NO. XXVI.—A BED OF POST-GLACIAL CLAY, EXPOSED BY DREDGING
IN THE HARBOUR OF GIRVAN, Ayrshire. By DAVID FORSYTH,
A.M., VICE-PRESIDENT. [With a Plate, No. IX.]

[Read 15th February, 1883.]

General Description of the Girvan District.—This district lies nearly at the southern angle of the Ayrshire triangle, and is classic from the fossiliferous character of its Silurian strata. There are few districts in Scotland in which, within short distances, the geologist can enjoy such opportunities of studying different strata, and of practically testing so many interesting geological theories. To the south-east and east there is a large Silurian area that constitutes a part of the great tract forming the southern ridge, or axis of elevation across Scotland from S.W. to N.E. To the north-west of the Girvan Valley lies a smaller area of Silurian strata, yet including the famous Mulloch Hill, Drummuck Burn, Threave Glen, and Craighead Quarry. Between these two tracts lies the beautiful valley of the Girvan, which is composed of Carboniferous strata to within a mile or two of the town of Girvan. Three patches of Old Red Sandstone occur in the immediate vicinity—one to the south of the town, one on which the town is built, and one further north, where, near the shore, an old quarry still is occasionally worked. The last two are no doubt continuous, although the union is hidden by the diluvium of the valley.

Glacial Phenomena.—The shore to the north of the river is strewn with boulders, many that lay on the south shore having been utilized for housebuilding. In dredging near the shore it is found that a fringe of boulders extends below low water-mark. The majority of these boulders are grey granite, and as no granitic boss is nearer than the head of Loch Doon, ice must have been the agency that carried them to this district. Inland there is not a mountain burn but has some of these strangers blocking its channel. Interspersed among the shore boulders I have found blocks of syenite, granite like that of Arran (at Corrie), smaller pieces of sandstone, coralline limestone, greywacke, and still smaller fragments of such soft rocks as serpentine and graptolitic shales.

Till.—Deposits of Till overlie large tracts of the country, the scours on the banks of all the tributaries of the Girvan Water showing the depth and frequency of the deposit. The deep scours on the banks of the Stinchar are figured by Professor James Geikie

SECTION AT "A" IN THE PLAN.

PLAN OF GIRVAN HARBOUR.

in his "Great Ice Age," as indicating two periods of glacial deposit. Two years ago, near the Girvan harbour, within 50 yards of the clay which forms the subject of this paper, a well was sunk for the harbour operations, and although excavated to the depth of 43 feet, it did not pierce through the layer of Till. Although the material dug out was closely watched, there were no evidences of intercalated beds, except the sand pockets which occur so commonly in such deposits.

Post-tertiary Clay.—This occurs at Dippool or Drumbain, three miles to the north of Girvan, and is made into tiles for the agricultural district around. According to Mr. David Robertson, judging from fossil and physical considerations, there are three distinct layers of clay at Dippool, the lowest marine and the upper more lacustrine or freshwater. I exhibit specimens of the different kinds of clay; but owing to the partial stoppage of the works from heavy rain, I am unable to show specimens of the fossils in the meantime. On the sea-shore, between high and low water marks, there is another stratified clay, a specimen of which I submit also.

Description of the Girvan Harbour Deposit.—From the sketch map of the coast-line to the north and south of Girvan, it is evident that the nature of the underlying material is hidden by blown sand; and possibly were this surface covering removed, stratified clays might be found which have escaped denudation. In the recent operations for the clearing and improving of Girvan harbour a deposit of post-glacial clay was exposed, and I carefully watched the material brought up by the dredger or gripper. The position of the clay is best shown by reference to the accompanying sketch of the harbour and the section.

The north side of the harbour has at its greatest elevation a dune of sand, beneath which is a gravel bank. Lower still is a bed of river or estuarine silt, and lowest of all the stratified post-glacial clay. Beyond the accompanying diagrammatic section of the arrangement of the layers of the clay, I can say nothing regarding the depth or extent of the bed. It is not apparent at any other portion of the harbour, and it was only the fact that excavations were being carried on which revealed its presence. Indeed, it was this fact that influenced me to bring the bed under the notice of the Society; for once the harbour works are completed, the post-glacial bed will be no more seen.

Fossils.—In all such deposits the evidence of fossils is not con-

clusive. Although I have taken all these which I exhibit, and of which a list follows, from the solid masses of clay dredged out, yet many recent or doubtful glacial shells also occur. The action of storms, or denudation from river currents, may have scooped out hollows, and so have allowed recent marine forms to be deposited amidst glacial clay; or recent clay-boring animals may have pierced deep down into it from above. Although such deposits cannot therefore be made test-cases of the nature of post-glacial deposits, yet they are interesting as collateral evidence at least of the occurrence of typical forms in adjacent or corresponding areas.

From the colour and physical character of the clay, and its position relatively to the sea-level, I should be inclined to think that the Girvan harbour deposit most resembles the lower bed of the Dippool clay, and that it is like also the smaller bed to the west of that deposit, between high and low water marks.

The colour of this clay is a brownish red, such as one would expect in a clay laid down over a red sandstone area. Then layers of bluish-grey material do occur occasionally; but from the method of extraction I cannot well say how these lie in relation to the red-coloured beds. The clay is composed of exceedingly comminuted particles, although stones are sometimes found. These are usually small, and for the most part are granite, syenite, greenstone, grey-wacke, and Carboniferous sandstone.

The following is the list of fossils found in the post-glacial clay:—

<i>Fusus antiquus.</i>	<i>Tellina balthica.</i>	
<i>Fusus gracilis.</i>	<i>Leda pernula.</i>	
<i>Buccinum undatum.</i>	„ <i>pygmæa.</i>	
<i>Natica affinis.</i>	<i>Axinus flexuosus.</i>	
„ <i>Grœnlandica.</i>	<i>Balanus crenatus.</i>	
<i>Littorina littorea.</i>	<i>Unio margaritiferus.</i>	} <i>Doubtful.</i>
„ <i>rudis.</i>	<i>Mytilus edulis.</i>	
„ <i>obtusata.</i>	<i>Cardium edule.</i>	
<i>Lacuna divaricata.</i>	<i>Mactra solida.</i>	} <i>Raised Beach.</i>
<i>Velutina undata.</i>	<i>Ostrea edulis.</i>	
<i>Pecten Islandicus.</i>	<i>Anomia ephippium.</i>	
<i>Cyprina Islandica.</i>	<i>Patella vulgata.</i>	
<i>Tellina calcaria.</i>		

I cannot conclude this paper without referring to the kindness of Mr. David Robertson in assisting me to name the shells, and

as I have been unable to complete my examination of the minute forms, Foraminifera, Entomostraca, etc., I hope to be still more indebted to him in naming these troublesome and difficult forms, and in this way completing the correlation between the beds of Girvan harbour and those of Dippool tile-work.

NO XXVII.—THE GEOLOGY OF THE ISLE OF MAN. BY JOHN
HORNE, F.R.S.E., F.G.S., H.M. GEOLOGICAL SURVEY OF
SCOTLAND.

[Read 15th February, 1883.]

The geological formations represented in the Isle of Man are not numerous, but some of them embrace features of special interest. If we except the extensive plain between Ramsay and the Point of Ayre, which is covered with glacial deposits, and the small areas of Old Red Sandstone and Carboniferous rocks in the neighbourhood of Peel and Castletown, nearly the whole of the remainder of the island is occupied with Lower Silurian strata. Consisting for the most part of black and grey slates, grey flags, and occasional bands of sandstone and conglomeratic grit, they bear a close resemblance to the Skiddaw slate series of Cumberland. This correlation is strengthened by the occurrence in the Manx slates of *Palæochorda major*—a fossil which is characteristic of the Skiddaw series. This is the only trace of organic remains which has been hitherto met with in the Silurian rocks of the Isle. So far as the available evidence goes, therefore, the remarkable development of clay-slates in Mona may be regarded as of Llandeilo age. Their prevalent strike is north-east and south-west, which coincides with the trend of the chain of heights forming the backbone of the island. Indeed, there can be little doubt that the existence of this ridge, whose summits vary in height from 1,500 feet to 2,000 feet, must be ascribed to this cause. Few satisfactory sections are to be found inland, but along the coast-line, both on the east and west sides of the island, they are well displayed. The attempts which have been made to discover in the Isle the various subdivisions of the Skiddaw slates established in Cumbria have not been hitherto successful; but several prominent flexures of the strata have been traced. An anticlinal axis extends from Port Moar, near