EXPLANATIONS

TO ACCOMPANY

SHEETS 188 AND 189 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTIES OF CORK AND WATERFORD.

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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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EXPLANATIONS

TO

ACCOMPANY SHEETS 188 AND 189 OF THE MAPS

OF THE

GEOLOGICAL SURVEY OF IRELAND,

ILLUSTRATING PARTS OF THE

COUNTIES OF CORK AND WATERFORD.

General Description.

These sheets include some of the southern parts of the counties of Cork and Waterford, which lie on each side of Youghal Bay, and the mouth of the River Blackwater. The principal places within the limits of the district are the towns of Youghal and Castlemartyr, with the villages of Ardmore, Clashmore, Killeagh, Ladysbridge, and Dungourney.

1. *Form of the Ground.*

The northern part of the district is high undulating ground, partly cultivated and partly moorland, having many elevations, ranging from 400 to 700 feet, and one to the N.E. of Clashmore, reaching nearly to the height of 1,000 feet above the sea; while along the southern side and the sea-board the summit elevations do not exceed 250 or 300 feet above the sea. In this undulating country the general direction of the ridges and intervening valleys is, as nearly as possible, E. and W. This may be observed in the small valley of Clashmore, in the larger one that runs a little N. of Youghal, from Mount Uniacke out to Ardmore, as well as in the much longer and wider valley in which Castlemartyr stands, which is continued to Cork and beyond it, and that of which the northern border only comes into this district, namely, the one which we may call the Cloyne valley, lying south of the ridge that ends in Knockadoon Head. The ridges that separate these longitudinal valleys, have their sides often furrowed by little lateral valleys and glens, through which small brooks hurry down to the larger rivers in the flats. There is, however, one much more remarkable feature, that, namely. of the valley of the Blackwater, which here, and for some distance to the north, cuts right across all the ridges, running nearly due S. from Cappoquin, in Sheet 177, out to Youghal Bay. This valley, as might be expected, is of a very different aspect from the other large valleys mentioned before; its sides, where it cuts through the ridges, being steep, cliffy, and often precipitous, while, when it crosses any of the longitudinal valleys, it expands into marshes, or is bordered by wide alluvial flats.

The coast, in like manner, differs in different parts, exhibiting a line of frequently inaccessible cliffs where it runs across one of the longitudinal ridges, and low sandy or marshy shores where the valleys strike

out upon it. The cliffs rise to between 150 and 200 feet near Mine Head, while at Ardmore Bay, the coast consists of a gravelly and sandy beach, backed by low vertical banks of clay. Between Ardmore and Ardogina Heads it again presents cliffs, some of which are 190 feet high; these are broken at Whiting Bay into low rocky shores, with sandy beaches, but appear again beyond it and continue as far as the mouth of Youghal Harbour. From Youghal Harbour a gradually widening strand stretches to the S.W. for four miles, along low cliffs of marly clay, which in one place, at the end nearest to Youghal, rise to a height of ninety feet, but further to the S.W., sink down so as to permit the tide to encroach considerably inland. Knockadoon Headland again is edged by vertical cliffs, with heights of 130, 170, and 200 feet; but south of Kilcredan another strand commences, where the Cloyne valley comes out upon the coast.

The part of the district lying E. of the Blackwater is drained chiefly by the little river Lickey, which runs down through the valley of Clashmore, while from the west come the Glendine brook, and the small Tourig river, traversing the valley which lies just north of Youghal.

The Castlemartyr valley has the Womanagh River for its principal stream, issuing out of the high land on the north with such force as to strike directly across the valley to the foot of the ridge on the south, before it turns eastward to seek the sea. It receives a considerable tributary on its way, called the Dissour river, running by Killeagh.

Several other smaller brooks run directly into the sea, or into the estuary of the Blackwater.

The Blackwater is tidal for a considerable distance north of this district, and is navigable for small steamers up to Cappoquin.

J. B. J. and A. B. W.

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

Aqueous Rocks.

	Name.	Colour on Map.
	Alluvium and other superficial Deposits,	*Sepia.*
	Drift (Gravel, Clay, and Marl,)	*Engraved Dots.*
Carboniferous.	d^2. Lower Limestone.	*Prussian blue.*
	d^1. Lower Limestone Shale,	*Prussian blue and Indian ink.*
Old Red Sandstone.	c^3. Upper Old Red Sandstone,	*Indian red (dark).*
	c. Old Red Sandstone,	*Indian red (light).*
Silurian.	b. Lower Silurian,	*Purple.*

Igneous Rocks.

F. Felstone.

b. *The Lower Silurian Rocks* consist of a quantity of gray, dark-blue, and black silty slates, often containing small, hard, black quartzose pebbles in abundance, but still disseminated and giving to the rock a peculiar yet hardly conglomeritic appearance. Some green arenaceous slates also occur, but the dark gray ones predominate. Owing to the prevalence of a minute and excessive cleavage, the bedding in these silty rocks can scarcely be distinguished; and in some places fragments of thin grit layers, apparently once continuous, seem to have yielded to the force of the cause which produced the cleavage, and to have been thus disconnected, drawn obliquely asunder, and left near each other, but out of their original position in the bed, the intervening spaces being occupied by slate.*

No fossils were observed in these rocks, and the prevalence of the cleavage, together with the non-occurrence of thin flaggy shales, likely to expose fractures on the planes of deposition, leave little encouragement to hope that any will be found here.

c and c^3. *The Old Red Sandstone* consists in its lower part of purple, reddish gray, and green slates, and gritstone, passing towards the upper part of the group into pale whitish-gray flagstones and siliceous sandstones, associated with dusky gray, olive, greenish, and blue shales, and some peculiar beds of pale whitish gray and pink mottled fossiliferous shales near the top of the group; but among the rocks of this upper portion, red beds still continue to occur. The fossils of the upper portion of this group consist of impressions of linear plants, and in the mottled beds alluded to above, some well preserved casts of crinoidal fragments and fenestellæ. The thickness of this group may be about 3,000 feet.

d^1. *The Lower Limestone Shale.*—These are the passage or transition beds between the group last described, and the Carboniferous Limestone. They consist of dark olive gray and black shales or slates, with some grit beds below, which are in some instances calcareous, and in others, conglomeritic,† while the upper portion of the shale beds contains many bands of crinoidal limestone, usually of a dark gray, or blackish colour. The shales, as well as the limestones, are highly fossiliferous, containing an abundance of fenestellæ, and the remains of crinoids. The thickness of this group is estimated at about 200 feet; but it seems to thicken considerably as we proceed southwards.

d^2. *Lower Limestone.*—The lowest part of this group consists of dark blue limestone, with dark crinoidal bands and cherty layers passing downwards, by flaggy and shaly crinoidal beds, into the Lower Limestone shale. Further up in the group, are beds of gray compact limestone, which are frequently cleaved; and amongst the highest beds seen, white and bluish gray splintery limestone prevails. Owing to the fact, that in these pale gray beds, joints and cleavage occur to such an extent, as to render its stratification very frequently obscure, it is difficult to say what the thickness of the part of this group which is exposed may be, but it is supposed, at all events, to amount to several hundred feet.

F. *Felstone.*—A dyke of pale bluish gray Felstone, containing

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* In one place, where these dark gray and bluish silty slates contain also some black portions, they were observed by Mr. Willson, to resemble the slates of Stradbally Cove.

† There is one peculiar bed of quartzose conglomerate in this group here, which is well seen on the east shores of Whiting Bay, forms the block known as St. Declan's stone, in Ardmore Bay, and reappears to the S.W. in Ballycotton Bay, and even apparently extends much farther. since a small band, exactly like it, was lately observed by me near Kilworth, three miles N.E. of Fermoy, in these same Lower Limestone shales.—J. B. J.

some small widely disseminated crystals, occurs in the Silurian Rocks, at the base of the cliff south of Seaview, and there is an indication of another further to the N.

A. B. W., [chiefly from notes by W. L. Willson and A. Wyley.]

3. *Relations between the Form of the Ground and its Geological Structure, and General Account of the latter.*

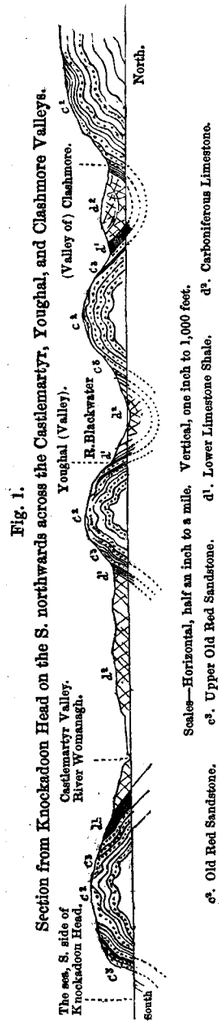


Fig. 1.

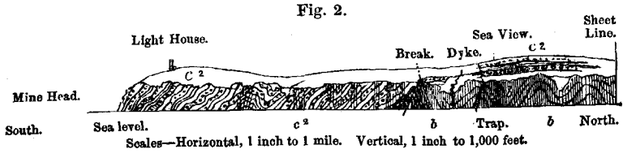
The high undulating grounds, and E. and W. ridges spoken of when describing the form of the ground, are entirely composed of Old Red Sandstone. The intervening valleys and low grounds are all occupied by the Carboniferous Limestone, and its underlying soft shaly beds (*See* Section, fig. 1).

The relations, therefore, between the form of the ground and the rocks of which it is composed, are the same here, as are almost universal in the S. of Ireland.

It will be at once obvious, from an inspection of the section, that the several detached pieces of Carboniferous Limestone, were all united into one great sheet, when the rocks were originally deposited in horizontal layers; and that after they were bent into these undulations, much of the limestone, and more or less of the sandstone, was worn away or denuded, and removed from the tops of the ridges, and the lower beds allowed to appear at the surface. At one part of the district, N. of Mine Head, in Sheet 189, the very base of the Old Red Sandstone is shown in the present cliffs, and even the rocks that lie below it, namely, the Lower Silurian formation. Between this point, then, and the northern part of Ardmore Bay, we have the whole series of the Old Red Sandstone, though it is much disturbed and interrupted by contortions, as shown in fig. 2.

The principal undulations are remarkably steady, the crests of the ridges and the bottoms of the troughs being nearly even for many miles; in other words, the imaginary straight lines, or axes, over and under which the beds are bent, remain horizontal for these distances. Consequently we have long parallel ridges of Old Red Sandstone, and troughs of Carboniferous Limestone, with no change of rock for many miles along the strike. This is especially the case when the undulations are comparatively narrow and the steepness of their slopes considerable, as in the Castlemartyr and Cloyne troughs, and the intermediate ridge that ends in Knockadoon Head, which may be called the Great Island anticlinal. When, however, the undulations are broader and flatter, as in the case of the one occupying the northern part of this district (which is, in fact, but a part of a broad undulation of Old Red Sandstone, between the Carboniferous Limestone trough of Castlemartyr and Cork, and that of Fermoy, Lismore, and Dungarvan), then smaller or shorter undulations frequently occur on the back or flanks of the larger one. These smaller undulations have curved axes, which rise or fall in the direction of their length, and then a change of rock sometimes takes place in the direction of the general strike, in comparatively short distances. This is apparent in the trough of Clashmore, and that which runs in from Ardmore. The limestone in these troughs rises out, not only N. and S., but also more gradually towards the E. and W., in consequence of the rise of the axis, although the synclinal or trough-like curve of the beds is continued much further to the E. or W. in the lower rocks.

Fig. 2.



There is another subject depending, doubtless, on geological causes, which it would be interesting to discuss, and that is the origin of the valley of the Blackwater, cutting directly across all the ridges; but this belongs more particularly to the district north of this, that one included in Sheets 176 and 177.

As it will be useful to have names for the principal features, it is proposed to speak of them as the Cloyne synclinal, the Great Island anticlinal, the Cork and Castlemartyr synclinal, the Cork and Youghal anticlinal and Ardmore synclinal, the Clashmore anticlinal and synclinal, and the Great Mangerton anticlinal, which latter extends from Helvick Head and Mine Head, in Sheet 189, to the coast of Kerry. The Ardmore and Clashmore synclinals are, in fact, but minor undulations on the S. flank of the Great Mangerton anticlinal.

J. B. J. and A. B. W.

Detailed Description.

[The principal part of this district was examined by Mr. W. L. Willson, of the Geological Survey of India; smaller portions were examined by Mr. Andrew Wyley, late Government Geologist at the Cape of Good Hope, and by myself. The following detailed description has been chiefly drawn up by Mr. A. B. Wynne, from the notes on the six inch map.—J. B. J.]

4. *Position and Lie of the Rocks.*

These details will be commenced at the S.W. and W. of the district, and continued to the N. and N.W., in a direction as nearly as possible parallel to the coast.

Cloyne Synclinal and Great Island Anticlinal.—The ridge extending from the S.W. corner of Sheet 188, to Knockadoon Head and Capel Island, is

formed by an anticlinal fold in the Old Red sandstone, which consists of red, purple, and gray sandstones, gritstones, shales, and slates, with occasional green beds. Owing to the rareness of exposures of rock in the inland localities, the angles of inclination are not often determinable; but along the shores of the headland the strata were observed to be greatly contorted with predominant dips, however, at high angles to the S., on the southern shore of Knockadoon Head, and to the N. on the northern side of it. Small quantities of the rocks, indeed, are exposed in the interior in almost every roadway and stream-course along the flanks of the ridge, enough to prove the existence of the rock, although not sufficient to determine its inclination accurately. Perhaps the best of the inland sections will be found in two bye-roads in the parishes of BOHILLANE and GARRYVOE.

The lowest beds seen here are red shales and purple sandstones, over which are purple flaggy beds, and above them, red and green sandy shales and slates, with red, green, and gray micaceous sandstones and shales. In some of the upper beds nodules of iron pyrites occur, surrounded by a coating of brown (?) hematite. Round the point of the headland, the same red, gray, and green sandstones prevail; and in two places N.E. of the Telegraph Tower, and on different sides of the height 135, traces of copper ore were found in compact gray sandstones. These two spots, in consequence of the contorted state of the rocks, were supposed by Mr. Willson to expose the same beds, rolled into apparently different parts of the section. Along the lowest part of the flanks of the hills, the passage beds from the Old Red sandstone into the Carboniferous limestone are frequently seen, viz., near Kilbree House, N. of Dromadda House, near Ladysbridge and Ballymacoda, on the N.; and on the S. side of the ridge, N. of Ballymaloe and S. of the name GARRYVOE, as well as on the coast at both sides of the ridge. They will be found to consist, in their lowest part of red, brown, and green sandstones, shales, and arenaceous slates, forming the Upper Old Red or Yellow sandstone, and coloured dark red upon the map; while above these occur blue and gray grits and fossiliferous slates, amongst which a bed of conglomerate (such as occurs at Whiting Bay) was observed. This was where a dip of 80° to the S. is marked in the dark gray band below the symbol d^1, on the seashore S.E. of Ballycrenane Castle.

The cleavage of the rocks above described runs E. and W., and dips sometimes N., and sometimes S. at 80°, or is nearly vertical.

The Limestone, which overlies the blue grits and shales, does not appear anywhere along the flanks of the ridge in junction with them, but dark gray limestone, in which the dip is not apparent, occurs not far from their upper boundary, near Bridgefield House, and also to the E. of Gurteenina.

Cork and Castlemartyr Synclinal.—That part of the Castlemartyr valley, in which the drift is not represented upon the map, is thickly dotted over with quarries in, and crags of, pale and darker gray compact limestone, sometimes thick bedded, at others thinner and flaggy. Some are also seen within the space upon which the drift is marked, and gray compact limestone appears at low water, as stated on the map at the W. side of Youghal Bay.

The blue grits and slaty beds coming out from under the limestone, on the N. side of the Castlemartyr synclinal, are only to be seen in three places, one S. of the first part of the name Ballynascarty, at the W. side of map 188; another nearer to that village, and the third close to the village of Killeagh; but some gray grits and shales occurring near the G. in MOGEELY, are supposed to be on the same horizon, and to have been rolled in as a small synclinal trough, among the Upper Old Red rocks.

Although these blue shales and grits of the Lower Limestone shale appear so seldom at this side of the valley, the Upper Old Red sandstone beds immediately below them may frequently be seen along the roads, in the

stream channels, and in many other places where the ground begins to rise to the N.

Near the outlier alluded to above, and at its S. side, yellowish, green, gray, and red shales, and gritstones, with soft bands, weathering to a deep or rusty brown, occur; and red, purple, and green sandstones and slates may be seen in several places along the dark red band, both to the E. and W.; but are best exposed at the W. side of Youghal Harbour, a place which will be noticed further on.

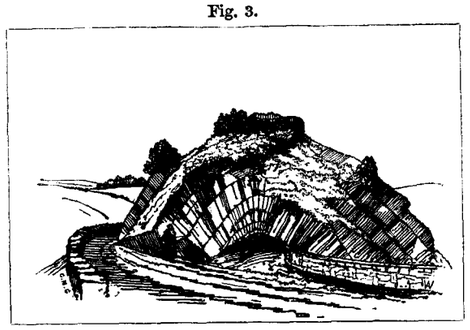
Great Mangerton Anticlinal.—The elevated undulating ground at the N.W. corner of the district presents many sections along streams, or where roadways have been cut through the rocks to reduce the heights of the hills.

All these sections are of very similar character, exposing a quantity of minor anticlinal and synclinal curves in purple, red, and green slates and sandstones.

The cleavage in these rocks is so universal, as often to conceal their true dips. The strike of the cleavage very frequently coincides with that of the beds, but its angle of inclination varies from between 50° and 80° to the N., to 65° and other high angles to the S.

A cutting for the new road close to Dungourney Old Castle, where the word "Church" is engraved upon the map S. of the village of the above name, exposes a cross section of an anticlinal curve in some beds of reddish-purple slate, in which the cleavage planes can be seen to radiate from the axis of the curve, as shown in the accompanying figure (see fig. 3), which is from a sketch taken on the spot.

Fig. 3.



Radiating clay, Dungourney.

There exists a great similarity in the general appearance of these rocks everywhere about Dungourney, as well as for some distance to the N. and N.E. of it. This similarity, together with their being so much contorted, is taken as an indication that there is no very great thickness of the beds apparent at the surface, but that the same beds are often repeated over and over again, as we cross the country from N. to S., or *vice versa*.

The Clashmore and Ardmore Synclinals and their surrounding Ridges.—Among these numerous contortions, two larger synclinal troughs are indicated by the dip arrows, from the middle of map 188 northwards, being the extension of those of Clashmore and Ardmore. The same red and green sandstones and slates which appear upon the ridge between Castlemartyr valley and the valley of the Tourig River, occur in the upper part of that stream, and in the country about Redforge, Ballynatray, and Strancally, on the shores of the Blackwater. Where these beds dip, as they approach the synclinal curves, they pass beneath the red, dull greenish, and yellowish gray sandstones,

slates, and shales of the Upper Old Red sandstone, which may be very frequently seen, although their dips are not so often perceptible, within the band of darker red, by which the forms of these troughs will be readily recognised upon reference to the maps. The sandstones and shaly slates above described, have in their upper part some white conglomeritic grit stones and blue, gray, and yellow shales, which may be observed along the Tourig River, and in other places within the dark gray band to be seen upon the map. These beds are not exposed at the W. end of the northern or Clashmore synclinal, but the northerly dip which would bring them in is well seen in the red slates and sandstones along the Glendine stream, near Ballynatray House, and on the opposite bank of the Blackwater near D'Loughtane House.

The passage beds from the blue and gray Lower Limestone Shale beds into the limestone of the Towrig valley are nowhere visible, and the gray and dark blue cherty and compact limestone itself, where it appears from underneath the drift at three places to the E. of Kilnatoora Cottage, seems from the high angles at which it dips to be much contorted.

Close to the town of Youghal there is a good section in the rocks, embracing all the beds from the Old Red proper up to those immediately below the basal beds of the limestone. At Moll Goggins' corner there are soft red shales and purple slates, with thin greenish gray and red shales belonging to the Upper Old Red sandstones, and dipping S. A little to the N. of these, and apparently underlying them, are gray and green slates, and purple shales and sandstones, with beds of red shale to the N. of the Light House. Further on, overhanging the S. end of the town, are red, gray, and green slates, with some beds of sandstone. These beds have all a contorted and undulating, dip, but still chiefly to the N., while those first described, to the S. of the Light House, have a general inclination in a contrary direction. Close to the church there are fine yellow and brown sandstones and shales, with blue soft silty shales, dipping to the N., and gray sandstones and blue shales appear with a similar dip, in a quarry near the Gas Works, while a large quarry to the S. of Glenally, and near Greencloyne Pottery, exposes hard siliceous sandstones, interstratified with blue and green concretionary shales, with thin red sandy shales, and one bed of decomposed rock, forming a soft brown and ochreous sand.* Underneath all these are thick-bedded gray and brown sandstones, frequently rippled over by the marks of currents upon the bedding faces. Several of the more sandy blue shales contain fragments of plants; and in one of the hardest quartzose grit beds, I observed the obscure carbonized remains of large plants, several inches wide. Similar beds to these are seen to the W., near Brook Lodge; and in the townland of Ballynacarriga, at about 300 yards to the N., some lumps of limestone, probably nearly *in situ*, are to be seen.

Upon inspecting the map (Sheet 188), it will be seen that the band of dark red colour on the W. side of Youghal Bridge, if produced, would abut partly against the paler red representing the underlying beds, and partly against the dark red band at the opposite side of the river. The beds are, therefore, possibly not continuous, but may be interrupted by a fault in the bed of the river, which has shifted their position, and which may, perhaps, extend southwards to Youghal Harbour. On the other side of the Blackwater, the central ground being low and covered with drift, only allows the limestone to be seen in two or three places:—one at the N. side of the mouth of a creek or inlet from the Blackwater, where the limestone is gray compact, and lies

* I was once able to break into a large block of this decomposed rock in this quarry, and get the inner core, which was still undecomposed. I found it a mottled red and green highly calcareous concretionary sandstone, precisely like the cornstones, which are found in both Old Red and Permian rocks in England.—J. B. J.

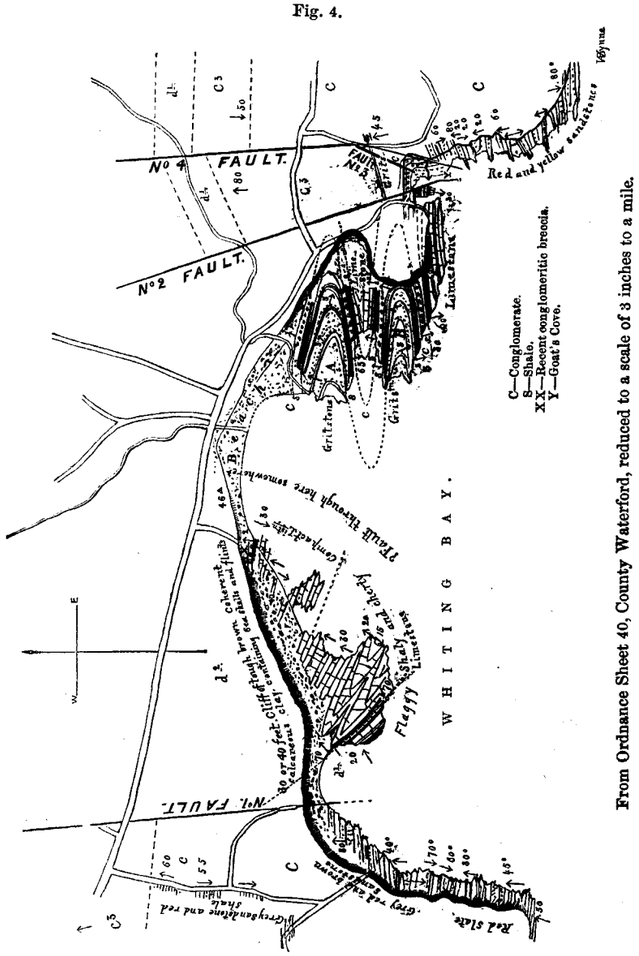
nearly vertical, but dips a little to the S.; the others at the head of the S. branch of the same creek, where compact white, blue, and dark gray limestone is seen. On the S. side of the synclinal, the greenish white and yellowish sandstones, grits, and shales of the Upper Old Red sandstone, are seen in quarries near the roads to the S. of Mayfield, and to the E. of Woodbine Hill; at the former place they dip N. at 20° and 50°, but in the latter, although they incline in the same direction, their angle of dip is not known. The rising ground immediately to the S. of this place, is formed of red, gray, green, and purple slates, sandstones, and shales, which are much contorted, but dip generally N., near Monatray House, and in an opposite direction from East Point, along the S. side of the headland, where they are well exposed in the cliffs.

The following note by Mr. Willson occurs upon the map at the E. side of Youghal Harbour:—"In many places along here may be seen the curious effect the weathering of the sea has upon the colouring matter of the shales and sandstones; those parts above high water being of a bright red and purple colour, while the portion of the same rocks washed by the sea is of a bright yellow and brown colour." "Purple sandstones here often become gray where washed by the sea."

Whiting Bay.—Following the coast line eastwards, a large indentation of the shore, called Whiting Bay will be reached. As the displacement of the rocks by faults, and the consequent interposition of a piece of low limestone ground, partly under water, between two high portions of the Youghal anticlinal, are well seen here, the annexed reduction of the six-inch map is given at page 14, for the sake of a clearer description.

On the W. side of the bay there are contorted red slates, overlaid by red, gray, and brown sandstones, with beds of bright red slate; and over these, at a little distance to the N., are gray sandstones and red shales, which may be seen in a bye-road or lane-way upon the hill, dipping S. at 55° and N. at 60°. In the N.W. angle of the bay, two hundred yards to the E. of the last of the red and gray beds visible upon the shore at low tide, gray, flaggy, and cherty limestones, interstratified with dark shales, being the group known as the Lower Limestone Shale are likewise visible at low water. They dip to the N.E., but are bent in that direction into two small anticlinal curves. They strike directly at the high ground, formed of the gray sandstones and red shales, thereby proving the existence of the fault marked No. 1 on the plan. Further to the N.E. along the shore, at the base of a high bank of calcareous clay, which contains fragments of chalk flints and recent marine shells (littorinæ, &c.), there is a pebbly beach, composed of a variety of different rock fragments, and numerous chalk flints. Protruding from this at low water, there will be found beds of pale gray compact limestone, overlying the flaggy and shaly ones, and containing bands of chert six or seven inches thick: these form apparently an open synclinal curve. All the angles of dip in these limestones are low, and they have cleavage planes striking a little to the S. of E., and dipping N. at 75°. A beach extends for about a third of a mile to the E., in which rock does not appear; but the next rocks seen to the E. are directly in the strike of the limestones, and consist of the Lower Limestone Shale and the top of the Upper Old Red. Standing upon the drift cliff overhanging the E. end of the beach at low water, this patch of rocks will be observed to the S., forming two flat anticlinal undulations; the bedding lines arranged in the manner shown by the plan at A. Upon a closer inspection, the beds at A will be found to consist of hard olive gray grits, forming the interior of the curve, and passing under dark gray shales, both to the N. and S., the shales containing the peculiar band of white pebbly quartzose conglomerate before mentioned. These beds dip to the N. at about 5° on that side of the contortion, but on the other their dip is to the S. at 65°, and in the latter place the conglomerate band is again

Fig. 4.



From Ordnance Sheet 40, County Waterford, reduced to a scale of 3 inches to a mile.

seen. The synclinal trough between A and B is occupied by limestone of a dark gray colour, which can be seen at both sides of the trough resting upon the shales, and at its S. side dipping to the N. at 35°. Between this limestone and the underlying grits, where they reappear in the interior of the anticlinal curve, B, a thickness of about seventy-five feet of the dark gray shales, observed before at A, intervenes. They wrap round the east end of the grits, and then strike to the W., dipping S. at 30°, and are still found to contain the thin bed of conglomerate. Overhanging these shales on the S. side of this contortion, and dipping to the S. at 60°, are thinly bedded dark gray and

crinoidal limestones, with chert bands. The succession from the grits at B up into the limestones, is as follows, taking the beds in their natural order :—

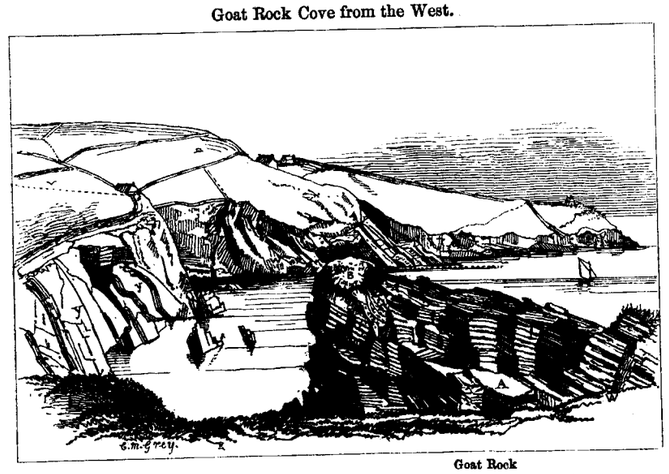
10. Thin limestones, with chert bands, and beds of shale, three feet thick.
9. Dark gray crinoidal limestones, flaky-looking beds, very shaly. These and the beds No. 10=about 100 feet.
8. Greenish gray shales cleaved (cleavage dip S. 50°), seventy feet thick.
7. Thin shales and bands of limestone, one foot thick, and under.
6. Gray shales and grits—some of the shales full of worm tracks.
5. Brown rusty thin rotten grits—calcareous.
4. Hard conglomeritic grit* and conglomerate.
3. Thick dark gray shales, about ten feet.
2. Dark gray shales and grits interstratified.
1. Hard greenish grit (Upper Old Red).

Thickness of rocks in this section about 300 feet.

Following the strike of the limestone to the E., an indentation in the shore, called the Goat Island Coose, is arrived at; and to an observer, standing on the cliff at its west side and looking eastward, it presents the appearance seen in figure 5.

Fig. 5.

Goat Rock Cove from the West.



Goat Rock

The rocks forming Goat Island, coming up in the foreground to the right, are composed of flaggy limestone. The cliff on the left of the sketch is formed of hard sandstone, with conglomerate layers and bands of shale; and the cliff on the opposite side of the bay, against which the beds of Goat Island strike, consists of red and green slates, and grits of the Old Red sandstone.

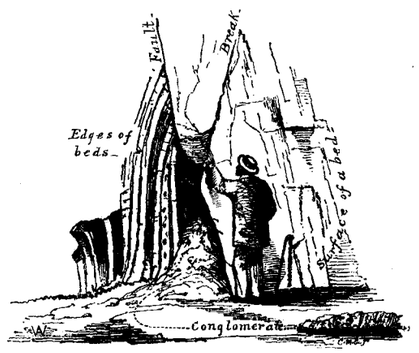
y y surfaces of the beds. The limestones at A are conformable to those on the left of the sketch, but dip at a smaller angle. B patch of drift. v v dotted line, showing course of fault No. 4.—A. B. W.

The mass of rock in the foreground of the above sketch and at its right side is a detached portion of thin and flaggy limestone called Goat Island; its

* On the upper surface of one of these beds of grit, a number of large ridges and furrows, resembling a great current mark, were observed. They measure from two feet to two feet six from top to top of the ridges, and the furrows were filled by small separate little layers of shale, parallel to the regular stratification of a thin bed of black shale which overlies the grit, showing that these inequalities existed on the surface of the grit bed before the deposition of the shale. The lower surface of the conglomeritic grit bed is as smooth as such surfaces usually are.—A. B. W.

beds dip seaward at an angle of 30°, and this strike, continued across the little bay, would abut against the Old Red sandstone rocks, which, although contorted, have a similar strike. The existence of a fault between the two is thus proved, its place being represented by the dotted line v, v. The cliff on the left is formed of the grits and conglomerates already stated to underlie the limestone, which here stand nearly on their edges, with a high slope to the S. In the near part of the cliff their bedding appears to be parallel, while further off it becomes contorted, being highly so near the cave to the left, but nearer to the fault No. 4, being broken, crumpled, and squeezed. On descending to the base of the cliff, a few yards to the E. of a deeply cut track, used for conveying sand to the farms above, the rocks will be observed to be displaced by a fault, throwing them into the positions represented in the sketch, figure 6.

Fig. 6.



Fault No. 2, Whiting Bay.

This fault is marked No. 2 in the plan, and although it cannot be traced with any certainty inland, it appears to have aided in allowing the whole of the beds along the shore to the W. at A and B to have subsided to a lower level.

A little further on to the E. the beds begin to undulate, being at the top of the cliff nearly horizontal, while at its base they are bulged outwards and curved, but still have a high dip to the S. Passing between an outlying crag and the cliff itself, the N.E. corner of the little bay is reached, and here the rocks have suffered such pressure and contortion, and are so much broken up, that their stratification no longer gives a character to the cliffs, and the beds can with difficulty be traced for any distance; but they seem to turn so as to strike generally to the S. Another fault, underlying to the W., is seen running upwards through the face of the cliff; and the rocks on each side, although frequently hard and quartzose, seem to have been so crushed and ground together, that a shaly or *killas*-like intervening portion marks the course of this fault No. 3.

The E. side of the little bay and the line of cliffs which runs to the southward, and then trends round to the eastward, are formed of the red, brown, and greenish slates, shales, and sandstones of the Old Red sandstone group, which are contorted at high angles, but not nearly in the same degree as the compressed and twisted gray and greenish beds on the other side of fault No. 4.

This fault can be traced inland, for at the distance of about 100 yards N. of the corner of the bay, the red and green slates dip N. at 45°, and still further northwards red slates and gray flagstones dip to the S. at one side of it, while on the other side, green and brown sandstones and shales, with rotten beds, incline to the N. at 80°.

At the W. side of the bay, where the fault passes into the sea, the apparent shift southwards amounts to 1,400 yards, and the downthrow to the E. can hardly be estimated at less than 500 feet while it may be 2,000; but, owing to the contorted state of the Old Red sandstone and the other beds, the amount of the downthrow cannot be ascertained with any greater precision.

The united effect of the two, or perhaps the three, faults at the E. side of Whiting Bay, has been a downthrow on the west, of perhaps an even greater amount than at the opposite side of the bay, producing, in the same way, an apparent shift of some amount to the S.; but as contortions occur in all the rocks here, and a double anticlinal appears to have existed in the upper beds before the fracture took place, any speculations as to the exact amount of the movement here would be unsafe.

The extension of this fault, No. 4, to the N., passes through a country covered with drift, and affording little or no evidence whereby to see the structure of the country; and the boundaries here, therefore, represent probabilities depending more or less upon what is seen along the N. shore of Whiting Bay.*

Before leaving this locality it must be noted, that at the E. side of the bay, in the section at A and B—one of the most typical sections of the transition from the Old Red sandstone into the Limestone, in the S. of Ireland—all the beds from the gritstone upwards to the limestone are fossiliferous, and the black shales particularly so—containing abundant casts of fenestellæ and crinoid fragments.

Ardmore.—To the eastward of Whiting Bay, the Old Red sandstone is excellently seen in the cliffs between Ardogina Head and Ram Head, generally dipping S. at high angles. Between Ram Head and Ardmore Head its beds undulate, but, on the whole, curve gradually over from a southern to a northern dip, which they then preserve steadily along the south side of Ardmore Bay into the village. The upper beds consist of greenish brown fine-grained sandstone, gray gritstone, and flagstones, with calcareous shales and nodules, and some red beds. The highest rocks in the series are seen to the E. of the village, and resemble the shales and associated beds of Whiting Bay.

At a little distance to the N. of the village, blue compact and crinoidal limestone, dips N. at 80°, and may be seen again at two other places to the E. and W.

Further to the N., at the Black Rock, the lower beds of the limestone are laid bare by the sea, and may be seen to dip to the S.S.E. at 60°, 35°, and 40°. They consist of thin bedded, flaggy, shaly, and nodular limestones, over which are thick compact limestones, of an entirely different aspect, notwithstanding that both are cleaved.

North of the Black Rock are some smaller undulations, the nature of which may be seen in the sandstones on the hill above the road, which dip E. beneath black shale, but with undulations both to S. and N. Gray gritstones, with black and greenish fossiliferous shales and slates, and one thin bed of conglomerate or conglomeritic cornstone appearing in two places, are seen here; while along the shore to the E. the same limestones seen at Black Rock reappear with an anticlinal and synclinal curvature, but striking nearly E.

* It appears probable that a N. and S. fault, with a downthrow to the W., occurs in the sea between the limestone and grits, &c., striking towards each other at the N. side of the bay.—A. B. W.

and W. Sixty yards to the E. of this the green shales, gritstones, and conglomerate, similar to the beds at Ardmore Head and the Whiting Bay section, are brought in by a N. and S. fault, having an upthrow to the eastward, and thus producing an apparent lateral shift in the beds to the southward.

A. B. W.

A part of the upper sandstone, consisting of brown and yellow sandstone and shale, is visible on the shore to the north-eastward, immediately S. of Glencorran, dipping S. at 60°; and a little to the E. of that a N. and S. fault is well seen in these beds on the shore, producing in the beds on the E. side of it an apparent shift of thirty-two yards to the north; and therefore, as the beds dip at about 80° to the S., involving a downthrow to the E. of 184 yards.

Red slates and sandstone strike out beyond that as far as Mine Head.

Ground West of Ardmore.—In the country immediately west of Ardmore Bay there is very little to be seen. A band of low land stretches from it to the Blackwater, opposite Youghal, which is believed to have limestone below it, although no more can be seen of it than has been already mentioned.

The ridge rising just W. of Ardmore Bay, between the Blackrock and Aughnaglena Bridge is composed of gritstones, brown, yellow, or whitish. These, as already mentioned, dip eastwards towards the bay with an undulating fold, and pass beneath black shales.

About one-third of a mile due W. of Aughnaglena Bridge there was a quarry in them, where they dipped N. at 55° or thereabout. Due S. of that, and about one-third of a mile from it, another small exposure of them showed a dip to the S. Half-a-mile W. by N. of that red shales appears. In the bed of the brook, one-third of a mile N.N.E. of Crossford Bridge, red slates or shales may also be seen. Half-a-mile N.E. of that there is a quarry by the side of a crooked lane, just N. of some houses, in which are seen pale-green and yellow flagstone, with impressions of plants, dipping N.N.E. at 55°.

There is an old Roman Catholic chapel half-a-mile north of this, and on the road to it red, sandy slate appears; and on the road 200 yards W. of it red and green sandy slate was seen dipping apparently E. at 10°. About a mile to the west of these localities, just S. of Gattanvoher cross-roads, white gritstone dips S. at 75°; and red shales and slates appear two-thirds of a mile N.W. by N. of that in the bed of a small brook.

Guided by these scanty facts and by what was seen on the coast as already described, I ventured to draw the boundaries as they will be seen on the map, and to continue the most eastern fault of the Whiting Bay dislocations, into the country to the east of Gattanvoher cross-roads.

I also ventured to suppose that the western fault of Whiting Bay was continued to the north, though if it be as drawn on the map its throw must change sides, being a downthrow to the E. near Whiting Bay, and to the west about Knocknageeragh House. This is not very probable; but on the other hand it is probable that a dislocation of some kind is continued from the western side of Whiting Bay to the eastern side of the Clashmore valley.

J. B. J.

Clashmore.—This dislocation is made probable from the occurrence of yellowish and red sandstones at the S.E. corner of the basin, striking directly at a quantity of dark blue limestone, the dip of which, near Ballyheeny Bridge, is 60° to the N. These limestones, in their uppermost part, are gray and blue and compact, but pass downwards by shaly and cherty beds into black shales and white gritstones, which appear in several places at the S. side of the trough, within the dark red band.

The only other place in the basin besides in this neighbourhood, where the limestone appears, is close to the Court-house at Clashmore, where it is gray, and appears to be nearly vertical. Limestone was also said to have been quarried from the stream between the mills and the Roman Catholic chapel.

A small portion of the limestone of this basin may pass underneath the River Blackwater and reappear at its other side.

To the N. of the basin the ground is cultivated, and does not expose the rocks, except along the banks of the Blackwater, where a section in contorted red slates and shales, and gray sandstones may be observed.

In the neighbourhood of the village of Cross the same rocks may be seen at intervals in the roads; and the summit marked 947 is an undulating eminence, covered with heather and furze, and strewn over with blocks of vein quartz, containing crystals of specular iron ore.

Ground E. of Clashmore.—In the tract, coloured dark red upon the maps, and extending from the fault at the E. side of the Clashmore basin, on both sides of the River Lickey, the Upper Old Red sandstone rocks frequently appear, but chiefly upon the high ground immediately overhanging the river. At both sides of the wooded glen through which the river runs, and at a little distance to the eastward of the fault, red and green silty slates and green grits, weathering brown, are associated with beds of red cleaved shale and green flagstones. The cleavage in the slates runs E. and W., dipping S. at 75°; and they have been extensively quarried for roofing slates. The beds seem to dip generally to the N. at high angles, but some dips in an opposite direction were also taken.

Slates

Further up the stream, near Grallagh Bridge, yellow and greenish shale and yellowish brown sandstones appear on both sides of the river; and a little to the W. of where the w of the name DECIES-WITHIN-DRUM is engraved, a bye-road leading to the river along the parish boundary exposes a section, in nearly vertical beds, of white flagstone, sandstones, and pink and gray mottled shales, with some liver-coloured and bluish black beds, and bands or streaks of hematitic iron ore, upon which workings have been driven. In the pinkish white, mottled, and blue shales here, fragments of large and small plants were met with.*

Still further up the course of this river, where it comes from the northward, some exposures of the Upper Old Red beds are marked upon the maps. Where the dips 70° and 45° are engraved, there are brown, purple, green, gray and white conglomeritic sandstones, together with shales of the same colours. A streamlet from the E., which is engraved, falls into the river a little above this place, and where it is intersected by the sheet line of maps 188 and 189, yellow sandstones, with a bed of quartzose conglomerate, and beds of black and pale mottled shale, dip S. at 22°, with one apparent undulation N. at 15°. This dip to the S., if continued, would carry these beds beneath the sandstones and shales last mentioned. In the mottled shales here were observed an abundance of fenestellæ, and crinoid fragments, with some small orthoceratites.† To the N. of this, near the height 513 (N.W. corner of 189), yellowish white sandstones, with conglomerate bands, and green and yellow shales, dip S. at 60° and 70°, appearing to pass underneath the beds last mentioned; as would be seen if the dips were engraved upon the map.

White sandstone appears on the N. side of a new road, close to the letter

* Bands of the whitish-looking mottled pink and pale gray shale, often soft and apparently weathered, occur frequently through this country among the Upper Old Red beds, and are often associated with layers and small veins of hematite: they seem to be situated near the upper part of the formation, but sometimes underlie a considerable quantity of sandstones; and in them may be found beautifully preserved casts of encrinite joints, and other fossils. In some places, too, a white clay, apparently formed by the weathering away of these shales, is found at the surface, nearly in a fit state to be used for manufacturing pottery-ware.—A. B. W.

† Where these shales have been stated to contain fossils in abundance, a note appears on the map, in Mr. Wyley's writing, saying:—"These are probably just the bottom beds of the Carboniferous slate," meaning by that term what we have spoken of as the Lower Limestone shale—J. B. J.

D in the parish name, ARDMORE; and in the stream, immediately to the N.W. of the letter, it was found to contain strings of hematite.

At the very N.E. corner of Sheet 188, the dip arrow of an inclination S. at 50°, is engraved without the figures; and here yellow sandstones and conglomeritic beds, with beds of fine blue slate, and weathered-looking pale mottled shales, the same as to the S. occur. In the latter beds some beautiful casts of crinoid joints were observed.

To the eastward of this the ground is frequently moory, and the dip of the rocks is rarely seen; but some doubtful inclinations in the yellow and purple sandstones and shales occur in the stream S. of the last R in the parish name ARDMORE, and W. of Loskeran House. Coarse sandstone and beds of conglomerate, with purple shales and slates, occur in a lower part of the same stream, close to where the letter D in the word DRUM is engraved.

Along the line of cliffs from Mine Head westwards, to the S. of this, and for some distance up the streams inland, red shales and slates, and gray sandstones, with frequent beds of conglomerate, are constantly seen. Their general dip near the coast is to the S., but further inland it seems to incline to the N. The cleavage in these beds strikes generally E. and W., and dips N. at 85°.

Northwards of Mine Head the red and gray sandstones and shales, although very frequently contorted, have many dips to the S., which have been engraved upon the map. About a mile and a half in this direction from the headland, a change in the rocks occurs; the red sandstones and shales dip in the cliff at 65° to the S., and a little further on, at the top of it, appear to lie nearly horizontal, their basal bed being formed of a massive coarse conglomerate or breccia, containing little worn fragments of slate, sandstone, and quartz, with large nodular-looking pebbles of crystallized reddish saccharine limestone.

Silurian Rocks.—Underneath this breccia are blue Silurian clay slates, containing some gritty portions, and many pebbles of black quartz, and more angular portions resembling thin layers of fine grit, all fractured, drawn, and displaced by cleavage, which has very strongly affected these rocks; so strongly, indeed, as to render the stratification in most places invisible, but it nevertheless appears to be contorted.

A trap-dyke about two feet wide occurs near a little strand S. of Seaview; it is of a pale blue-gray colour, slightly feldspathic, and fuses a little on the edges before the blow-pipe.

Red shales and conglomerates appear to overlie these slates unconformably in the stream S. of Seaview, between that house and the top of the cliff, and in many places above the road to the N.W., but their bedding is seldom well seen.

5. *The Drift.*

The Drift in this district is chiefly represented by large deposits of clay and gravel in the Castlemartyr valley, and the depression extending from the W. of Youghal to Ardmore Bay. In these places it may be frequently observed.

Towards the sea coast, along Youghal Bay strand, Whiting Bay, and Ardmore Bay, a deposit of sand and calcareous mud, with chalk flints and sea-shells occurs. Underneath this, and directly in contact with the limestone, in two places marked x in the plan of Whiting Bay, there was observed a bed of recent breccia as hard as the rock beneath it, of which its fragments mainly consisted they being cemented by brown clay and carbonate of lime. At the most northerly locality it dipped to the N. at 2°, but in the other to the E.S.E. appeared to be horizontal. Drift of the same age as that in the valleys also occurs frequently on the high ground. A deposit of this, containing a few limestone pebbles, was observed to the N. of Dungourney, by the road to the E. of Clonmult; and in the E. part of the district, at the N.W.

corner of 189, blocks of limestone, many tons weight, were raised in the valley of the Lickey river, from the ordinary clay and gravel drift.

The beach at Whiting Bay affords an example of the heterogeneous character of the rocks accumulated in the drift. They will be found to consist of pieces of green and purple grit, sandstone, and flints,* with pebbles of black slate, white quartz, black quartz, coarse Silurian gritstone, containing large grains of white quartz, many varieties of trap rocks, syenitic, porphyritic, and hornblendic, with numerous limestone pebbles; and others, such as pebbles of a gray conglomerate, and some of the limestone ones, consisting of the harder varieties of the rocks belonging to the neighbourhood.

6. *Minerals and Mines.*

The minerals found in this district are principally quartz and carbonate of lime, in veins; the former sometimes contains, in such situations, other minerals—as at Meanoughter, six miles N.W. of Youghal, where a large vein of quartz, in red sandstone and slates, contains quantities of chlorite; and upon the hill N.E. of Clashmore, marked 993 feet, where erratic vein quartz contains specular iron ore.

Hematite occurs in several places in the N.E. part of the district as beds or layers in whitish sandstone, and also occupying strangely arranged veins, with a rectangular reticulated structure, the interspaces being filled with the sandstone of the bed. These hematitic portions of the rocks have been worked with a view of extracting the iron, both before and since the district was examined.

The operations were carried on in and outside the space occupied by the N.E. corner of map 188 and the adjacent one of sheet 189. They are now abandoned (August 1860). The places where the works were carried on, or trials made, were all upon the property of Lord Stuart De Decies; and the names of the localities within the district are as follows:—

Drumslig—layer of hematite, in fossiliferous shaly beds—worked.
Grallagh—worked.
Moanagilleeny—trials.
Moyng—Fiddlers Rock—trials.
Moyng Little—trials.

Iron pyrites occurs in many of the Old Red sandstone grits and slates in small quantities.

The only mines are those just alluded to, and the copper-mines stated, in ?where the details, to occur at Knockadoon Head.

Slates have been raised for roofing purposes, as already stated, near Clashmore, and also on the other side of the Blackwater.

A. B. W.

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* The chalk flints along this shore and that of Youghal Bay are numerous, so much so, indeed, as to render it doubtful at first whether they had been brought in the ballast of vessels or not. Some, at all events, if not most of these flints, appear to have been derived from the brown marl bordering the beach, for, upon searching, similar ones were found within it, as already stated, associated with comminuted fragments of sea shells.

These flints, therefore, were brought here, in all probability, by the same transporting action as that which brought the drift. It is not unlikely that they came from the N. of Ireland, as it is stated that pieces of Antrim chalk, probably carried in the same way, have been found in the county Wexford. Their appearance above water, together with the marine shell fragments, is due to a comparatively recent elevation of the land.—A. B. W.

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