



Cliffs in Achill Island stretching from the base of Minaun southwards, with Clare Island in the distance (from a Sketch by Professor Hull).

Memoirs of the Geological Survey.

EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 62 AND THE NORTHERN PORTION OF  
SHEET 73 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

BY

W. F. MITCHELL.

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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.

This Memoir gives a plain matter-of-fact account of the Geology of a very interesting island, which cannot fail to be useful to Geologists interested in the subject.

ANDW. C. RAMSAY,  
Director General.

26th March, 1879.

The district described in this Memoir was geologically surveyed by the Author, Mr. Mitchell, during the years 1876-7, and inspected by me on two occasions during this period. The rocks of which it is formed belong to the great series of Metamorphosed Lower Silurian beds, which occupy the western portions of Galway, Mayo, and Donegal; and emerging from beneath the ocean enter largely into the structure of the central Highlands of Scotland. They are well represented in the sections laid open along the precipitous cliffs and bold headlands of Achill.

EDWARD HULL,  
Director of the Geological Survey of Ireland.

29th January, 1879.

## EXPLANATORY MEMOIR

TO ACCOMPANY

SHEET 62 AND THE NORTHERN PORTION OF SHEET 73  
OF THE MAPS

OF THE

## GEOLOGICAL SURVEY OF IRELAND.

### GENERAL DESCRIPTION.

The area included in these sheets embraces a small portion of the coast of West Mayo from Ballycroy to Blacksod Bay, the extreme southern end of the Mullet at Termon on the north, and the country known as Curraun Achill on the south, as also the islands of Achill, Achill Beg, Clare, Innishbiggle, Innishgalloon, Duvillaun, Leamarch, &c.

The principal villages in Achill are the Missionary settlement at Doogort, Cashel, Keel, Dooagh, Slievemore, Dooega, Sraheens, and Kildavnet.

### *Form of the Ground.*—(Sheet 62).

The whole of the island of Achill, and a considerable portion of the adjacent mainland, is of an extremely mountainous character, the valleys and low-lying lands being occupied by bogs, lakes, and alluvial flats. The Drift deposits are scanty, rare and insignificant, being, with few exceptions, found thinly skirting the bases of the hills and mountains, and creeping to no great altitude up their flanks.

The island of Achill, whose extreme dimensions from east to west are fifteen miles, and from north to south eleven miles, is separated from the mainland by Achill Sound, a channel of the average width of, from half to, three-quarters of a mile, narrowing to about 300 yards at Bulls mouth, the Ferry, and Darby's Point, and spreading out into a large expanse of water north of the ferry between Achill and Ballycroy, containing the islands of Innishbiggle, Annagh, &c., and sweeping away to the eastward and southward, joins Ballacragher Bay, forming with the waters of Clew Bay at Mulranny a peninsula of that large tract of country which lies to the west of the village, of which Curraun Hill, 1,715 feet high, is a conspicuous feature. Along both sides of the sound the bog extends inland to a distance of, from half to, one and a half miles, forming low-lying, swampy grounds, and is found over nearly the whole surface of the islands of Innishbiggle and Annagh.

Proceeding to the west, or W. 20° N. from the ferry at the

Sound, the ground rapidly rises within a distance of  $4\frac{1}{2}$  miles, as the crow flies, till it attains west of the village of Mweelin an elevation of 1,530 feet, forming there a ridge or table-land, running due south for nearly three miles, and terminating at a height of 818 feet in Dooega Head. Its western margin descends with a nearly vertical descent of 900 feet into the sea, forming the precipitous and picturesque cliffs of Minaun. To the north of this, and east of the Protestant colony, the ground again rises 698 feet above sea level, whilst immediately to the west abruptly rises the mountain of Slievemore, attaining a height of 2,204 feet within a horizontal distance of one mile. This mountain gradually slopes to the west, and at a distance of one and a half miles from its apex terminates at Ooghnaboo in sea cliffs 80 feet high. Its north-east face is broken by a precipitous rift or chasm, which extends to within a few hundred feet of its summit, and runs down nearly to the sea-cliff. The direction of this rift remains constant at right angles to the dip, and approximately parallel to the great south-east fault, which runs through the heart of the mountain. From this, out to the extreme west point of the island, viz., Achill Head, the surface of the country consists of only high hills and elevated boggy plateaux, culminating in the mountain called Croaghaun, whose summit towers nearly vertically over the Atlantic at a height of 2,192 feet. This mountain is sheared off by an enormous precipice of nearly 2,000 feet, running from top to bottom of its north-west face, and forming an almost perpendicular wall to the sea. In this case also the dip of the rocks—which is nearly invariably at right angles to the major joints—approximately coincides in direction with the inclination of the cliff.

Croaghaun slopes down at a steep incline to south-west, forming with the undulating mountain land of Benmore a deep north-west and south-east valley, along which runs a line of fault; this high ground terminates in a narrow spit of land, one mile in length from Saddle Head to Achill Head, flanked by abrupt cliffs of 380 feet in height.

*Lakes.*—Among the bog lands the largest is Keel Lough, one mile long by three-quarters of a mile at its widest point. It is dammed in on the south by blown sand and shingle, and fed by five streams, which drain the southern flank of Slievemore, and communicates with Keel Bay by a single stream. The other lakes are Sruhll-beg, Loughanascaddy, Mweelin, Naneaneen, Gall, Doo, Nambrack and Sruhll. The two latter, like Keel, are dammed in from the sea by blown sand and shingle bars.

The rock-basins are, L. Aigher, L. Nakeeroge East, L. Nakeeroge West, L. Bunnafreva East, L. Bunnafreva West, L. Corryntorrey, L. Sraheens, and L. Acorrymore.

*Rivers.*—These are all small streams, viz.—Tonreege, Owenavally, Mill Stream, &c., draining the country to north of Dooagh, and emptying themselves into that Bay; Gallagher river, draining the district around Dookinelly; Dooega river, draining the mountain slopes above and west of Mweelin, and falling into Campport Bay; Cashel river ending in Bunacurry Harbour.

*Form of the Ground.*—(Sheet 73).

This sheet embraces the southern half of the island, Achillbeg Island, part of the mainland called Curraun Achill, and Clare Island. Starting at Dooega Head, 818 feet high, the ground undulates, sinking into a valley from Mweelin to Dooega and Campport, and rising to the east to 1,119 feet above sea level. From this it undulates towards the south and forms a hill 931 feet high, one mile north-east of Ashleam Bay, from whence to Breanaskill the road runs through a boggy valley. To the south the ground rises to a height of 940 feet, half a mile north-west of Kildavnet. The rest of the ground from this to the south end of the island is occupied by high hills and valleys, except along the eastern coast, which is low bog-land.

*Achillbeg Island.*—One and a half mile long by one mile wide is an elevated tract of land lying about half a mile from the main island. Its surface consists of steep hills and intermediate valleys, the highest point being 360 feet above sea level. Three hundred feet up the sharply inclined flank of the south-east face of this high ground are found large perched blocks of *Red Sandstone*, more than a ton in weight, in a condition of unstable equilibrium. These have been undoubtedly transported by ice from the Old Red Sandstone country to the east.

The eastern slopes of this island are also covered with a mantle of Boulder Drift, chiefly of red gritty sandstones. Achillbeg is bisected by a broad, sandy, east and west cut, or passage, running parallel to the passage that divides the two islands, and the three east and west valleys occurring at intervals of two miles each, going north on the main island. The above passage is nearly on a level with the sea, which has evidently swept through it; its direction coincides with that of the joint planes and of the numerous east and west faults.\* It is bordered on the east side by sharply inclined high ground. Crossing on to the mainland, we have the bog along the whole east border of the sound, down to Ard, where we get blown sand and shingle. Ascending from this in a N.  $10^{\circ}$  E. direction, we arrive by a gradual slope at the top of the rugged, craggy, quartzite mountain of Curraun, 1,715 feet above sea level. This sinks abruptly to the north, and at its base, around Loughaun, the bog comes in and spreads outward to the east, enclosing numerous lakelets. Loughaun is dammed in on the western brink by moraine *débris*, tossed blocks, drift, and bog. It is fed by the Fiddaunmatramore river, and empties itself into the sound by the Belfarsad River. The western flanks of this mountain are drained by the Bunna-pullida, the Bunanioo, and the Bolinglanna rivers, all small streams, the former two empty themselves into the sound; the latter into Clew Bay.

\* Similar passages or sections occur in the Arran Islands to the South. See Explanatory Memoir G. S. Map, Sheets 104 and 113. The faults are too small for insertion on the 1-inch map.

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

AQUEOUS ROCKS.

RECENT AND POST-PLEIOCENE.

Name.	Colour on Map.
Alluvium, Bog, or other superficial covering . . . . .	Raw umber.
Drift or Post-Pleiocene Beds . . . . .	Engraved Dots.
c. Old Red Sandstone . . . . .	Indian Red.

METAMORPHIC ROCKS.

(Lower Silurian ?)

μ. Gneiss and Schist . . . . .	Crimson lake.
q. Quartzite . . . . .	Chrome yellow.
λ. Crystalline Limestone . . . . .	Cobalt.
Σ. Serpentine . . . . .	Carminc, with wavy green lines.

IGNEOUS ROCKS.

B. Dolerite or Melaphyre . . . . .	Rose lake.
Gf. Granite . . . . .	Carminc.

*General Description—Sheet 62.*

μ & ν. *Schist and Gneiss.*—These rocks in the district of Achill vary very much as to their crystallization, texture, and composition. Merging from a highly micaceous, much foliated, soft, friable schist, into a harder quartziferous schist, and from the latter into quartzite, by the gradual interchange of silica for mica, and again into gneissose schist or gneiss by the substitution of felspar for more or less of the two former minerals.

They extend from Ridge Point, the extreme N.E. point of the island, along the whole north coast, embracing as well, the mountain land to the E. and S.E. of Doogort, for a distance of more than two miles—Slievemore, down to an E. and W. line, running through that village, from the latter to the S. for one mile, thence to the S.W. as far as Tonregee, and for one and a half mile along the coast to the W. at Doogagh, where they terminate against a boundary and fault line running N.W. to Gubfoheratory.

They come in again at Moyteoge Head, near Keem, along another N.W. fault line, and extend along both N. and S. coast lines to Achill Head. To the E. they form the hill and point of Salia, and the mountain ground for a distance of 4 miles W. of the Sound to the south of Sraheens Lough.

The different varieties of schistose rocks that occur are—"Mica Schist," "Quartzite Schist," "Gneissose Schist" or "Gneiss," "Chlorite Schist," and "Talc Schist." The foliation for the most part coincides with the lamination along the N. coast.

q. *Quartzite.*—It forms the whole of the mountain of Croaghaun and its cliffs, and extends as a broad band towards the S.E. to the coast between Moyteoge Head and Kiveelaun Point, the headland from Keel to Doogagh, the highland from Cashel to Dooki-

nely on the N., and to Mweelin on the S., including the Cliffs of Minaun, and a narrow strip at Ridge Point. This rock is well bedded, tabular, and flaggy, pale bluish-white, very hard and brittle, with a small proportion of finely disseminated mica.

λ. *Limestone.*—There is very slight evidence of the occurrence of limestone in the island. One band occurs among the flaggy schists, which are much cut up here by faults—one quarter of a mile to the N.E. of the village of Doogort. *Note by Mr. Symes:*—"A large boss of highly-crystalline pink and white or greyish-blue limestone occurs along the line of fault, and being devoid of foliae or bedding, is probably due to infiltration." Of somewhat similar bands occurring among the metamorphic rocks to the N. of Castlebar Mr. Symes says—(Expl. Mem. Geol. Survey, Sheet 75, foot note, p. 12):—"My reason for supposing that these limestones are not metamorphosed is, that they are highly crystalline, and totally devoid of mica. They appear to me to have been formed from the original superincumbent rocks, supposed to be the Carboniferous limestone, the limestone passing in a state of solution along its own crevices down to the subjacent strata, and then trickling into the apertures, crystallized out in a stalactitic form. In the district N. of this under consideration, there is no doubt that such is the case, as the limestones there lie right across the strike, bedding, &c., and there seems to be no other way of accounting for their formation."

*Sheet 73.*

μ & ν. *Schist and Gneiss.*—The schistose rocks are included between boundary lines, running from Doonty Eighter in a N.E. direction, within half a mile to N.W. of Doogaga, and from Ashleam Bay through Sraheens on the S.E.; also all S. of a S.E. line from Claggan to Carricknahelty on the mainland, including Achillbeg, and a small patch on the mainland E. of Carrickbelfarsad and N. of Loughaun. The last-named S.E. boundary is the most distinct line of demarcation between the schists and quartzites in this district, as in other cases they blend into one another in a very gradual manner. With reference to this, Mr. G. H. Kinahan says:—"In all metamorphic countries the quartzite (metamorphosed grits and sandstones) occurs as a regularly stratified rock. In such cases there are rarely well defined boundaries between the quartzite and the associated schists, as one usually graduates into the other both horizontally and vertically. This is due to the eminently siliceous rocks only changing into typical quartzite, while impure sandstones, slates, and shales become micalyte (mica schist), hornblendyte (hornblende-schist), felsilyte (felsite-schist), or some other variety of schist, some varieties being quartzitic, and this merging into quartzite."\*

q. *Quartzite* forms the headlands of Doogaga Head and Doonty Eighter, and stretches in a fan shape between the lines from Claggan to Carricknahelty on the S., and from Ashleam Bay to the Ferry on the N., dipping beneath gneiss or gneissose schist at the N.E.

\* See Paper on "Quartzite, &c.," by G. H. Kinahan, M.R.I.A., read before Manchester Geol. Soc., Nov., 1877.

corner of the map, and under Old Red Sandstone and Conglomerate on the E., lat.  $53^{\circ} 52'$ . These rocks behave similarly in the West Galway district, &c., Twelve Pins, Croagh Patrick, &c.\*

*Relation between the Form of the Ground and its Internal Structure.*

*Sheets 62 and 73.*

The configuration of the ground is greatly due to the nature and disposition of its rock formations. Starting from the N.E. end of the island, viz., Ridge Point, we observe that the ridge is due to the hard siliceous nature of the schists, backed up on the least weathered side by a strip of still harder quartzite. On the W. side of this the sea has encroached along the line of strike, leaving exposures of the harder portions of rock here and there. N. of Doogort the coast line is most irregular, the rock being soft and easily decomposed, and also cut up by numerous faults. The bold sea cliffs at the base of Slievemore, standing out in a semilune, are composed of a hard quartz-schist, which becomes more felspathic to the W. approximating to gneiss. From Dirk to Annagh the coast line is recessed at right angles to itself. Here the rocks are not less hard, but we have a sudden change of dip along a N. and S. fault at Dirk, and the change in the outline is probably due to jointing, by which the rocks are much cut up—

Joints: 1st set vertical, parallel cross joints, striking N. 25 W.  
2nd " " " " W.N.W.  
3rd " " " " W. & E.†

This increased excavation is due also to the reversed dip. "If the rocks forming a coast be arranged in beds, the amount of destruction depends much on their inclination relatively to the direction of the breakers, the most favourable arrangement of the strata for the waves to exert an influence upon being when they incline from the sea." (Tate's Physical Geology.)

From this point the seaboard projects outwards until it terminates on the N.W. point of Gubroenacoragh, composed of hard quartzose schists. The flanking cliffs on the N. and W. coasts of this table-land, being of felspathic or micaceous schists, have been more rapidly cut away along the parallel jointings, running N.N.W. at intervals of two feet, cutting the rock into slabs. In the Croaghaun cliffs the dip changes from S.S.E. to N.N.E. or N.E., and continues thus out to Achill Head, the master joints running parallel to the line of cliffs. Along the shores on the S., Moyteoge Head presents a barrier of quartzite to the agents of denudation, sheltering the inlet or bay of Keem from the S.W. gales. The bay is formed parallel to a line of fault. Further E. the headland of Gubalennaun More stands forth in the comparative impenetrability of quartzite, being carved out along the lines of

\* For description, see Professor Hull's "Physical Geology of Ireland," and Memoirs Geological Survey.

† See on these points—"Valleys, Fissures, and Faults," by G. H. Kinahan, M.R.I.A.

jointing—the indentations of Dooagh and Keel are cut in along the line of strike—on the E. side of Keel Bay, in the Minean cliffs, the strike bends round more to the N.E., the jointing continuing approximately at right angles to the dip. From Doonty Eighter, the S. point of the quartzite cliffs of Minaun the coast line as a whole trends to the S.E., the schists becoming softer, more micaceous, steatitic, and chloritic as we go south, and this portion of the coast being more exposed to the S.W. gales, has run at the S. end of the island away to a point. It is very noticeable that the coast line throughout is approximately either at a very high angle or at right angles to the direction of the dip.\*

Achill Sound itself appears to have been formed by a gradual subsidence of the land, the direction of the coast line being approximately parallel to the line of the strike of the rocks, viz. N.N.E., and E.S.E., and frequently coinciding with that of the major joints. On both the east and west shores also the bog is found running down on the beach and forming banks at the level of high tide.

The vertical inequalities as to hill and vale are due, in the main, to the relative hardness of the subjacent rocks, modified by ice action, crust motions, and other cosmical causes. All the mountains are composed of either quartzite, as Croaghaun, Mweelin, Dooega, Curraun, &c., or of very hard siliceous gneiss or gneissose schist (capped with quartzite) as Slievemore. Professor Hull in his annual visit remarked that here, as elsewhere, these quartzite districts were extremely unproductive and arid, which fact affords a tolerably accurate guide to the nature of the rock if seen from a distance. The heaths, however, grow luxuriantly here, (amongst them being the rare *Erica Mediterranea*) and also the wild juniper is to be found.

The rock-basins are all noticeable from the marked peculiarity of presenting a steep cliff-face to the N.E., at the base of which occurs the greatest depth, and being dammed in on the N.E. side by drift, and moraine *débris* and blocks. The dip in all cases is along or down the cliff-face. In each of the above cases the direction of the cliff is parallel to the N.W. and S.E., faults running through the island. My colleague, Mr. E. T. Hardman, pointed out L. Accorymore as being a fine example of a coomb, the tossed blocks and *débris* having the exact character of glacier moraines. This is also the case more or less in the other rock-basins. Immediately to the N.W. of the above lough on the coast line an abrupt change of dip occurs in a well marked corry, the rock being much shattered and ice-rounded on the S. side of the corry; the mammillated surface looking N. to N.N.E., presenting crag and tail to N.W. and S.E. It is also worthy of notice that the general direction of these lake cliffs corresponds very closely with that of the great N.W. ice-flow, (see Professor Hull's "Physical Geology and Geography of Ireland," Map, General Glaciation of Ireland.) The formation of these cliffs may possibly be due to the expansive force of congealed water along the bedding and joint planes, forcing out and shearing off the rock assisted by

\* This fact was pointed out to me by Mr. E. T. Hardman.

the pressure of local glaciers, the basin being afterwards scoured out and dammed up by the dominant ice-flow. That these lakes are due to ice action is in accordance with the views of such authorities as Professor Ramsay, Mr. Geikie, &c.; but the manner of their formation is still an undecided question. I believe that these lakes should be included in Professor Ramsay's Class 3. (See "Physical Geology and Geography of Great Britain.")

The waters draining the above mentioned district are largely impregnated with sesquioxide of iron ( $\text{Fe}_2\text{O}_3$ ), and many of the springs are chalybeate, and the streams are coated by a thick greasy metallic scum or froth of micaceous iron, a hydrogenic formation resulting from the decomposition of the iron pyrites ( $\text{FeS}_2$ ) contained in the schists.

There are also deposits more or less valuable of brown and yellow ochre derived from the same source.

#### Detailed Description.—Sheet 62.

*μ & ν. Schist and Gneiss.*—At *Ridge Point*, along the sea cliffs hard crystalline quartziferous mica schists—joints transverse to planes of foliation—dip and strike steady.—Dip E.  $30^\circ$  N. at  $45^\circ$ .

At *Corraun Point*.—Flaggy micaceous schists with occasional quartz veins, ferruginous at weathered edges—dip E. at  $35^\circ$ . A, N.W. and S.E. fault visible on shore, to S.E. of the Caher at the point.

At *Gubaphorteen*, another N.E. and S.W. fault visible on shore. Beds waving.

At *Pigeon Point*.—Rotten ferruginous mica schist over siliceous flags, foliae not following bedding, a N.E. fault occurs here along the line of strike,—dip S.E. at  $60^\circ$ .

At *Carricklea*.—Flaggy schists, capped by ferruginous rotten schists—dip S.E. at  $60^\circ$ .—Foliation waving.—There are four faults here along the line of strike, running from N.  $10^\circ$  E. to N.N.E., presenting on the faces fine evidences of slickensides. Here occurs the limestone band before referred to.

At *Pollhenry* the rocks are much cut up and under the village of Doogort micaceous and talcose schists with vein quartz along foliae, cut transversely by a double V fault, the fault rock showing in fault.

At *Gregancarragh*, E. of Doogort Bay—Grayish yellow sandy mica schists containing in some places small veins of white and purple quartz, and showing floccules of decomposing  $\text{Fe}_2\text{O}_3$  on fractured surface—dip N.N.E. at  $25^\circ$ – $30^\circ$ .

At *Foheraphica*.—Dark gray, very compact crystalline gneiss, becoming in places highly siliceous and nearly quartzite, and decomposing into a rotten mealy mica schist with black and gray mica and vein quartz; the latter along the transverse joints (more or less vertical to planes of foliation) by which the rock is much cut up—stained reddish brown from  $\text{Fe}_2\text{O}_3$  in weathered parts, the whole overlain with angular blocks and boulders more quartziferous than the rocks in situ—dip N.N.E. at  $30^\circ$ – $40^\circ$ .

At *Ooghvelleygrannell*.—At this point there is a cavern, cut in along the joint lines, called the Seal Cave, on the E. side of which we have hard flaggy gneissose schists, with parallel joints vertical to planes of foliation;—on the W., very much shattered mica schists, with masses

of vein quartz and containing in some places so much black mica as to render the rock black,—on the hill slopes above is a conglomerate containing quartz crystals. A recent describer speaks of this cave as roofed with "stalactites," but the sparkling crystals, which produce the brilliant effects of refracted and reflected light, are not those of any form of calcite, but rhombohedral crystals of quartz, infiltrated along the joint planes and crystallizing out in the geodes thus formed; they are probably due to hydroplutonic agency.

At *Ooghduff*. Hard flaggy quartz schists, with orthofelspar and dark mica, much broken with joints—master joints running N.N.W. along the latter are found veins of pink felspar (Pegmatolite)—dip, E.S.E.,  $55^\circ$ – $60^\circ$ .

*Gubnahinneora Point*.—Hard massive tabular gneissose schists, bedding obscured with cross jointing,—dip S.S.E. at  $45^\circ$ .

At *Toncroaghawn*.—Massive, compactly crystalline highly siliceous schists—dip S.S.E. at  $40^\circ$ , which within 500 feet to 600 feet to S. and W. of Bunnafreva L. West, become hard flaggy felspathic quartzites, much shattered—dip S.S.E. at  $25^\circ$ .

At *Ooghnagertleen*.—Quartzose and gneissose schists—dip N.N.E. at  $45^\circ$ .

*From Saddle Head to Achill Head*.—Very fibrous highly felspathic coarsely crystalline gneissose schists, very siliceous, and with gray and bronze mica, crystals of pink felspar very common in all these rocks, and several large bands and veins of the same mineral occur,—dip N.E. at  $40^\circ$ .—Cliffs dangerous and almost inaccessible.

At *Ooghnastasy* the dip abruptly changes from N.E. to S.S.E., or nearly at right angles to its former direction.

From this to Moyteoge Head, the rocks become more and more siliceous, the dip increasing from S.S.E.  $45^\circ$  to S.S.E.  $85^\circ$  at the Head, where the rock is a coarse agglomerate. Here the dip reverses again from S.S.E. to N.N.E., at which it continues steady to Mweelaun Point, where the schists come in again along a line of fault, the dip changing from N.  $30^\circ$  E. to S.E. at  $30^\circ$ .

At *Rusheen Cove*.—Hard tabular and massive quartzose schists with black mica.

W. of *Oogharusheen*.—Hard quartz and mica schists, gneissoid, with much black mica and granular quartz, very coarsely crystalline, dip S.E. at  $35^\circ$ , joints running N. and S.

E. of *Oogharusheen*.—Fibrous granular ferruginous quartzose and gneissoid schist, with rich brown, semi-opaque small garnet crystals (probably colophonite) thickly disseminated through the rock; much dark mica and cubical crystals of iron pyrites.

At *Gubroe*.—Rocks bent and convoluted with acute flexures and masses of vein quartz and fault rock; several N. to N.E. strike faults; high boulder drift banks, underlain by bright red ferruginous sandy schists; a little to the E. are beds waving and rolling with planes of oblique lamination striking W.  $25^\circ$  S., and here the rock is in some places nearly pure quartz with spicules of mica and much vein quartz.

S. of *Doogort Colony*.—Hard pale green shimmering agglomeritic talcose schists, with quartz in large blebs and fibres, dip E. at  $30^\circ$ ; to the west, going up the flanks of Slievemore, hard gritty, quartzose schists with black and gray mica; higher up typical quartzite micacized along foliae; bedding coinciding with foliae. The rift in the N.E. face of this mountain is of hard coarsely crystalline, yellowish gray gneiss at base, dip N.N.E. at  $45^\circ$  becoming more compact as we ascend, and the dip changing to E.  $10^\circ$  N. The top of the mountain is capped with compact



flaggy quartzites, with finely disseminated mica, dip E.  $10^{\circ}$  N. at  $35^{\circ}$ . Flanks of mountain for fully one half their height are thickly strewn with a mass of large angular tossed blocks of quartzite; the northern flanks for three-fourths of the way down present numerous exposures and crags of hard quartzose schists and quartzites, much jointed and containing iron pyrites, dip N.N.E. at  $30^{\circ}$ . Down the W. flanks we have crumpled and corrugated fibrous schist, highly siliceous and mineralized along foliæ, dip N.E. at  $25^{\circ}$ . One mile further W. are hard siliceous glistening mica schists, dip E. at  $15^{\circ}$ - $20^{\circ}$ ; foliæ weathering at edges into a serrated edge, due to the foliation being frilled or crumpled on itself. One mile further W., and just above and to the E. of L. Nakeerogue, hard, shining, siliceous, coarse, fibrous, reddish gneissose schists, with large crystals of feldspar, dip E. at  $30^{\circ}$ ; this rock appears to me to approximate closely to that described as 'stangel gneiss' by Mr. Kinahan, ("Handybook of Rock-names"); "the ingredients are placed in a fibrous manner in one direction, so that a peculiar linear parallel conformation is produced." In a variety of fibrous gneiss the quartz particles are of elongated almond shape, and a cross section of the rock has a peculiar aspect." South of Sraheens L. and around the shores of Salia, we have hard tabular siliceous and felspathic mica schists and gneissose mica schists, dip E.S.E. at  $45^{\circ}$ - $50^{\circ}$ .

q. *Quartzite*.—At Altderg, E. of Ridge Point, hard gray and purple somewhat ferruginous flaggy quartzites, with veins of quartz along joints, dip E.  $10^{\circ}$  N. at  $35^{\circ}$ - $40^{\circ}$ .

At *Ridge Point*.—Hard tabular crystalline quartzite, much broken with transverse joints filled with vein quartz.

At *Croaghau Cliffs*.—Hard flaggy felspathic quartzites, much shattered, dipping S.S.E. at  $25^{\circ}$ , increasing to  $70^{\circ}$  at Corryndoberleen, and reversing at an angle of  $70^{\circ}$  dip to N.N.E., terminating against the schists at Oghnagertleen.

The S.E. brink of L. *Accormore* is a vertical shear or cliff 200 feet to 300 feet high, presenting jagged edges of hard tabular quartzites, dip E.S.E. at  $40^{\circ}$ .

Up the S. flanks of Croaghau are numerous exposures of massive typical quartzite, dip N.  $30^{\circ}$  E. at  $40^{\circ}$ ; one half mile to E. extremely hard, coarse gneissose looking schists with strings and fibres of quartz, dip E.N.E. at  $45^{\circ}$ . Further E. at an elevation of 822 feet we have flaggy quartzite, foliæ much frilled and weathering into knobs on the surface, dip E.N.E. at  $25^{\circ}$ - $30^{\circ}$ .

At *Keem*, along the coast W. of the village, vertical cliffs of coarse quartzite and flaky mica schists, foliation dipping S. at  $60^{\circ}$ . From this to Mweelaun Point vertical cliffs of tabular or flaggy highly felspathic quartzites with so much transverse jointing as to obscure the bedding in places.

Just E. of *Dooagh*, are massive gray quartz schists with planes of oblique lamination striking W.  $25^{\circ}$  S.

Beds generally vertical at Ooghgowan Cove; beds waving, strike fault; beds traversed by vertical fissures and joints.

At *Black Cove*, hard compact crystalline quartzite, with numerous parallel and interlacing joints and several slips filled with vein quartz. Fault running S.  $50^{\circ}$  W. showing slickensides. Round to Gubalemaunbeg is rock of the same nature, beds waving, and rock much cut up being curved folded and contorted, and intersected with numerous transverse diagonal joints, which have apparently small slips along the joint lines, general dip is to S.E. at  $40^{\circ}$ - $60^{\circ}$ . East of this, hard tabular quartzites, bent into acute flexures laterally and vertically, dip E. at  $45^{\circ}$ .

Just S. of Keel village. Hard coarsely granular quartzite, beds crushed and contorted, and broken with transverse parallel joints mineralized along planes of foliation, with black and gray mica.

At the E. side of Keel Bay in the Minaun or Cathedral Cliffs (so-called from their fancied resemblance to cloistered aisles,) the sea having excavated passages through projecting points, along the joint planes) we find the coast line and head land of hard flaggy and tabular quartzites with occasional bands of argillaceous and other schists. General dip is S.S.E. at  $60^{\circ}$ . We here notice in all the more weathered parts, i.e., those cut into the cliff, that the direction of the dip is at right angles to that of the most weathered face of the cliff. (See ante note from Tate's Physical Geology.)

These quartzites end in Dooega Head and Doonty Eighter, dipping S.S.E. at  $50^{\circ}$ . Some four miles to the E. of this in the hills S. of Cashel, we get exposures of quartzites dipping S.E. at  $60^{\circ}$ - $70^{\circ}$ , and near the ferry at the Sound in the hill behind Mr. Pike's house, typical well-bedded quartzites, dip S.S.E.  $30^{\circ}$ - $35^{\circ}$ .

#### DETAILED DESCRIPTION (SHEET 73).

##### *μ & v. Schist and Gneiss.*

At *Dooega* along the coast. Hard dark gray siliceous schists, with cross jointing, dip S.E. at  $45^{\circ}$ .

At *Campoort*.—Siliceous schists, much jointed, joints nearly parallel, running S.  $10^{\circ}$  E., nearly vertical, dip S.E. at  $40^{\circ}$ . East of the village, micaceous schists, much jointed, nearly horizontal, foliation not following bedding. Further on are micaceous and siliceous gritty schists much jointed, joints running W.S.W. dip S.E. at  $25^{\circ}$ .

At *Ooghnaashinnagh*.—Hard siliceous schists, major joints W.S.W., minor joints very close, S.E.

At *Ooghnaattogue*, hard micaceous grits, much shattered.

Inland, N.E. of Ashleam, and in the hills W. of Sraheens are numerous small N.E. valleys amongst massive tabular highly siliceous gneissose schists, dip E.S.E. at  $35^{\circ}$ , ice-rounded. Further to S. felspathic and siliceous schists, dip E.S.E. at  $35^{\circ}$ . Roches moutonnées, line of flow, N.E. to N.N.E. Top of hill N.E. of Ashleam, 931 feet high; hard siliceous schists, dip S.E. at  $35^{\circ}$ . At the fault line S. of Kildavnet the schists come in again, highly siliceous, either vertical or dipping at a very high angle to N.N.E., getting more micaceous and chloritic as we go S. W. of Kildavnet Castle, coarse silvery looking schists, dipping N.  $60^{\circ}$  E. at  $45^{\circ}$ .

At *Claggan*.—Hard flaggy schists, with black and white mica, thrown up into nearly vertical N. and S. flexures.

At *Carricknacrubogue*.—Hard quartzose schists much broken, dip N.E. at  $80^{\circ}$ .

At *Killeennabausty*.—Hard quartzose and talcose schists, dip.  $80^{\circ}$ . Between this and Gubgarve, E.N.E. and E. and W. faults occur among talcose and steatitic siliceous schists, dip vertical, strike N.  $10^{\circ}$  W.

At *Gubgarve*.—Steatitic siliceous schists and hard dark shattery schists with margarodite. S. of *Bumatruffawn*, N.E. fault, among hard siliceous schists, outcrop twisted, dip N.W. of fault. N.E. at  $60^{\circ}$ - $80^{\circ}$ ; S.W.  $80^{\circ}$  to vertical.

At *Toorrevagh*.—Silvery glistening schists, much interfoliated quartz,



dip N.E.  $40^{\circ}$ - $45^{\circ}$ ; 400 yards S.E. of this are numerous N.E. faults across the line of strike of hard quartzose talc or margarodite schists, much broken; dip N.E.  $25^{\circ}$ - $30^{\circ}$ . E. of Doonaglass Point the rock becomes a very soft black friable plumbago-like schist, dip E.N.E. at  $60^{\circ}$ , having all the features of graphite mica-schist. Cotta's definition of Graphite is—"Grayish black aggregate, texture flaky to compact, soft, streak black, greasy feel, not inflammable." Graphite or Plumbago is carbon in a state nearly pure . . . "is the last member of the series of transmutation of the Carbonaceous rocks, and is therefore principally (and normally) found in subordinate beds in strata of crystalline slate rocks, or as a local admixture in the same rocks". . . . "found in separate beds, probably the final product of the transmutation of vegetable remains" . . . "as an essential ingredient of graphite-granite, graphite gneiss, graphite-mica-schist, &c." The igneous origin of some graphite may be inferred from its presence in furnace slags in the form of thin laminae (Cotta's "Rocks Classified," &c.). Mr. Kinahan says of it—"Graphite occurs in beds and imbedded masses, laminae or scales in Granite, Gneiss, Schist, and Schistose limestone." (Handy-book, &c.) Dana (Mineralogy) says, "a result of the alteration by heat of the coals of the coal formation."

In the E. of these, and S. of the village of Carrowgarve, hard siliceous glistening schist, highly talcosed along foliation; dip E.N.E. at  $45^{\circ}$ .

In Achillbeg Island, at the N.W. point, opposite Doonaglas, we have blue-black, shining graphitic schists, much crumpled and frilled, with interstratified bands of quartz; dip E.N.E. at  $30^{\circ}$ .

Further S. steel-gray, slaggy graphitic schists, much broken and jointed, dip E.N.E.; also siliceous steatitic schists having a porphyritic look, with vesicles containing decomposed iron and blebs of quartz. In the vertical cliffs forming the W. coast of the northern half of the Island, the schists have a gneissose appearance, with fibrous quartz showing between the foliae. Inland on the hill slopes, reddish siliceous gneissose schists, with vein quartz becoming in places of a knotty texture. The coast-line here is very irregular, being cut into numerous inlets among rapidly weathering rusty-looking schists; dip N.N.E.  $80^{\circ}$  to  $90^{\circ}$ . In the guts the sea is rapidly cutting its way between the foliation planes. Numerous exposures on the hills of siliceous schists, becoming soft, flaky, and steatitic on the coast; dip N.E. at  $35^{\circ}$ , inland; N.E. at  $80^{\circ}$  on coast. Foliation waving, crumpled or frilled throughout. Every exposure of rock on these hills presents a vertical crag face to S.W., and in the inlets the cliffs to N.E. are more precipitous than those to S.W.

In S. half of the Island, on the southern slopes of the E. and W. passage, argillaceous, slaty schists much broken, nearly vertical. Further S. hard compact gritty schists, containing much felspar where they are much broken, as at S.W. of passage; and along a small E. and W. gap they appear as a shattery shaly schist, with a greenish-gray glazing along foliation planes, the foliation finer than that of the gritty schists. Along the E. coast, beds occur dipping N.E.  $80^{\circ}$  to  $90^{\circ}$  on S., decreasing to  $35^{\circ}$  on N. Rock greenish-gray, dark green or black argillaceous slaty schists, mineralized along foliation, mica not perceptible. Beds much crumpled and broken and traversed by numerous E. and E.S.E. faults. On the N. highly siliceous silvery schists occur, talcosed along the foliation, which is waving.

On the S. coast of the mainland at Carrickoultaun hard compact flaggy quartzose schists, much crumpled and broken. At Gubnabin-naiboy, are hard splintery schists, becoming blueish-black, and steatitic looking to N.E. Iron-stained and rotten under the bank and full of iron-pyrites, dip N.E. at  $35^{\circ}$ .

W. of Carricknahelty, massive silvery mica schists with iron-pyrites and gray mica or margarodite, dip N.E.; all these rocks are highly ferruginous and easily decomposed.

To the N. of Loughaun we have fine-grained brownish-gray gneiss, foliation or bedding not apparent; up the mountain slopes coarsely crystalline gneissose schists, dip S.S.E.; crag faces to N.W.; the mountain slopes covered with tossed blocks and debris.

q. *Quartzite*.—N.W. of *Sraheens* the hills are studded with exposures of typical quartzite; general dip S.S.E. at  $40^{\circ}$ - $45^{\circ}$ . S. of *Breanaskil* bands of quartzite occur striking S.S.W.; rock flaggy, much weathered, with transverse joints dipping to W. at an angle of  $40^{\circ}$ . General dip S.S.E. at  $80^{\circ}$  to vertical.

These rocks run across this portion of the Island in well-parked bands, along the high ground out to Ooghnadarve. The dip continues steady at a high angle to just N. of Kildavnet, where it is reversed to N.N.E. at  $80^{\circ}$  to vertical. Along the coast line on mainland, at Carricknahelty, S. of Bolinglanna, we find the above beds continued to S.E., as hard flaggy quartzite, much crumpled and cut up with cross jointing and veins of quartz; beds rolling, intermediate bands of schist.

Up the slopes of Curraun Hill and to the summit of the mountain are exposures of well-bedded, hard compact fine-grained flaggy quartzite, with occasional bands of very glistening white mica schist, dip S.E. at  $30^{\circ}$ - $40^{\circ}$  with the frequent occurrence of vein quartz.

*Old Red Sandstone*.—In Curraun Achill on the coast S. of Bolinglanna, at Gubanal, the quartzite is seen dipping against brownish-red shales, resting on altered Sandstone and conglomerate, dipping S.  $10^{\circ}$  E. at  $20^{\circ}$ .

At *Benderg* are well-bedded conglomerates alternating with beds of fine red Sandstone, in which a few small quartz pebbles occur, dip S. at  $20^{\circ}$ . These rocks continue similar at a steady dip to S. of  $20^{\circ}$  to and beyond *Altnaslat*. N. of *Benderg* and E. of *Lough Beg* we find in hill slopes, altered Sandstone and conglomerate, the latter composed chiefly of angular pieces of quartzite, but with less vein quartz than is usual in these conglomerates, dip S.  $10^{\circ}$  E. at  $20^{\circ}$ .

To the N. of this and just E. of the boundary between the quartzites and Sandstone (which here assumes a very curvilinear form) we find quartzose conglomerate alternating with coarse flaggy beds of slightly altered Sandstone.

From this to the N. and E. of *Lough Ard* are numerous exposures of well-bedded quartzose conglomerate, much jointed, dip steady to S. or S.  $10^{\circ}$  E. from  $5^{\circ}$ - $20^{\circ}$ .

At and S.E. of *Lough Ard Beg* the rocks are striated; the grooves of ice-striae running N.  $50^{\circ}$  W.

*Dolerite*.—Just under the jetty at the Sound occurs a small dyke of dark-gray or black very compact fine-grained anamesite, running E.  $10^{\circ}$  N. A similar boss occurs in the mountain to S. of *Polranny*, in nearly a direct line.

#### DRIFT DEPOSITS, BOGS, &c.

*Blown-Sand*.—On the N.E. coast, around L. Doo, L. Nambrack, and L. Dooniver for half a mile inland, are hills or dunes of sand. The same occurs from Cawbawn to and around Keel, between the Lough and the shore. At *Dooagh*; also in Achill Beg, along the whole passage through the island, and covering the points of land at Gubnahardia and in Curraun Achill, S. of the village of Ard, blown-sand occurs.

*Boulder Clay and Gravel.*—Along the shore, for  $1\frac{1}{2}$  mile S. of Bull's Mouth, are Boulder Drift banks, containing water-worn blocks of mica-sandstone and quartzite, with low drift hills 120 feet high. These are capped with bog, which in places extends to the shore, replacing the boulder bank. On the higher ground, wherever the bog is broken through, patches of gravelly Drift are exposed, consisting of red sandstone, mica-schist, and quartz pebbles.

N. of Dooniver Lough are cliffs of Boulder Drift 80 feet high, which extend to Ridge Point, where they are but 30 feet high. W. of Barnynagappul Strand we get 40 feet Boulder Clay, with blocks of red siliceous schists and conglomerate predominating. N. of Doogort occur stratified sands and gravels. Along the whole N. and N.E. cliffs of Slievemore are similar boulder banks, varying from 40ft. to 100ft. high. At Annagh, N. of Lough Nakeerogue are drift cliffs 60 feet high, pebbles and blocks mainly of gneissoid and quartz schists.

Around Loughs Nakeerogue, Bunnafreva, and Tinny, under and W. of the vertical craggy cliffs which cut off abruptly the mountain slopes, and form a boundary between them and the elevated plateau of Roenacoragh, are rounded hummocks of schist and quartzite *débris*, covered with blown-sand and numerous tossed-blocks. The cliffs bordering this table land are covered with a thick coating of Drift. Around L. Acorrymore, Keem, and up the slopes of Croaghaun to nearly 800 feet above sea level, occurs moraine matter, embedding and covered with, blocks of quartzose, highly ferruginous schist, and quartz conglomerate; the steep mountain slopes are thickly strewn with sharp angular blocks of quartzite.\* W. of Dooagh occur high Boulder Drift banks, underlain by bright red ferruginous sandy schists. These banks follow the coast line round to Keel, the character of the contained pebbles and boulders being that of the local rock.

Salia Hill, 336 feet high, is thickly covered with bog-covered Drift, boulders of mica-schist, and ferruginous sand; the latter and the subjacent rock are in some places copper-stained. Trial cuttings have here been made for copper, but with no success. N.W. of Bunacurry are several Drift hills. A thick coating of Drift extends over the hill behind the Priest's house (395 feet), along the S.W. ridge west of L. Naneaneen up to the mountain slopes above Dookinelly. Up the E. slopes of Achill Beg thick Boulder Drift, chiefly of red gritty sandstones, is found; on mainland at Gubroe Cliffs, capped with 5 feet to 20 feet of drift, is *débris* mainly of schists and quartzites. At Benderg, above Old Red Conglomerate, are Drift cliffs from 30ft. to 100ft. high. The flanks of Curraun Hill are coated with Drift up to 400 feet, and along the streams and water-courses, banks and cliffs of Drift occur from 10ft. to 60ft. high. Banks strewn with blocks of red sandstone and quartzite similar to contents of drift deposits.

*Bog*—extends around Loughs Doo, Dooniver, Nambrack, and Gall, and up the hill slopes W. of the valley, and as a light coating over the mountain. The thick bog comes in S. of the Colony, its northern boundary being just N. of the road to Slievemore village; it extends from this to Keel on the W., and to Dookinelly on the E., and thence up the slopes of Mweelin Mountain, near the summit of which it is cut. It is

\* Just N. of Keem many of the blocks are encrusted with aggregations of quartz crystals, varying in arrangement, size, and colour from clusters of minute white crystals resembling the palate of the ray, to large imperfect rhombohedrons of various tints of violet or purple; the amethystine colour being considered due to the admixture of binoxide of manganese ( $MnO_2$ ), forming, it is thought by some chemists, a silicate of the sesquioxide of manganese. These amethysts are of small commercial value.

found very thick in Mweelin valley, and extends out to Bunacurry on N. and to Salia on S. Along and lining the valley from Ashleam to Breanaskil, and extending along both shores of the Sound; it occurs around Dooagh, and generally in all the minor valleys, and inter-colline hollows.

#### MINERALS, METALS, &c.

At Gubnabinniaboy an old mine occurs, which has been worked for sulphur or arsenical pyrites. It is now, however, filled up, and the proprietor of the Curraun estate (on which it is) informed me that the result of some analyses he had recently obtained gave so small a per-centage of arsenic as to render it unprofitable to work. Further out to E. at Benderg there is a copper mine amongst the Old Red Conglomerate. It, also, is filled up, and I could gain no very reliable information as to its success when worked. Mr. S. B. Wilkinson makes the following note with reference to it (1868):—"On the sea shore of (Curraun) Achill a small copper mine has been opened. It is very rich, but apparently it is almost worked out. Two shafts have been sunk, but they have given up working the mine."

On the property of Charles Dickens, esq., in Curraun Achill, on the coast at Carricknahelly, occurs a deposit of fine iron ore, consisting of red hæmatite,  $Fe_2O_3$ . This vein is of extraordinary richness, the numerous specimens I picked up at haphazard containing from 60 to 70 per cent. of iron, which is as high a per-centage as British red hæmatite ever contains. The situation of this deposit is highly favourable for profitable working, lying, as it does, near the shore, in close proximity to the Sound, whence it could easily be transported to Westport by sea or road should it be found, on further inspection, to be sufficiently plentiful. The occurrence of masses of hæmatite among metamorphic rocks, such as those of Achill, is probably due in the first instance to concretionary action, *i.e.*, such a molecular movement as produces botryoidal and other globular masses in dolomite, &c. The ore, however, would not be collected as hæmatite, but as pyrites,  $FeS_2$ , which is formed, according to Ebelman, whenever organic matter in decomposition acts on the sulphates of mineral sea water in presence of ferruginous mud, or is deposited from a state of solution in mineral waters containing  $H_2S$  and  $Fe$ . By the action of heat and pressure, which converted the shales into crystalline schists, and in presence of water, limestone, and carbonaceous matter, the pyrites was first oxidised to sulphate, then converted into carbonate of iron (spathic iron ore,  $FeCO_3$ ), which was then reduced to the hydrated sesquioxide (brown hæmatite,  $2Fe_2O_3 + 3H_2O$ ), and finally to the red hæmatite or anhydrous oxide ( $Fe_2O_3$ ). In fact, in this series of chemical reactions Nature has done on a large scale what is effected in the process of smelting iron ore by artificial means. The clay and limestone, which are added to form a flux and supply  $CO_2$ , are present naturally in the great metamorphic operations, of which we have evidence in the production of altered rocks, metallic veins, &c. It is a confirmation of this view of the transformation of iron ores (which is held by Cotta and other authorities) that, whereas we find spathic iron and brown hæmatite in Secondary and Recent formations—where the reaction has taken place in presence of air and water, by what Haidinger calls "Anogenic transmutation"—we never find the anhydrous red hæmatite in such recent formations, but it may be regarded as formed by "Catogenic transmutation" from limonite or even spathic iron ore, under special circumstances. It is thought by

some chemists that the massive fibrous and reniform varieties of hæmatite form a transition from the colloid hydrate to the crystallized anhydrous oxide.

Mr. Dickens's agent informed me of the occurrence of yellow ochre in the cliffs of Curraun Hill. He considered that there was a sufficient quantity of this deposit—which is clay, coloured by oxides of iron, and sometimes manganese—to render the working of it profitable.

In the townland of Claggan, between Gubgarve and Killeennabausty, among the talcose and steatitic schists, are seen some noticeable bands or veins of steatite, a variety of talc, occurring among serpentine rocks; when soft, called saponite, or soapstone, and the whitest and finest kinds are known as French chalk. These bands consist of a yellowish or greenish-gray, soft, amorphous, sectile rock; greasy to the touch, with dull, resinous lustre; whitens and exfoliates; chemical composition, a hydrated silicate of magnesia, with some alumina. It occurs in vertical bands, filling up joints and fissures in the adjacent rocks.

These deposits, which are on the estate of W. Pike, esq., J.P., the proprietor of this portion of the island, who has already obtained some tons of samples of very good quality, are sufficiently accessible to be worked profitably for pottery purposes, &c.

It is to be hoped that the increased facilities of sea transport now afforded may induce attention to the mineral and other resources of this little-known district.

The occurrence of bands of crystalline limestone, steatite, graphite, and hæmatite among these metamorphic rocks, and the theories of the conditions necessary for their formation, all seem to afford additional arguments and evidence for the former extension of the Carboniferous rocks over this part of Ireland.

Dec. 21st, 1878.

W. F. M.

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