

## SOME PHYSICAL FEATURES OF THE FIRTH OF CLYDE.

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The physical features of the Firth of Clyde proposed to be discussed in this paper are mainly those of the configuration of the bottom shown by means of longitudinal and transverse sections (see plate.) On glancing over a chart of this waterway the great variety of depths is at once noticeable; these having a range of from 25 to over 100 fathoms. The most striking feature in connection with these soundings is that of the shallowness of the water at the southern termination of the Firth, and the extreme depths to be found at parts further up. Thus, all around Ailsa Craig—which marks the southern termination of the Firth—we find 26 fathoms a very usual depth, and not only so, but from the Craig westwards, towards Cantyre, we find the same depths more or less in evidence. So that if we carefully go over the chart it is shown that over an area of about 90 square miles, lying about Ailsa Craig and north-westwards towards Arran, the bottom is reached at depths not exceeding 28 fathoms; 24, 25, 26 and 27 being the most frequent figures noted. Again, if we draw a line from Ballantrae to Sanda, and one from Turnberry to the Southend of Arran, we find the enclosed area, about 200 miles, lies within the 30 fathom line. Northward and southward the water deepens. So that here, at the entrance to the Firth, we have a great mound or bank lying right across with deepening water on both sides. Passing northward the depths increase until some miles off the Arran shore, about Corrie, we reach 92 fathoms, and opposite this point on the west side of Arran, in the Kilbrannan Sound, there is one part where a depth of 82 fathoms is reached,

Deep water also exists all round the Northend of Arran. Still deeper water, however, exists in Loch Fyne, where 104 fathoms is reached near the Skate Islands, and onwards to near Ardrishaig the depths are over 60 to 70 fathoms. Very shallow water follows at Otter Spit, and from there to Inveraray the depths increase from over 30 fathoms to 70 fathoms.

In the upper part of the Firth, above Little Cumbrae, the depths vary very much, a depth of 60 fathoms occurring between the Southend of Bute and the Little Cumbrae. Within the Cumbraes the water is shallower, but there is a line of deep water along the shore from Wemyss Bay to near Largs of over 40 fathoms. Opposite Dunoon 56 fathoms is reached and finally, in Loch Long, opposite the entrance to Loch Goil, we get 50 fathoms.

In the lower part of Loch Striven there are depths of 40 and 41 fathoms. These side lochs show increase in depth inwards just as the Firth itself does. Thus, Loch Fyne, as already stated, reaches a depth of 104 fathoms near the Skate Islands, but lower down it is considerably less. Again although we find a depth of 50 fathoms well up Loch Long yet, at its entrance, the depth is only 34 fathoms, and in Loch Striven the depth at entrance is only 23 fathoms, deepening to 41 fathoms farther up.

Rothesay Bay gives from 29 to 25 fathoms. Curiously very much the same as obtains on the great plateau around and to west of Ailsa Craig.

The line of deep soundings already referred to as existing along the shore near Wemyss Bay has been of special advantage to the shipbuilder in the testing of the speeds of steamships, as the great depth of water, and comparatively sheltered conditions, enabled a measured mile to be marked off with satisfactory results. The advantages obtained by great depth of water against shallower depths on some recent trials of swift and powerful vessels being much on the side of the deep channels,

The tidal wave as it reaches our coasts is deflected around the northern and southern end of our coast line. Part of this wave enters the North Channel, passing between the Mull of Cantyre and the Coast of Ireland, and divides into two streams, one passes southwards towards St. George's Channel, whilst the other sweeps round into the Firth of Clyde. Its course can be noted by the times of high-water at "Full and Change" thus, we have the time of high-water as recorded on the chart at Sanda as taking place at XI.-40; at Lamlash, XI.-49; at the Garroch Head in Bute, XI.-49; Skipness, XI.-50; Ardrishaig, XI.-53, and Inveraray at XII. o'clock.

In the inner part of the Firth it reaches Millport, Largs and Rothesay at XI.-50; Kyles of Bute at Colintrave, XI.-50; head of Loch Striven, XI.-55; and Greenock, XII.-8; and at Loch Goil Head arrives at XII.-6. Locally, in the Kyles of Bute, near South Hall, we find the meeting place of the two divisions of the tide as it comes up the channel, part going round by the West Kyle and the other entering the East Kyle, after passing between Toward and Bogany Points, and north-westwards by the Cowal Shore.

Around Ailsa Craig there is only a slight rise and fall, about one foot, but there is a strong current of fully 4 knots.

At the Mull of Cantyre the range of springs is 4 feet; at Campbeltown,  $8\frac{1}{2}$  feet; Lamlash, 10 feet; Troon, 10 feet; and generally 10 or 12 feet at other parts. At Loch Striven head the range is only 6 feet. The rise and fall of the tide, as also the times of these movements, is much affected by the direction and force of the wind. In general southerly winds increase the rise, whilst east and north winds decrease it.

The height of waves during a southerly gale in the lower part of the Firth may range from 12 to 15 feet; within the Cumbræes the range may be from 8 to 12 feet. The height of the waves in southerly winds is increased with an ebb tide.

Sometimes, even in a calm, large waves may break upon the shore, and both before and after a gale waves roll in from outside; sometimes these may arrive twelve hours before the wind follows.

From the observations of experts upon the temperature of the water of the Firth inside and outside of the Clyde Barrier Plateau, as it has been called, it appears that the temperature of the water to the south of the Mull of Cantyre, and in the open channel there, is nearly uniform throughout its depth, and changes regularly with the seasons, and that this temperature appears to be higher than that of corresponding depths inside the Barrier Plateau; also that the very deep water areas resemble inland lakes in having a greater range of temperature about the surface than at the bottom.

Looking over a Meteorological Report one can get some idea of the climate on the shores of the Firth. Thus, at the Mull of Cantyre we may have 38 inches of rainfall; at Turnberry, 36; Ayr, 35; Ardrrossan, 32; Pladda, 37; Rothesay, 50; Greenock, 60. And we may have ranges of temperatures as follows:—Mull of Cantyre,  $18.6^{\circ}$ ; Corsewall,  $19.2^{\circ}$ ; Pladda,  $18.7^{\circ}$ ; Lamlash,  $16.7^{\circ}$ ; Rothesay,  $20.6^{\circ}$ ; and Greenock,  $21.3^{\circ}$ .

Section No. 1 is a profile of the Firth from Ailsa Craig to Loch Long, and represents a distance of about 50 miles. It is drawn through the parts usually traversed by outgoing and incoming vessels.

Section No. 1a is a similar section through Kilbrannan Sound. The short extension of No. 1 from 92 to 90 shows the depths around the Northend of Arran, and practically meets the line through Kilbrannan Sound as indicated by the dotted line 1a, and indeed from opposite Holy Island to the Northend, and from opposite Saddel in Kilbrannan Sound to the same point the sections are very similar.

Section No. 2 is a cross section across the great Plateau from Sanda and past the north face of Ailsa Craig to Girvan, a distance of about 27 miles.

Section No. 3 is a cross section from near Davaar to Dunure.

Section No. 4 is drawn from Davaar, past Kildonan to Heads of Ayr.



Section No. 5, from near Saddle in Kilbrannan Sound to Troon.

Section No. 6, from above Carradale to Ardrossan.

Section No. 7, from Fallen Rocks north of Sannox to Fairlie Head.

Section No. 8, from Garroch Head Southend of Bute, to Fairlie Head.

Section No. 9, from Mount Stuart Shore to Largs.

Section No. 10, from Bogany Point, Rothesay Bay, to Black Rock.

Section No. 11, from Toward Point to Skelmorlie (the shallow water,  $2\frac{3}{4}$  and 7 fathoms, shows Skelmorlie Bank).

Section No. 12 shows the deep water from near Dunoon across to Inverkip.

Looking over a chart of the Firth, we find that the bottom in all the very deep parts consists of mud. On the Barrier Plateau, however, we have also mud, but in many cases sand, mud and sand, and in one case clay. This sounding showing clay lies about six miles north-west of Ailsa Craig, and is in the centre of an area two or three miles square at 27 fathoms, and five soundings, all at about a mile apart, giving each 27 fathoms, shows that this is a level patch probably more or less of clay extending to about six square miles.

From measurements and dredgings carried out by the Challenger expedition it was found that a comparatively shallow plateau extends from the North of Scotland by Iceland to Greenland. As glaciated stones were dredged up it was inferred that this might have been the terminal moraine of a great Polar glacier. May the great plateau at the entrance to our Firth not be also the result of glacial activity. There are well known abundant evidences of the glacial period on our coasts in perched block and moraine matter, and clay with glaciated stones within tide mark on our shores. And as the movement of the ice was more or less towards the south, we might expect to find evidences of a great deposit of moraine matter to the south of Arran and the mainland on its north-western border.

