O C E A N O G R A P H Y

Beam Transmittance Measurements carried out in the Waters around Surtsey 1-2 August 1966

by

Svend-Aage Malmberg
Marine Research Institute, Reykjavik

Summary

Beam transmittance measurements were carried out in the waters around Surtsey and Jólnir at two spectral intervals, in the red and in the blue, and temperature recordings as well, during 1-2 August (Fig. 1; Table 1). All measurements were made continuously from sea surface to bottom. During the observations Surtsey was inactive, but Jólnir active. The object of the investigations was mainly to determine the attenuation coefficients in the sea water and their connection with the vertical stratification and to obtain data for studies on suspended and dissolved matter in the sea water for comparison with other areas.

Table 1. Beam Transmittance Measurements in the Waters around Surtsey and Jólnir 1-2 August 1966.

Stat. No.	Pos.		Depth
No.	N	W	m
30	63°30,5′	20°37,1′	78
31	63°26,0′	20°37,3′	85
32	63°22,0′	20°37,3′	102
33	63°19,0′	20°37,5′	85
34	63°16,3′	20°39,0′	65
35	63°18,0′	20°45,0′	134
36	63°18,0′	20°53,0′	138
37	63°18,0′	21°04,0′	155
38	63°09,0′	20°40,0′	218
39	63°11,3′	20°37,8′	185
40	63°15,0′	20°37,0′	148
41	63°16,5′	20°37,0′	125
42	63°17,0′	20°37,5′	85
43	63°17,6′	20°33,1′	120
44	63°17,9′	20°30,0′	103
45	63°18,0′	20°21,0′	136
46	63°18,0′	20°10,0′	136

The main results are as follows:

1) A distinct intermediate maximum of attenuation was observed at ca. 50 m depth on four stations (33, 34, 42, 43), all located over the submarine slope of the volcanic islands. On the other stations farther offshore it was not observed (Figs. 2-3). At the four above mentioned stations the vertical temperature distribution was similar as elsewhere in the study area. Thus the maximum attenuation found does not seem directly connected with the stratification but more likely related to the existence of the volcanic islands. Primarily, it may be due to some change in the building-up of Surtsey and/or other elevations in the area, and secondly due to currents. A noteworthy feature is the distribution of the scattering layer at about 30-60 m depth observed by means of echo soundings in the last week of July 1966 in the area around Surtsey (Figs. 4-7). The scattering layer occurs mostly only on one side of the submarine elevations, thus probably indicating a transport of particulate matter by currents in special directions and patterns. It may be of interest to repeat beam transmittance measurements in the area and collect water samples for filtering according to the observed distribution of attenuation.

2) The relation between the attenuation coefficients in the blue ($\Delta a (B)$) and in the red ($\Delta a (R)$) obtained around Surtsey at all depths and shown in Fig. 8 indicated one linear characteristic. Surface data all around Iceland (Fig. 9) show the same characteristic (Fig. 10), as well as most subsurface data, with few exceptions in the near surface layer at river outlets as e.g. at Þjórsá and Ölfusá (Fig. 11). According to Figs. 8 and 10 the coastal water all around Iceland is in optical view characterized by the equation

$$\Delta a (B) = 1.2 \; \Delta a (R)$$

However, salinity observations in connection with beam transmittance measurements could possibly distinguish between the run-off from the various rivers.

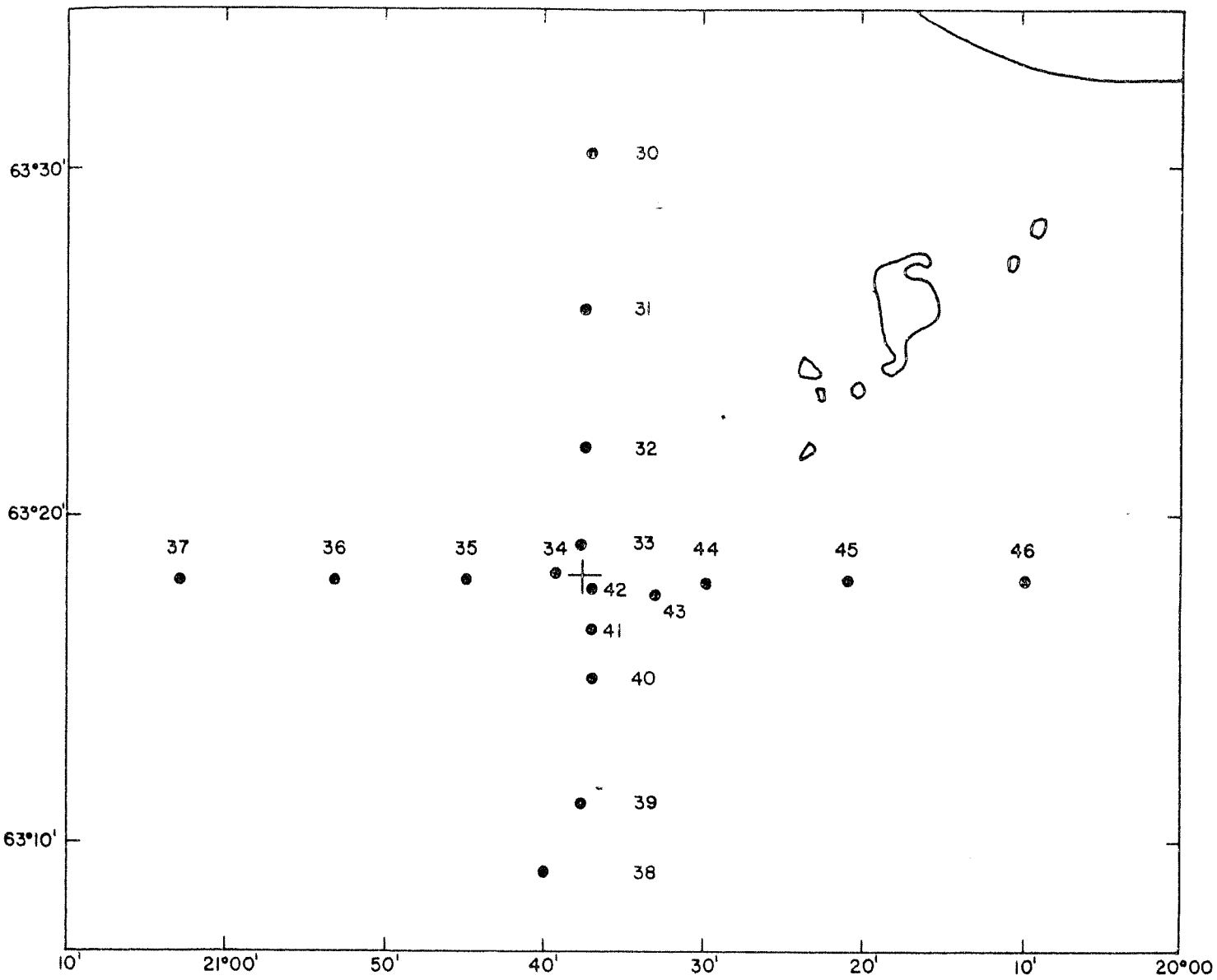

Fig. 1 Location of beam transmittance measurements in the area around Surtsey and Jólnir on 1-2 August 1966.

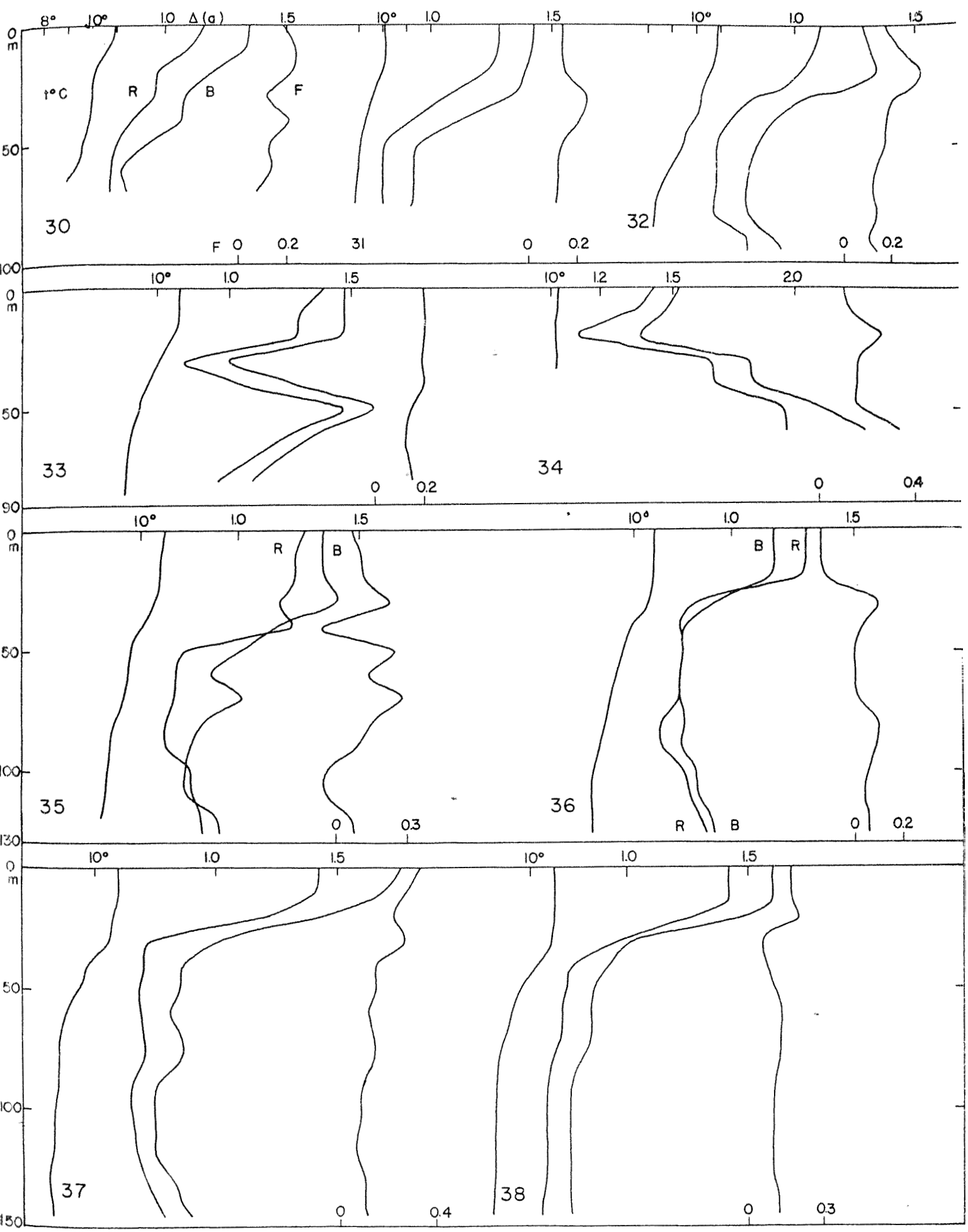

Fig. 2 Vertical distribution of temperature (t° C), attenuation coefficients in the red (Δa (R)) and in the blue (Δa (B)) and their differences (F), the last being a measure of the colour of the sea water, at stations 30-38.

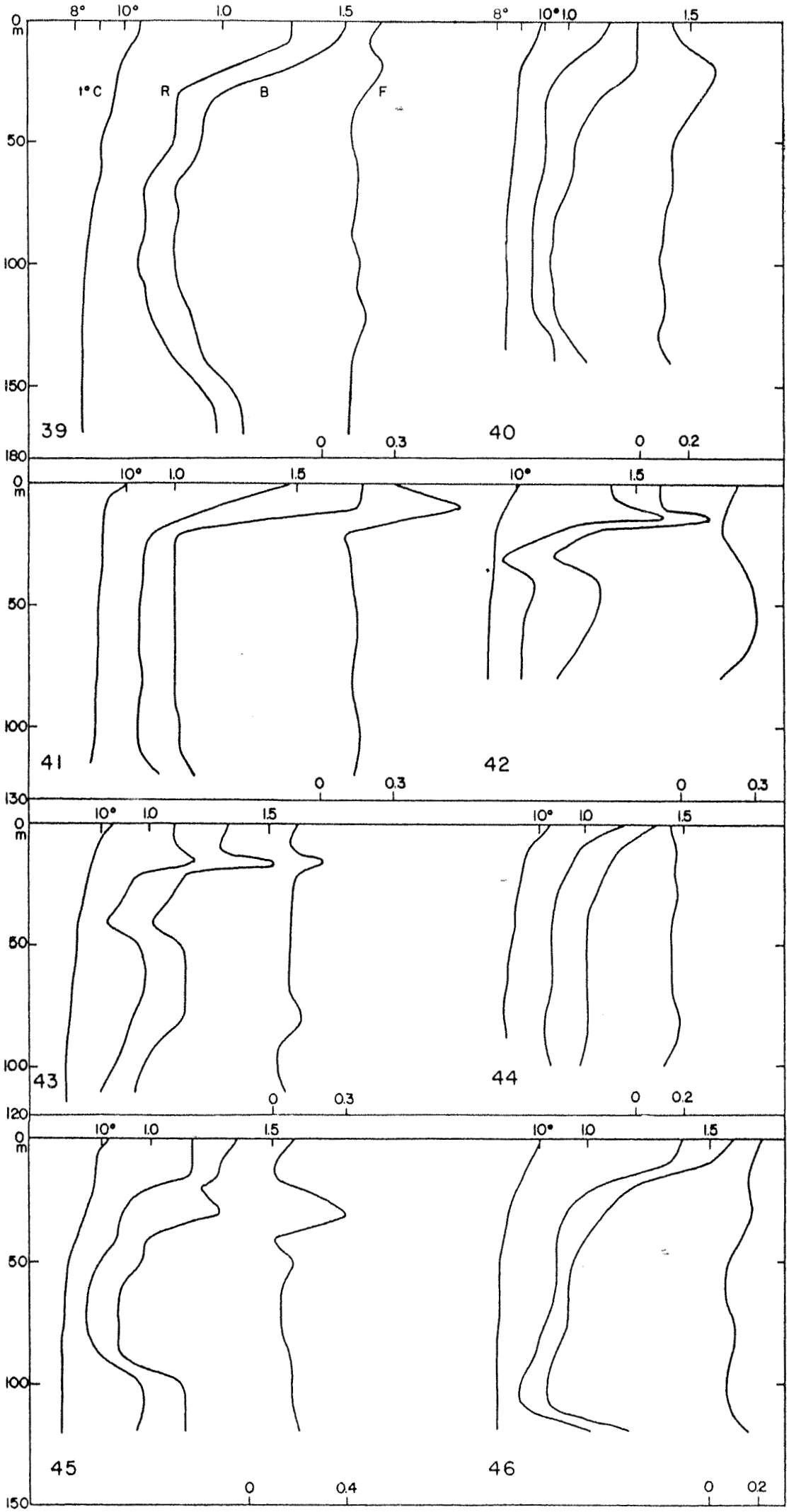

Fig. 3 As Fig. 2 except on stations 39-46.

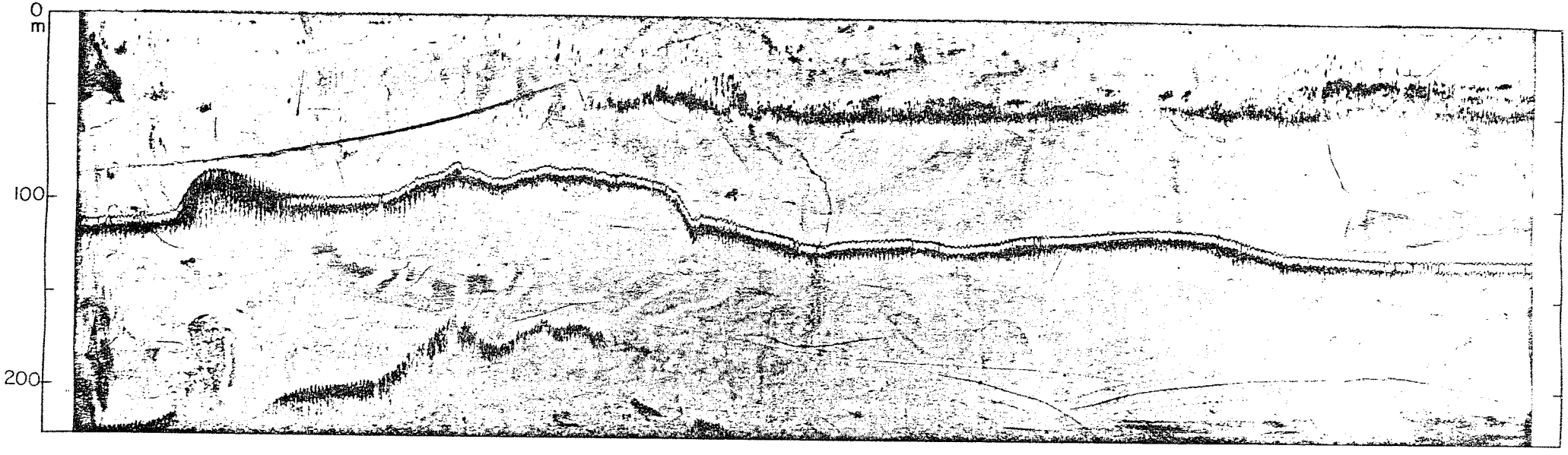

Fig. 4 Echo soundings carried out from the coast guard vessel "Þór" in the last week of July 1966 N and NE of Surtsey.

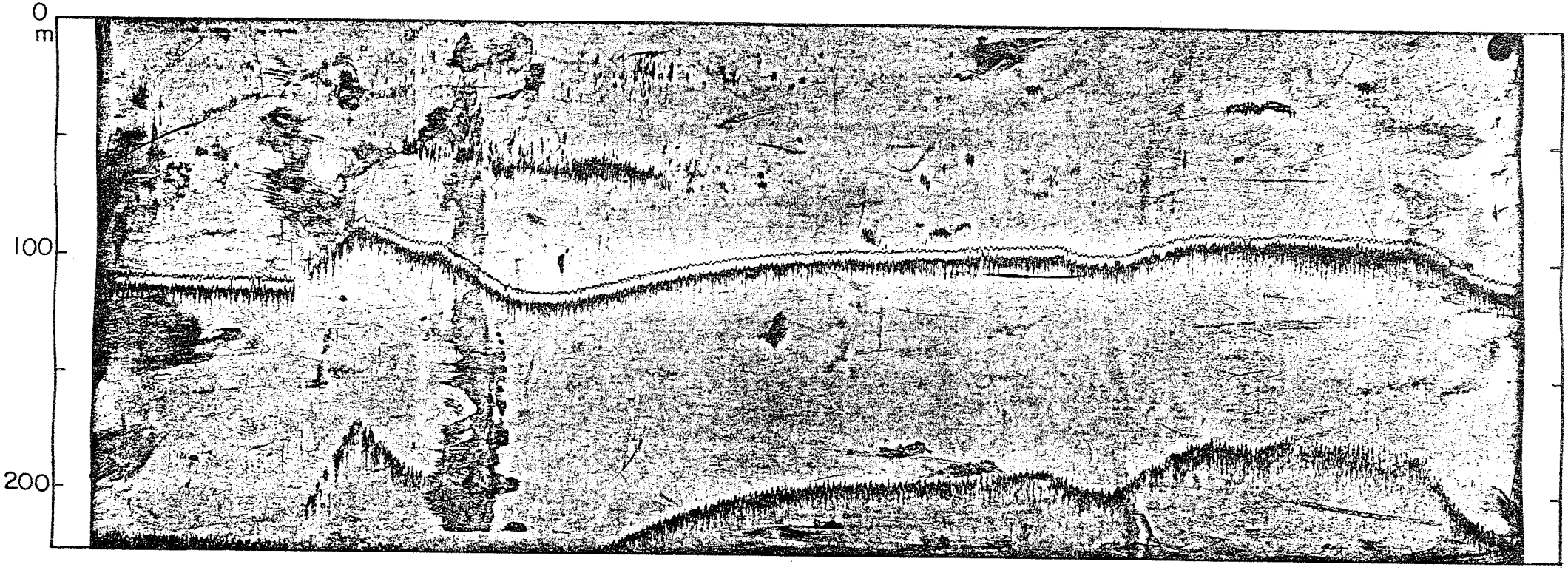

Fig. 5 Echo soundings carried out from the coast guard vessel "Þór" in the last week of July 1966 N and NE of Surtsey.

Fig. 6 Echo soundings carried out from the coast guard vessel "Þór" in the last week of July 1966 N and NE of Surtsey.

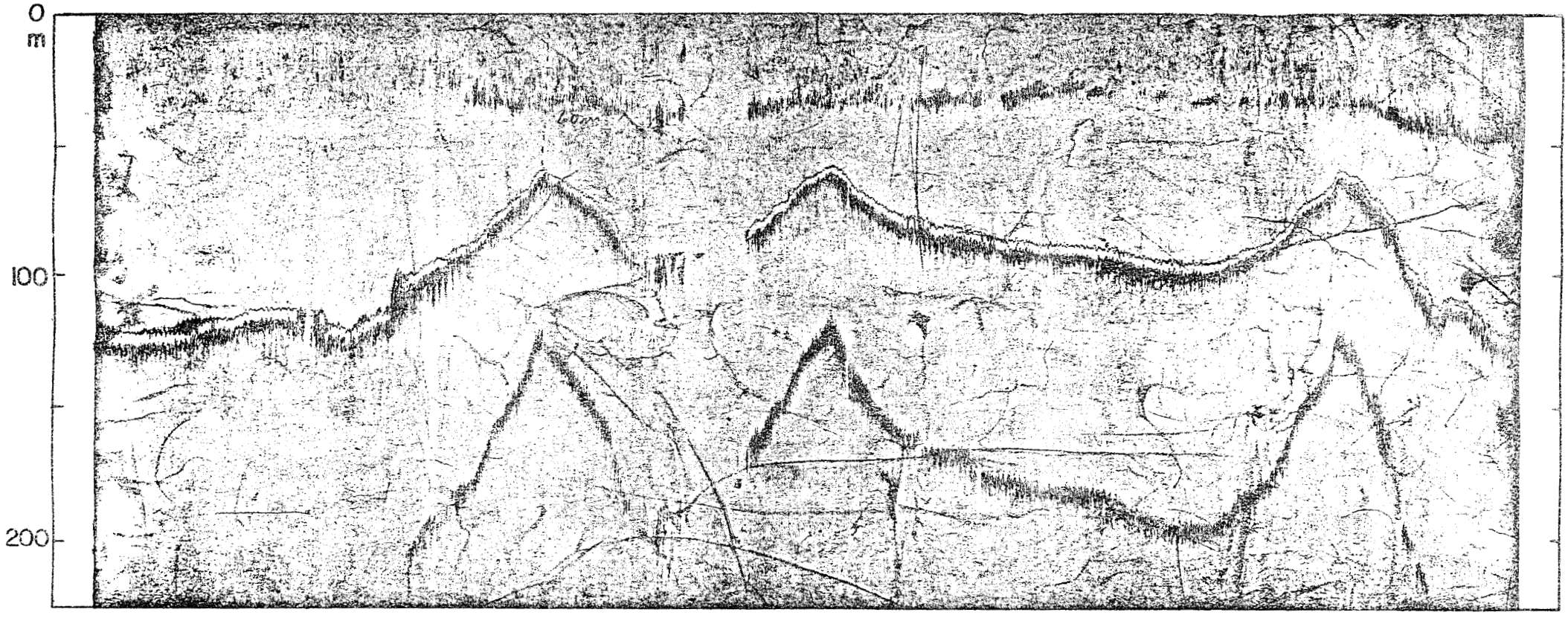

Fig. 7 Echo soundings carried out from the coast guard vessel "Þór" in the last week of July 1966 between Surtsey and Jólnir.

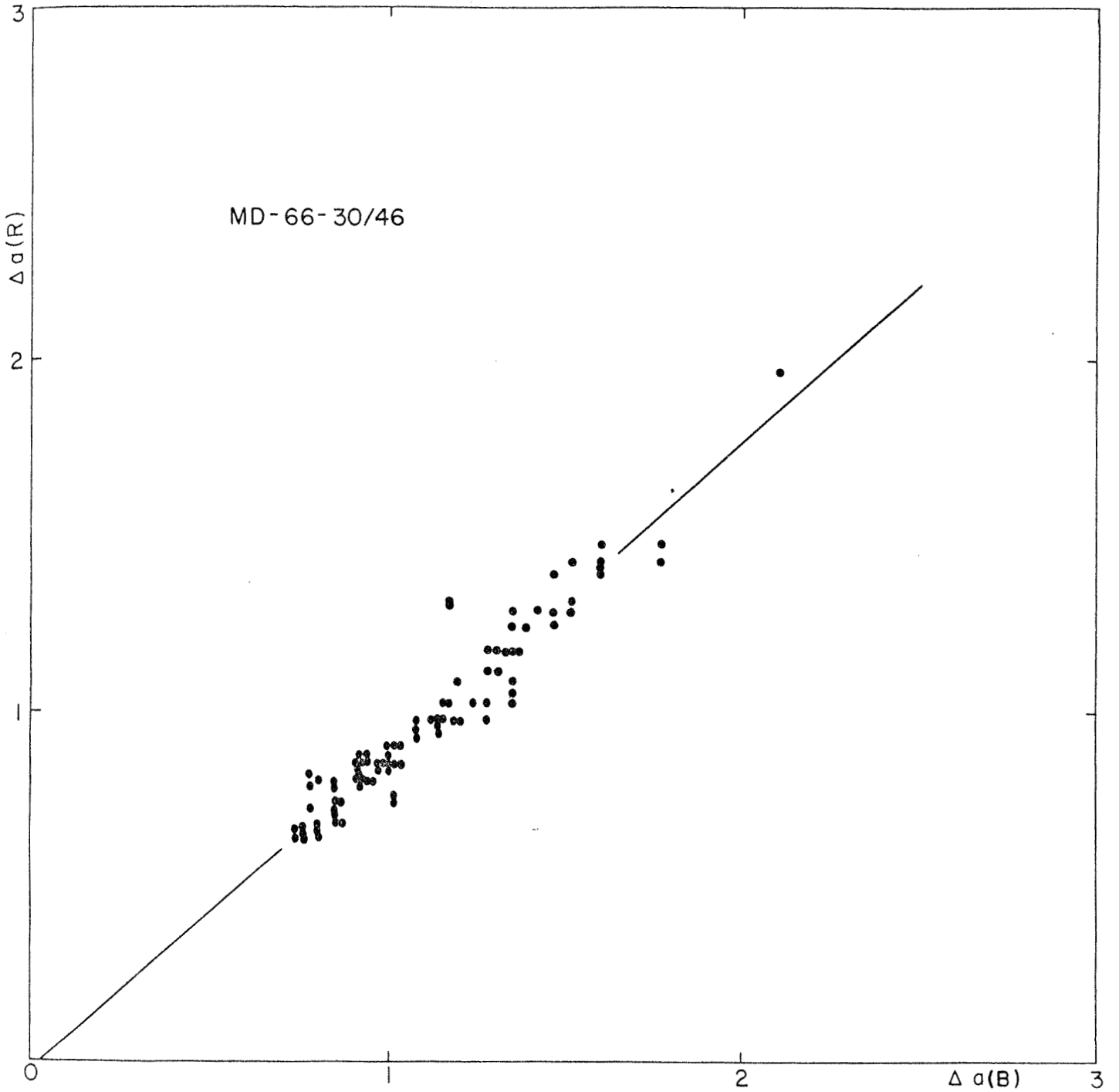

Fig. 8 The relationship between the attenuation coefficients (Δa (R) and Δ a (B)) on all station carried out around Surtsey based on data from 0, 20, 50, 70, 100, 120, 150, and 170 m depth.

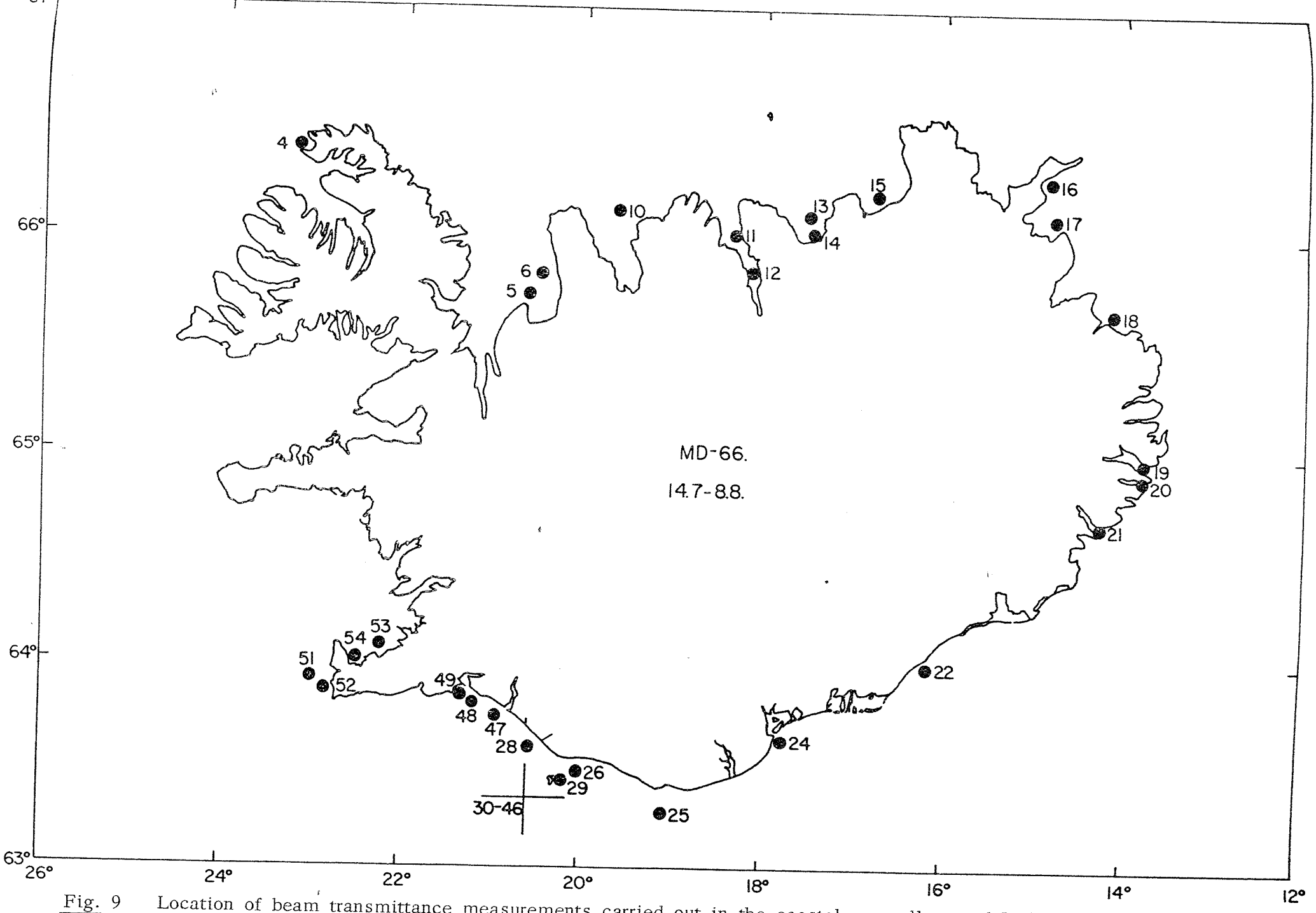

Fig. 9 Location of beam transmittance measurements carried out in the coastal area all around Iceland on July 17-August 8 1966 (Surtsey observation included).

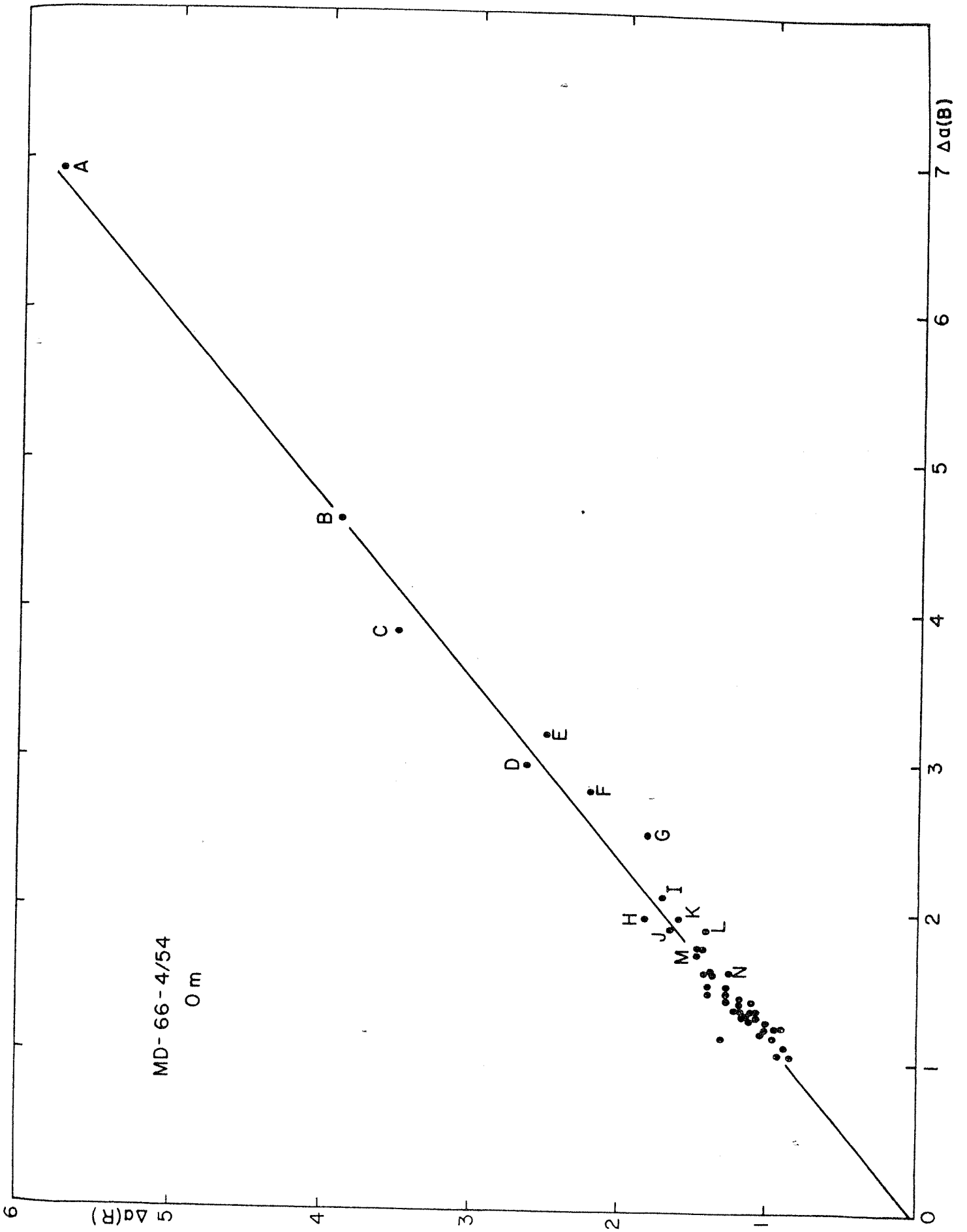

Fig. 10 The relationship between the attenuation coefficients (Δa (R) and Δa (B)) based on sea surface data at the stations shown in Fig. 9.

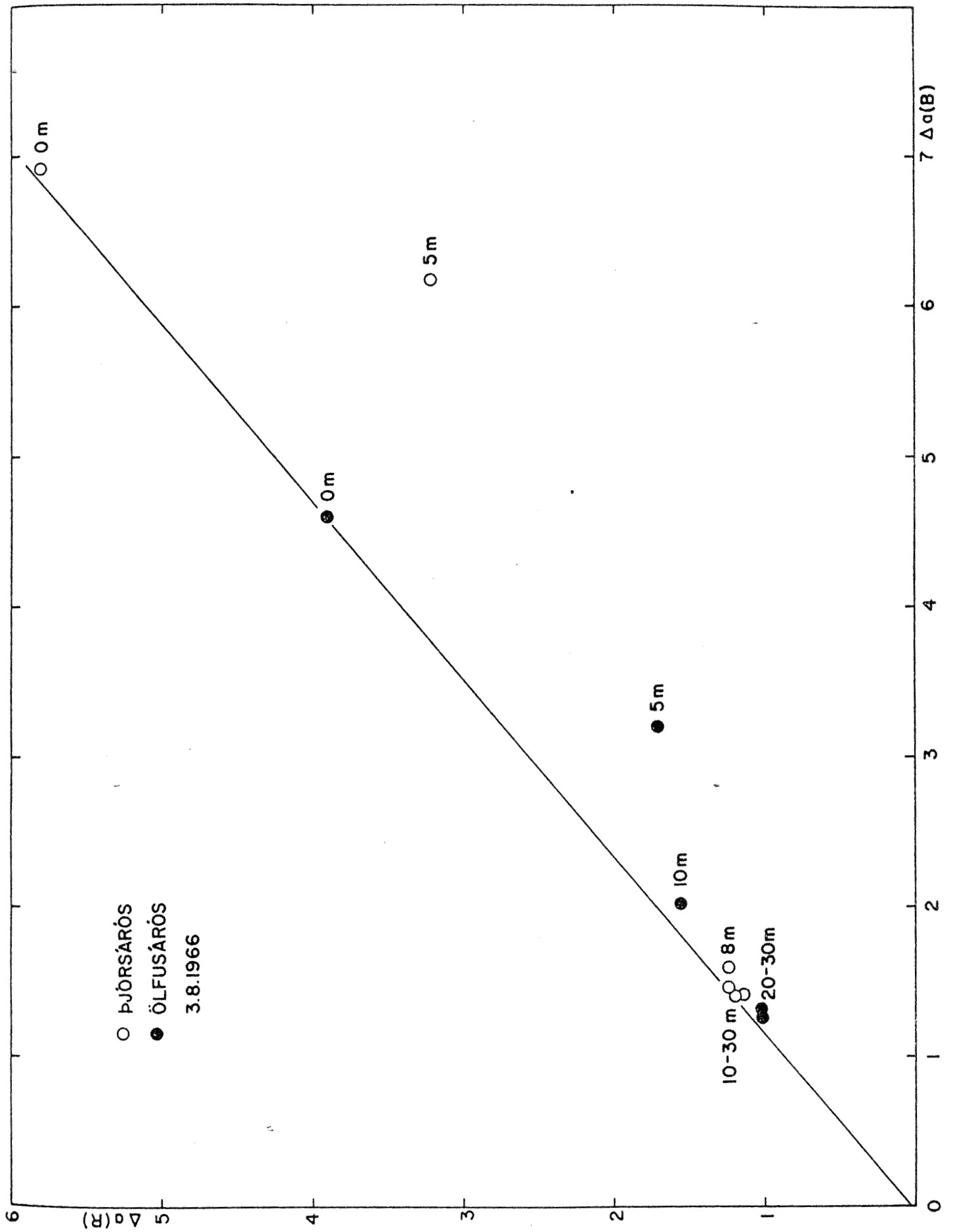

Fig. 11 The relationship between the attenuation coefficients (Δa (R) and Δa (B)) based on data from 0, 5, 10, 20 and 30 m depth at the river outlets of Þjórsá and Ölfusá (Stats. 47 and 49).