035Chapter 33 The sea-floor

A geological map, as a thing of 'man's control', 'stops with the shore'. Yet every now and then, a little information may be gleaned concerning, not merely the superficial deposits of the sea-floor, but the solid rocks that form its framework. Where ice has been moving landwards from a sea basin an opportunity occurs, and Anglesey is such a place.

The erratic blocks that yield this information have been described in Chapters 30, 31, but may be recapitulated here. They are:

1. Arenig Shales (near Menai Bridge)
2. Purple Conglomerate (Northern Coast)
3. Carboniferous Limestone
4. Posidonomya Cherts
5. Coal and Ironstone
6. Red Sandstones, &c. (Triassic)
7. Ferruginous Oolite
8. Chalk Flints

To which may be added the colour of the Upper Boulder-clay, derived from No. 6.; and the negative evidence yielded by the absence or extreme scarcity (locally) of rocks of the Mona Complex and the Ordovician.

The Menai Strait — To take the simplest case first: The glacial gravels at Ty'n-y-caeau, Menai Bridge, consist largely of black shale, which has yielded (see p. 431) all the zonal graptolites of the Arenig and Lower Llanvirn. As the shales of the zone of *Didymograptus extensus* occur along the shore of the Strait between the bridges, and at Garth Ferry, it is evident that the Eastern Reach is excavated, from below high-water mark, in Arenig shales. Most of its floor must be composed of the zone of *Did. extensus,* but the higher zones must come on to the eastward, where the hollow is widening to the sea.

The Sea-Basin — Along the northern coast, off which is a broken chain of islets composed of rocks of the Mona Complex, the drifts contain some of the materials of that Complex, but comparatively little. Boulders of unsheared purple conglomerate are not uncommon, from which it appears that the Ordovician rocks must fringe the shore, not compressed in deep infolds, but, probably, riding freely on a thrust-plane just inside the fringe of isles. From Point Lynas to Dulas Bay, however, where there are no such islets, though there is a little Ordovician material in the drift, none of the Complex has been, for certain, seen, most of the boulders being of Carboniferous Limestone. The older rocks cannot, therefore, have any extension beneath the sea to the north-east; and the limits of the anticline upon which they rise from beneath the Carboniferous must nearly coincide with those of the existing land and isles of Anglesey, from Traeth Dulas to The Skerries. Along the western. coast there is no evidence, but in' all probability the same relations exist there also.

The Carboniferous Limestone crowds the lower, grey boulder-clay; but the upper, red clay is poor in it. Its limits, therefore, cannot be very far from the eastern shore of Anglesey, the strike bending, probably, rather sharply round. Of the submarine distribution of the zones above that of *Dibunophyllum* there is, however, interesting evidence. Boulders of the cherts of the Posidonomya zone begin to appear in the neighbourhood of Red Wharf Bay, and accompany those of the Carboniferous Limestone proper about as far as Point Lynas. The latter then dwindle rapidly, but the cherts increase enormously, and are the dominant, sometimes almost the only, material of the drifts all along the north, and even far down along the western coast (pp. 715, 734, 741), and on the beaches of The Skerries. It is clear, therefore, that the zone, after it passes out to sea near Trwyn Dwlban, must bend round northwards, thickening as it goes, that it must extend far to the north-northeastward of Point Lynas, and must floor the Irish Sea almost all the way from Anglesey to the Isle of Man, where it is again visible. [Lamplugh, Geology of the Isle of Man', p. 217.] It may even extend into Holyhead Bay, for its boulders follow the local south-south-easterly ice movement of which there is evidence about Llanf wrog. Why, however, does not the Dibuno-phyllum zone accompany it round the northern coast, outcropping on a belt between it and the outer isles? Evidently the reason is that the great overlap, which, in Anglesey itself, cuts out the whole of both

these zones between Lligwy and Bodorgan, obtained to the north as well as to the west, so that over the north-western part of Anglesey and a wide region that is now beneath the sea, the Dibunophyllum Limestone was never deposited at all. From the neighbourhood of Bodorgan, past Holyhead and The Skerries, a broad Pre-Carboniferous ridge extended a great part of the way towards the Isle of Man.

Returning to the eastern drifts, the presence in them of shale and sandstone of Coal Measure types, of nodular ironstone, and of boulders of coal itself (some being of cannel type), which are sometimes quite abundant (p. 754), shows that the Limestone series and the cherts must be succeeded by a tract of productive Coal Measures beneath the sea, not far to the east and north-east. Perhaps they may bend round outside the Ortne, and join the Coal Measures of Denbighshire. But the outcrop on the sea-floor must be rather narrow, as (even allowing for the friable character of the materials) the recognisable boulders are but few, except at Lleiniog. They must be almost entirely overlapped by the beds next to be described.

These are red sandstones and green marls, with facetted quartz and pseudomorphs of rock-salt, possibly including the Carboniferous Red Measures, but in the main of unmistakable Triassic type. In spite of their friability they are abundant throughout the upper eastern boulder-clay, and impart to it the red colour that can be recognised as far west as Menai Bridge on the south and Amlwch on the northern coast. It is clear that they are much the most widespread formation on the sea-floor to the north-east, and there can be little doubt that they are in continuity with the Triassic rocks of Cheshire, Lancashire, and Cumberland. The intermingling, towards Amlwch, of their boulders with those of the Posidonomya cherts suggests that their western boundary must be indented with, very likely, outliers of them resting unconformably upon the cherts.

But the whole of the sea-basin is not occupied by them. Anticipating for a moment the last group of boulders with which we have to deal, the presence of the flints led to a search for fossils in a number of Jurassic-looking boulders, chiefly of calcareous shale, but without success. Fragments have been found, however, of a crumbly ferruginous oolite such as is frequent in England on the zones of *Lytoceras jurecse* and *Liococas opalinum.* The evidence, it must be confes4d, is meagre. But if it be taken in connexion with the general stratigraphy, and with the fact that an outlier of Lias exists on the margin of the sea-basin at Carlisle, there can be little doubt that some thin beds of Jurassic age rest upon the Trias to the north-east of Anglesey.

Chalk-flints are quite common in the eastern drifts, diminishing rapidly in number along the northern coast. They are generally, but not always, rather light in colour, and have the usual whitish crust. That they are derived directly from the Chalk, and not from later pebble beds, is shown by their irregular forms and pitted, often even cavernous, surfaces. The larger ones are as much as three or four inches in diameter. A rubbed and rolled specimen of [Af. 3230] *Echinocorys scutatus* Leske, was found upon the sea-beach at Traeth Bychan, probably washed out of the boulder-clay. An outlier of chalk, and of some size, must therefore exist between Anglesey and Lancashire, but it cannot extend a great distance to the north, or its flints would be as plentiful in the northern as they are in the eastern boulder-clays. These flints are the highest horizon represented in the drifts.

To sum up this rather curious body of indirect evidence. We may look upon the south-eastern portion of the Irish Sea basin (Figure 338) as a broad and gently undulating plain, composed for the most part, like the midland plains of England, of Triassic sandstones. Upon them rests a large outlier (or outliers), in which a narrow outcrop of thin and friable Jurassic rock's is surmounted by an extensive tract of Chalk.

At the western margin of this Mesozoic plain, the Coal Measures, with the Posidonomya Cherts and Dibunophyllum Limestones below them, emerge unconformably from beneath the Trias. The coalfield (surmounted, possibly, by an outlier of Red Measures), in which are productive coals and ironstones, may very likely be extensive, but is almost entirely covered by the Trias. It is very soon overlapped, and the Mesozoic boundary, deeply indented, runs in a northerly direction towards the Isle of Man. Here the Triassic sandstones rest upon the Posidonomya Cherts, which form the greater part of the sea-floor between the Isle of Man and Anglesey and for an unknown distance to the west. Not far from Point Lynas the cherts overlap the Dibunophyllum Limestones and rest upon the Ordovician rocks and the Mona Complex.

Lastly, as the margins of this portion of the sea (including the submarine line between Anglesey and Man) are everywhere composed of Triassic or of older rocks, and as Jurassic and Cretaceous beds exist somewhere in the midst of it, the tract as a whole must have the structure of a gentle synclinal fold, produced during the same Tertiary movements as those that determined the structure of central and south-eastern England. It is, of course, evident that the Mesozoic rocks in question must once have extended over the tract that is now the Isle of Anglesey. But in the submarine syncline the Mesozoic base must sink to a very considerable depth below the sea-floor, whereas over Anglesey it cannot be at less than some 300, and is probably at more than 700, feet above sea-level. Anglesey, therefore, is the site of a large Tertiary anticline. From the crest of that anticline the Mesozoic deposits were swept away during Tertiary erosion, leaving a broad core of Paleozoic and older rocks.

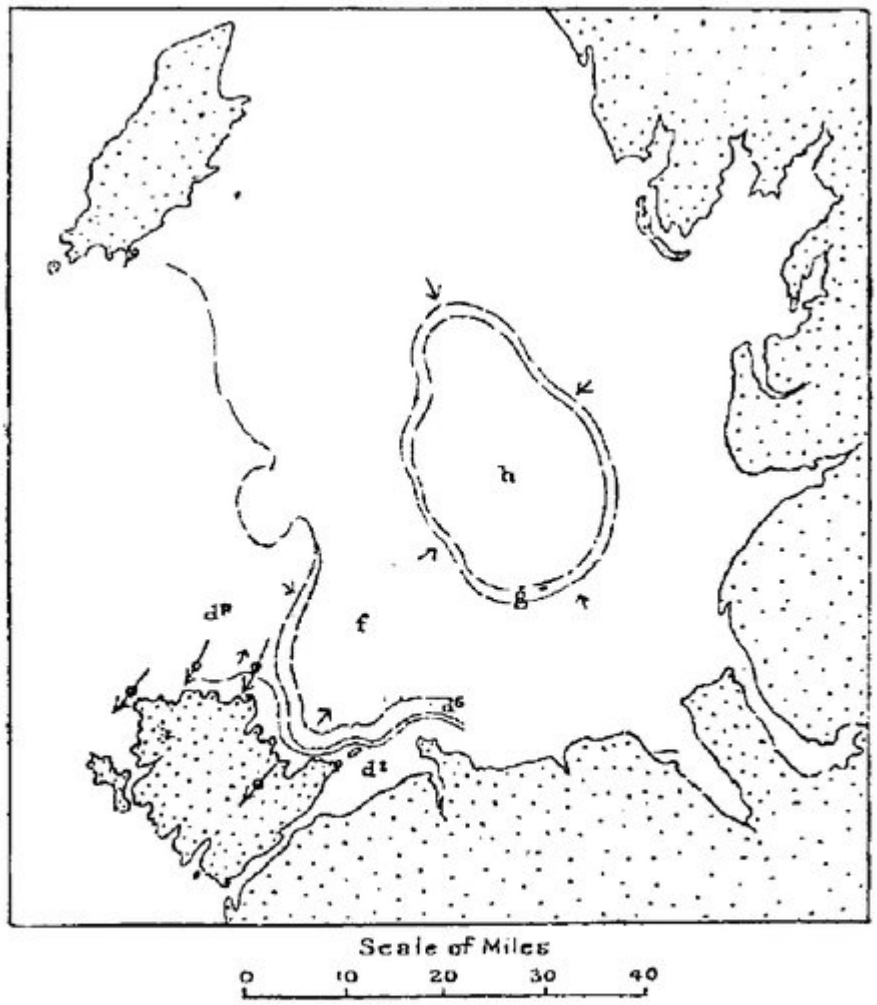

FIG. 338.—SKETCH-MAP OF THE SEA-FLOOR.

d^2 = Carboniferous Limestone.
dp = Posidonomya Cherts.
d^5 = Coal Measures.
f = Triassic rocks.
g = Jurassic rocks.
h = Cretaceous.

(Figure 338) Sketch-map of the sea-floor. d2 = Carboniferous Limestone. f = Triassic rocks. dp = Posidonomya Cherts. g = Jurassic rocks. d5 Coal Measures. h = Cretaceous.