E	7	N 19 W	1	E 11 S	3	E 38 N	1
N 9 E	13	N 25 W	1	E 12 S	2	E 42 N	1
N 10 E	12	N 40 W	1	E 13 S	1		
N 11 E	8	N 45 W	1	E 14 S	1		
N 12 E	12			E 15 S	5		
N 13 E	5			E 18 S	2		
N 14 E	2			E 20 S	2		
N 15 E	4			E 30 S	2		
N 16 E	3			E 40 S	1		
N 17 E	1						
N 20 E	1						
N 23 E	1						
N 25 E	1						
N 26 E	1						
N 27 E	1						
N 36 E	1						
N 40 E	1						
N 45 E	1						

6. *Mines and Minerals.*

Lead, zinc, and copper occur, though sparingly, in this district; they do not appear as true lodes, but as veins of infiltration filling up the open joints in the limestone.

The ores of lead to be met with are the sulphuret, *Galena*, and the carbonate, *White Lead Ore.*

Of zinc we have the sulphuret, *Blende*, or "*Jack*," and the carbonate, *Calamine*; with a rare and beautiful variety containing a greater per centage of water, and termed *Hydrated Calamine.*

The ores of copper found are the *Red Oxide*, the sulphuret, *Copper Pyrites*, and the carbonate, *Malachite*,—all, indeed, in such small quantity as to be hardly worth mentioning.

Fluate of Lime, *Fluor Spar*, and carbonate, *Calc Spar*, invariably accompany the ores of lead and zinc.

Iron occurs in the form of ironstone nodules and thin bands in the shales about Lisdoonvarna, but not in sufficient quantity to render it valuable; also as iron pyrites, with the crystals of which mineral the black fissile shales, when they are unweathered, may be seen coated.

Mineral Veins.—Three-quarters of a mile E. by S. of the summit of Moneen Mountain, and S.S.W. of Bell Harbour, is a vein of calc spar, bearing N. 10° E., averaging three feet in thickness, and traceable for half-a-mile. Some specks of galena were observed. It appears to have been worked for lead in old times.

Southwards, and marked on the Map as "*Lead and Silver Mine*," is another vein of spar, bearing nearly N. and S. No lead is visible now, but some years ago several tons are said to have been taken from it.

In Glenulla, sheet 123, just S. of the summit of Doomore, a small copper vein was worked some years ago. The vein stone is quartz, and the copper occurred in minute fragments of red oxide, malachite and, pyrites. The inconsiderable quantity of ore, and the vein soon ending both by N. and S., caused the work to be abandoned.

The Burren Mines.—In the neighbourhood of Castletown, sheet 123, several small veins occur, filling up the small open joints, and having a general bearing of N. 5° E.

Half-a-mile N.W. of Castletown, in the townland of Mogouhy, one of these veins is now being worked by a company. An adit has been run into the face of the cliff for some distance in the direction of the vein, as seen on the surface, and a shaft has been sunk on the adit. Some large lumps of galena were obtained. A vein, probably the same as this, appears half-a-mile southwards, whence it is traceable for more than half a mile, when it seems to die out, but reappears again on the east side of the road S.E. of Glencrawne Cave.

In the townland of Sheshodonnell, one mile south-west of Castletown, is a vein of hydrated calamine, associated with galena in small quantities, carbonate of lead, and fluor spar. This vein varies from an inch in thickness to eighteen inches, and dies out suddenly both to the N. and S. This mineral is botryoidal in structure, and is of a beautiful yellow, or apple-green colour, often streaked with red and green, or blue.

To the east of Lough Aleenaun, about one-fourth of a mile, there is also a small vein of spar, with traces of galena, bearing N. 5° E.

In the townland of Lisnanroum, about one mile N.E. of Noughaval Roman Catholic Chapel, is another small vein of spar, with traces of galena and copper pyrites.

Near the western edge of sheet 123, about half a mile N.W. of Doolin Castle, there occurs a vein of calc and fluor spar, with traces of *galena.*

7. Mineral Springs or Spa Wells.

It is from the decomposition of the iron pyrites in the Coal measures that these wells derive their sulphur and iron.

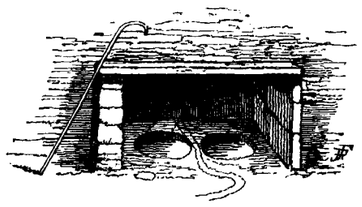
The water in the sulphur wells is beautifully clear, and possesses the strong and peculiar odour and flavour of sulphuretted hydrogen gas.

The iron spa is of a dull muddy red colour, with little odour and insipid flavour.

At the edge of the river S. of Rooska Lodge, at Lisdoonvarna, at the very junction of the limestone and shale, may be seen the rather singular phenomenon of a sulphur and iron spa side by side; two little circular hollows in the limestone receive respectively the two streams which flow from the superincumbent shales. *See sketch*, fig. 9.

One of these wells also contains a considerable amount of magnesia, and is called the magnesia spa.

Fig. 9.



Sulphur and Iron Wells at Lisdoonvarna.

The waters of the Lisdoonvarna Wells have been known to be beneficial in many cases of illness, and in the summer season it is the resort of numbers of invalids. There are two hotels, besides numerous lodging-houses.

Lisdoonvarna is conveniently situated for visiting the different places of interest of the Burren district; as is also the pleasantly situated village of Ballyvaughan, where reasonably good accommodation can be procured.

F. J. F.

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