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Scottish Marine Biological Association

Dunstaffnage Marine Research Laboratory

CRUISE REPORT

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Cruise Report

R.R.S. Challenger

Cruise 14/1987

24 April - 7 May 1987

R.R.S. Challenger, Cruise 14/1987

Duration of cruise: 1812h 24 April - 0800h 7 May 1987

All times GMT

Locality: Rockall Channel, Scottish continental shelf & Firth of Clyde.

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Aims:

1) To work the Anton Dohrn Seamount CTD section.

2) To make CTD and radiocaesium observations at sections across the Scottish continental shelf between Cape Wrath and the Mull of Galloway.

3) To sample benthos at station M(57^{o} 18'N, 10^{o}23'W) and at a second site in the northern Rockall Channel.

4) To service SMBA current meter mooring Y in the Tiree Passage, and mooring MJ off Loch Spelve.

5) To make CTD lowerings at stations in the Arran Deep.

Narrative: CHALLENGER sailed from Ardrossan at 1712h 24 April in fine and calm weather. Course was set for station 1Z in the North Channel, a CTD test lowering being made at 1913h and a surface radiocaesium sample being collected en route between Larne and Stranraer at 2238h. The Copeland-Portpatrick CTD section was worked between 0047 and 0725h 25 April, sampling being as shown in Table 1. Stations 1Y-5Y were worked across the entrance of the Firth of Clyde between 0843 and 1224h, and following this the deeper stations of the Firth of Clyde grid were worked to provide a section along the axis of the Arran Deep from Kilbrannan Sound in an anticlockwise direction. A section across the sill of the Firth completed the Clyde sampling at 0812h 26 April.

In continuing quiet weather the section between Kintyre and Antrim was worked from 1014 to 1453h, and the five central stations of the section between Lough Foyle and Islay during 1755 to 2207h. Section D, west of Islay was occupied during 2317h to 0746h 27 April and course was set for Rockall, surface salinity samples being taken at approximately 15 n.ml intervals en route. The CTD section from Rockall across Anton Dohrn Seamount was begun at station A in forces 4-5 southerly winds at 0650h 28 April and continued to station M at 0825h 29 April. Here benthic work was carried out about 5 n.ml northwest from the station. The second of two USNEL Spade Box Corer lowerings at 1047-1239 produced a good sample and successful Agassiz Trawl and Epibenthic Sledge hauls were retrieved at 1742h and 2304h respectively. With less settled weather conditions forecast, the CTD section was resumed at station N at 0102h 30 April and continued to the shelf-edge at 0851h. CTD and radiocaesium sampling stations were worked between the shelf-edge and the Sound of Mull from 0949h until 0544h 1 May in force 5 northwesterly winds with a moderate swell. At slack water mooring Y in the Tiree Passage was recovered and redeployed between 0829 and 1036h and CHALLENGER steamed via the Sound of Mull to the site of mooring MJ, off Loch Spelve. Recovery of the mooring began at 1406h, but after retrieval

of the spar buoy the buoy wire was found to have parted close to its join with the long-link chain above the mooring clump. Rising wind and strengthening tide made dragging impractical and it was decided that recovery from the buoyed meter end of the mooring by CALANUS on a quieter day offered the best course of action. The section from Mull to Jura was begun at 1617h, but at the second station the increasing sea and force 6-7 southwesterly wind made it difficult to maintain an upright CTD cable, and work was abandoned at 1702h.

With northwesterly gales forecast it was agreed to steam overnight to the Minches, where CTD work might be possible. Section K, from Loch Seaforth, was begun at 0910h 2 May, but was suspended at the fourth station at 1128h due to worsening conditions away from the lee of the land. CHALLENGER dodged towards Stornoway Bay in force 8 northerly winds and heavy swell and sheltered there overnight.

Winds gradually decreased to forces 5-6 during the morning, and at 0500h 3 May the ship returned to station 4K and resumed work upon the section, which was completed at 1125h. Section L between Eddrachillis Bay and Broad Bay was worked between 1621 and 2051h in a moderate northerly swell. In view of the possibility of further unsettled weather during the two remaining working days of the cruise it was decided not to attempt section J west of the Hebrides, but to complete the grid of coastal stations between the Little Minch and Islay. Sections N, HE and HD were worked between 0251 and 2127h on 4 May, after which the ship steamed to Skerrymore for section P to Islay, effected between 0246 and 0755h 5 May. Section B, from Islay to Gigha followed at 1111 to 1348h and CHALLENGER returned through the Sound of Islay to work section D, between Jura and Mull at 1743 to 2106h. Time was available for seven stations of the Firth of Lorne section, FL9 - FL15 and these were worked between 2309h 5 May and 0552h 6 May. The ship laid off Kerrera until 0840h whilst scientific gear was dismantled, and berthed at Oban North Pier at 0915h.

Upon completion of unloading, CHALLENGER sailed for Ardrossan at 1030h and docked there on the morning of 7 May.

Results (Aim 1) The Anton Dohrn Seamount CTD section was worked during 28-30 April. Although final calibration of the CTD can only be completed ashore, initial results indicate that upper layer salinities were slightly less than 35.4°/oo, still somewhat lower than conditions in the late 1960's. At station D, in 1185m on the eastern flank of Rockall Bank, near-homogeneous water (7.1°C, 35.66 - 35.69) existed from 360 to 910m depth, suggesting unusually deep winter mixing (or possibly cascading) in the preceding months. Temperature-salinity plots for station F indicated Wyville-Thomson Ridge overflow water at 1650-1800m.

(Aim 2) All CTD sections east of the Outer Hebrides and in the North Channel were worked, but time and weather did not allow the three northern sections (BN, J & M) west of the Hebrides to be worked. Radiocaesium samples were taken upon four transects (Z, A, D & K) for analysis at the Scottish Universities Research and Reactor Centre, and upon a fifth (G) for analysis by the Fisheries Radiobiological Laboratory. Intercalibration samples were taken at three sites.

Preliminary plots of temperature and salinity at 5m depth are shown in Figures 2 a & b. Temperatures throughout most of the coastal current were between 7.0° & 7.5°C, except in the Sea of the Hebrides, where the influence of Atlantic water raised them to 7.5° to 8.0°C. Atlantic water surface temperatures were 10.0° to 10.6°C, giving a 3.5 deg.C.range along

the section west of Islay, and somewhat less between Barra Head and the outer shelf. In the Firth of Clyde shallow patches at 8°C had formed during the calm warm weather at the start of the cruise.

Similar patterns are seen in the salinity distribution: The coastal current water has a salinity a little less than 34.0°/oo in the North Minch; Atlantic water salinity is about 35.37°/oo and is found undiluted in a tongue east of Barra Head.

(Aim 3) A successful programme of benthic sampling was undertaken at station M, extending the time series of samples from this station to nine years. Although the first attempt with the spade box corer only recovered a small washed sample, the second attempt produced a good core of relatively undisturbed mud some 30 cm deep. The MBA Agassiz Trawl provided a good sample dominated as usual by the ophiuroid Ophiomusium lymani, the echinoid Echinus affinis and the asteroid Hymenaster membranaceus. Specimens of a number of species were frozen for Dr P.A. Tyler at the Oceanography Dept. at Swansea University. The Epibenthic Sled produced a large sample of muddy ooze rich in bivalves and other macrofauna. Of particular interest were a number of gastropod egg capsules containing various developmental stages of the buccinid Colus jeffreysianus, a species which is common at this station. Unfortunately bad weather prevented further benthic sampling. Nevertheless the material collected will make a valuable contribution to ongoing studies of benthic community structure and life history processes such as growth and reproduction. (R.H. & J.G.C.)

(Aim 4) The Tiree Passage current meter mooring was serviced on 1 May and the current meter record, when processed on board, had provided 111 days' data from 10 January to 30 April 1987. The mean residual current over the period was 10.3 cm sec^{-1} (8.9 km day^{-1}) towards 032°.

Servicing of mooring MJ, north of the entrance to Loch Spelve, was also attempted on 1 May. The spar buoy was grappled and taken on board, but the buoy wire was found to have parted. Although increasing wind had begun to introduce handling problems, the most probable cause of the break would appear to be chafing of the wire since deployment by CALANUS on 14 November 1986. Several metres of the wire were unlayed and numerous short strands had the appearance of having been broken some while before the lesser number of long broken strands. In quiet conditions and slack tides a pellet float at the meter end of the mooring should be visible, and it was agreed that recovery by this means or by dragging would be best carried out by CALANUS in better weather.

(Aim 5) Twenty-two stations of the Outer Firth of Clyde grid were worked during 25-26 April, giving a section around Arran along the axis of deep water and another across the sill along the line of former and existing current meter positions. A preliminary temperature section around Arran is given in Figure 3. This suggests that the coldest winter-formed water at about 6.3°C in Kibrannan Sound was being displaced upwards by slightly warmer (ca 6.5°C) and more saline water which had subsequently crossed the sill to the southeast of Arran.

Miscellaneous Although the central processor of the Micro PDP11 had been carefully packed for transit in its original container, the Winchester disc system failed in operation when assembled aboard ship. As this was the only item of computing equipment handled by the Ardrossan dockers, a

connection may be inferred with notable breakages which have occurred at these hands in the past. Nearly all the CTD work was therefore carried out with the Bissett-Berman 9052 CTD and the LSI 11/23 computer. However, it was found possible to run the Micro PDP11 from its floppy disc drives and the Neil Brown 'Smart' CTD was used in the Firth of Lorne to gather data to test a plotting programme to be used in processing 'Yo-Yo' CTD lowerings in the autumn.

D.J. Ellett
7 May 1987

Table 1. Sections worked during Cruise 14/1987

Stations	CTD Disc/Dip Nos.	Location	Dates	Observations
1Z-6Z	050/002-007	Copeland-Portpatrick	25 Apr.	CTD, Cs surface; Cs mid-water & bottom (2-5)
1Y-5Y	050/008-012	Corsewall-Sanda	25 Apr.	CTD
AB15-17	050/013-015	Kilbrannan Sound	25 Apr.	CTD
AB48-44	050/016-020			
AB43-42	051/021-023			
AB38-20	051/024-030	Arran Deep	25-26 Apr.	CTD
AB10-14	051/031-035	F. of Clyde sill	26 Apr.	CTD
1A-5A	051/036-040	Kintyre-Antrim	26 Apr.	CTD, Cs surface; Cs near-bottom (2 & 4)
2C-6C	052/041-045	Lough Foyle-Loch Indaal	26 Apr.	CTD
8D-ØD	052/046-054	West of Islay	26-27 Apr.	CTD, Cs surface
A-C	052/055-057	Anton Dohrn Seamount Sectn.	28-30 Apr.	CTD
D,E	053/058-059			
F,G	054/060-061			
H-K	055/062-065			
L,M	056/066-067			
N,O	057/068-069			
P,Q	058/070-071			
16G-7G	058/072-080	Shelf-edge-Sound of Mull	30 Apr.- 1 May	Surface s^{o}/oo; CTD (not 3,5,8,12 & 14); Cs surface, mid-water & bottom (at 1,2,4,6,7, 9,11,13,15,16)
6G-1G	059/081-084			
5E & 4E	059/085-086	Firth of Lorne	1 May	CTD
1K-9K	059/087-095	Loch Seaforth - Loch Gairloch	2-3 May	CTD, Cs surface; Cs near-bottom (2,4 & 8)
1L-6L	059/096-101	Eddrachillis Bay-Broad Bay	3 May	CTD
6N-3N	059/102-105	Loch Eport-Loch Dunvegan	4 May	CTD

Table 1 (Continued)

Stations	CTD Disc/dip Nos.	Location	Dates	Observations
2N-1N	049/106-107	Loch Eport - Loch Dunvegan	4 May	CTD
HE5-HE1	049/108-112	Loch Bracadale-Canna	4 May	CTD
HD1-HD9	049/113-121	Loch Boisdale-Loch Moidart	4 May	CTD
P1-P9	049/122-128	Skerryvore-Islay	5 May	CTD
5B	049/129	Islay-Gigha	5 May	CTD
4B-1B	060/130-133			
1E-5E	060/134-138	Firth of Lorne	5 May	CTD
FL9-FL15	M021/001-007	Firth of Lorne (longitudinal)	5-6 May	Neil Brown CTD

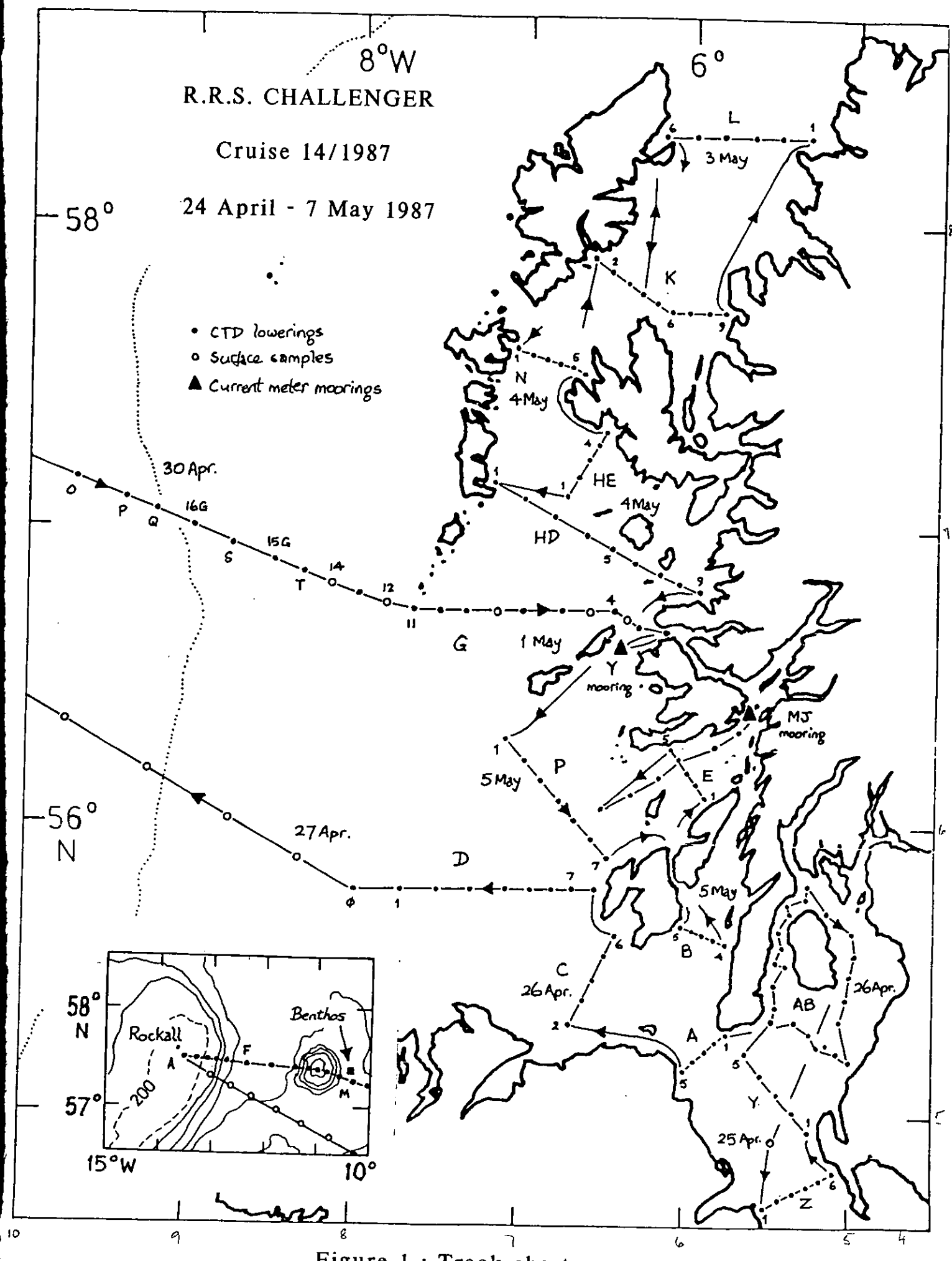

Figure 1 : Track chart

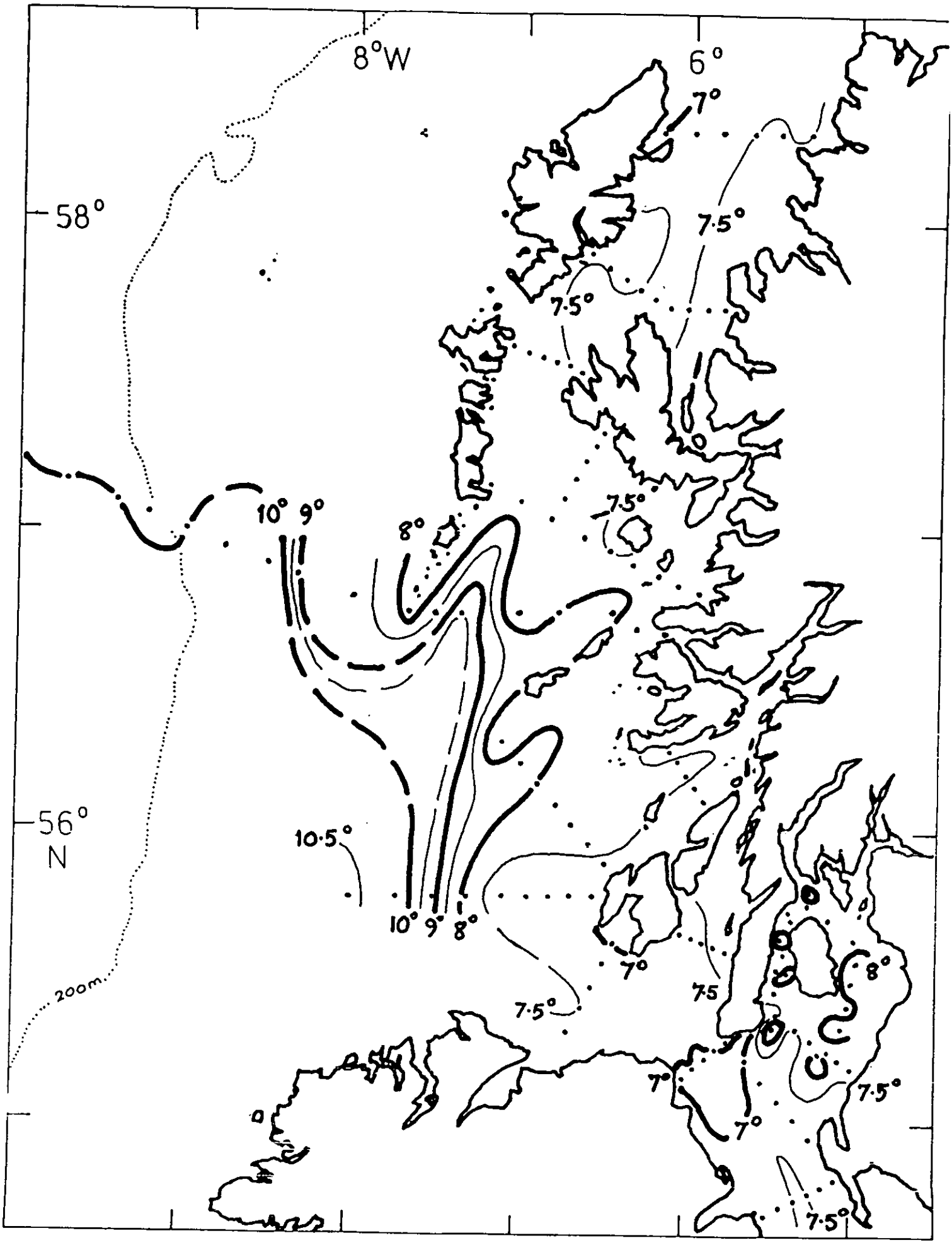

Figure 2a : 5m temperature

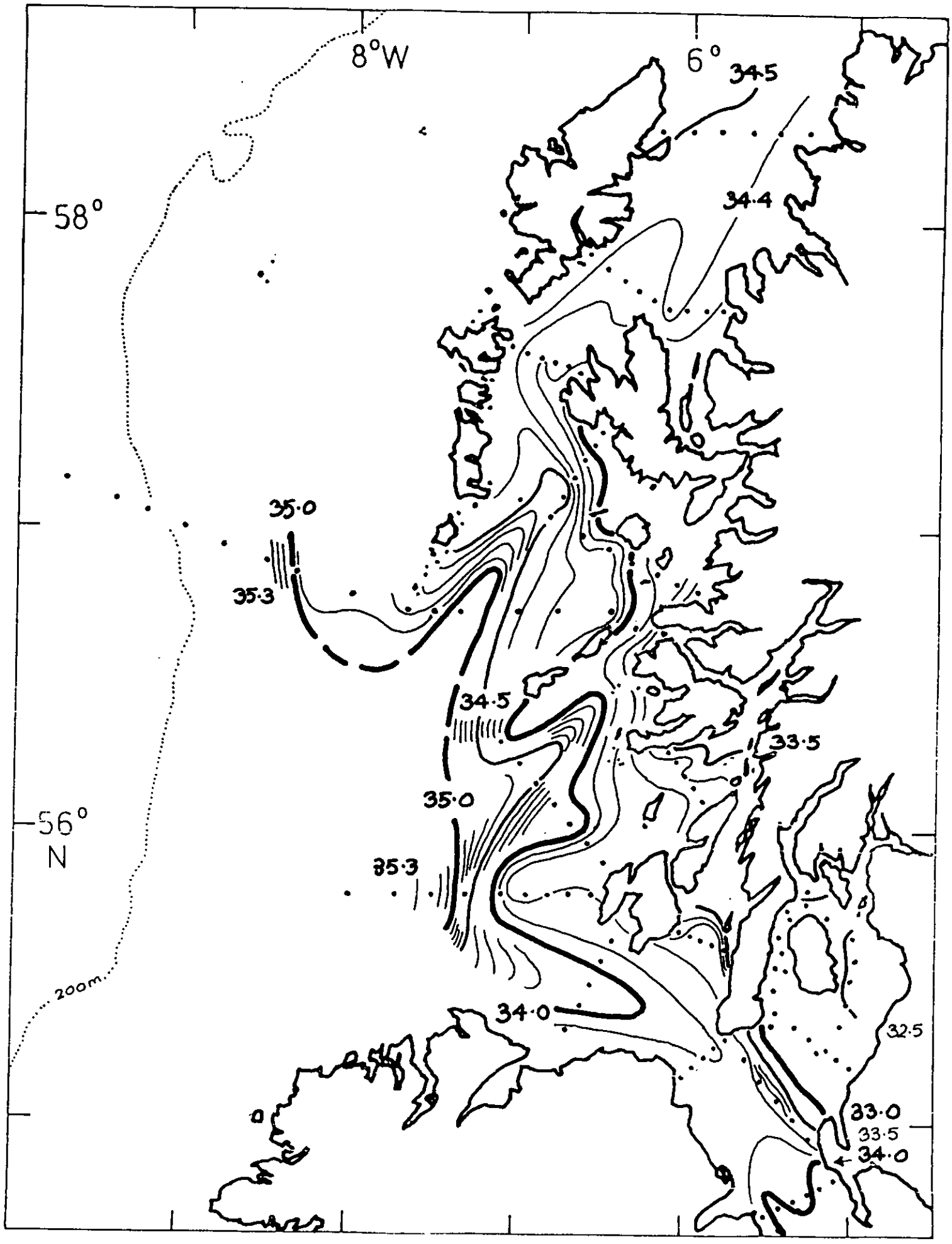

Figure 2b : 5m salinity

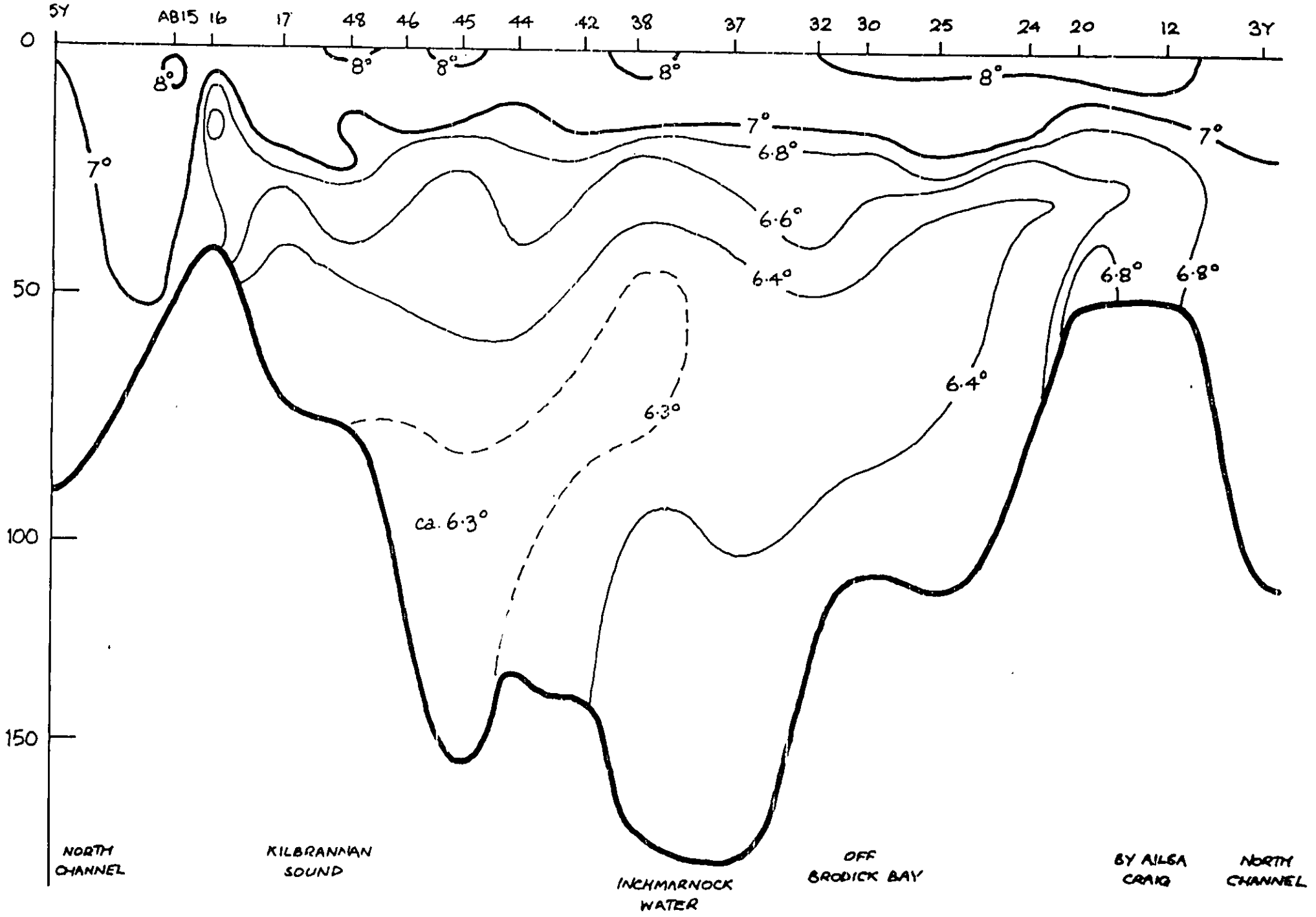

Figure 3 : Temperature section around Arran.