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Hydrographic Committee

A Note on
The Deep Water South of Iceland
- "Overflow '73" -

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by

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Introduction

In August 1973 an oceanographic section was worked from r/v "Bjarni Sæmundsson" in the deep waters south of Iceland as part of the "Overflow" '73" program (Fig. 1). The investigations were concentrated over the slope and foot of the Icelandic continental slope, especially in an area crossing two submarine ridges rising from about 2000 m to 1000 m depth (Fig. 1). The easternmost ridge is among German fishermen known as "Elisabeth Bank" (Malmberg 1962). This name has possibly been transferred from a bank which was wrongly believed to exist farther south (Sæmundur Audunsson, personal communication). Since the name "Elisabeth Bank" is not generally known and used, the present author suggests the names Katla Ridges and Katla Deep for the topographic features in question, but they are directly south of the volcano Katla in Mýrdalsjökull. As far as the author knows these topographic features have not yet been described by geologists or geophysicans, but have occasionally been referred to by physical oceanographers in connection with studies on water masses and deep currents in the

area, such as studies on the Arctic Bottom Water (overflow) and Irminger Sea Water (Steele 1961, Malmberg 1962). A study on the latter water mass was the prime motive for the survey dealt with in this report, a study which will be continued by the Marine Research Institute in Reykjavík.

Material

The hydrographic material consisted of 11 hydrographic stations made across the Katla Ridges, including observations on temperature, salinity, oxygen and nutrients. Observations were made at standard depths down to 1000 m, but closely spaced from thereon down to bottom. This paper deals only with the temperature ($\pm$ 0.02°C) and salinity ($\pm$ 0.003°/oo) distribution. The results are shown in temperature and salinity profiles made across the Katla Ridges (Figs. 6 and 7) and in t-S diagrams for all hydrographic observations in theprofiles with temperatures below 6.5°C. (Fig. 8).

Continuous depth recordings were made across the Katla Ridges between the hydrographic stations by means of a deep sea recorder (Simrad Scientific Sounder EK 12). Positions were determined by means of Loran-C. The results of the soundings are shown in Figure 2.

Results

a) Bottom topography

The cross section topography of the Katla Ridges between stations 73 and 79 (Fig. 2) is relatively smooth and thus widely different from the complicated topography of the Mid-Atlantic Ridge or the Reykjanes Ridge southwest of Iceland (Ulrich 1962) and the Kolbeinsey Ridge north of Iceland (Johnson and Heezen 1967, Mayer et al. 1972, see Fig. 3). The topography of the Katla Ridges may possibly be compared with that of the Iceland-Jan Mayen Ridge. The two west-east cross sections of this ridge made at 69°30′N (Jan Mayen Ridge) and 66°00′N which are shown in Figures 4 and 5, reveal a distinct smooth ridge, and in a bathymetric chart of the Iceland Sea (Stefánsson 1962), even two ridges are indicated by the 1500 m depth contour at about 67°N.

The topography of the Katla Ridges is of interest to physical oceanographers, but also raise various geophysical and geological questions regarding the origin of these ridges and their relationship to other submarine features in the northeast Atlantic. Today knowledge of the structure of the Katla Ridges is insufficient and can thus not be fitted into the overall geological picture of the region, but future work should reveal whether they are of oceanic, igneous origin, or of continental deriviation as has been suggested for the Jan Mayen Ridge (Johnson and Heezen 1967).

b) Temperature and salinity distribution

The temperature profile for the section across the Katla Ridges (Fig. 6) shows the general temperature distribution in the study area, with values up to 11°C in the surface layer, values of 7°C in the Northeast Atlantic Water down to 800 m depth, and values decreasing to less than 3°C in the bottom layer (Steele et al. 1962, Malmberg 1962).

The profile of the salinity distribution (Fig. 7) is more complex. The highest values, exceeding 35°/oo, were found in the uppermost 1000 m, but at 1100-1300 m depth an intermediate layer or tongues were found with values between 34.94°/oo and 34.98°/oo. Below this layer the salinity increased again to about 35.00°/oo, but values of 34.98°/oo were observed in the bottom layer. This vertical distribution of salinity in the slope area south of Iceland has been covered previously (Malmberg 1962), and appears in data presented by Steele, Barrett and Worthington (1962), whereas these authors point out a similar distribution farther south, where the salinity minimum layer was found at about 1500-2000 m depth and relatively widely distributed in the basin south of Iceland. It has been suggested that this water comes from the Labrador Sea (Steele 1960, Worthington and Metcalf 1961). These same conditions were also shown by Dietrich (1957) in a section along 60°N south of Iceland, in data obtained south of Iceland in July-August 1956 (Steele 1961, ICES ODL 1956), and by Hermann (1953-1961) in a section along 62°N in the same area, but always without remarks.

The t-S diagrams for the core of the intermediate water found in August 1973 south of Iceland (Fig. 8) reveal values which

are essentially those for Irminger Sea Water as defined by several authors (Dietrich 1957, Stefánsson 1968, Gade et al. 1965, Malmberg 1972). Steele, Barrett and Worthington (1962) also regard the water mass in deep waters south of Iceland as a mixture of North Atlantic and Irminger Sea Water.

Discussion

What is the origin of the intermediate water mass dealt with in this paper? Some authors have suggested, that the water found relatively widely distributed south of Iceland at about 1500-2000 m depth comes from the Labrador Sea. However, the intermediate water at 1100-1300 m depth south of Iceland seems to have the characteristics of Irminger Sea Water.

It may be connected with the water at greater depth farther south, or it might possibly flow directly from the Irminger Sea across the Reykjanes Ridge and along the Icelandic continental slope and the Katla Ridges. Further investigations are needed in the area to solve the question of the passage of the flow and its origin. This might also be of considerable biological interest.

Soviet investigators have found great concentrations of rattail (Macrurus rupestris) along the foot of the continental slope south of Iceland (Pechenik and Troyanowskii 1970). It has been suggested that the rattail migrate between the east coast of North America and the deep waters south of Iceland (Podrazhanskaya 1971). Thus the influx of Irminger Sea Water or Labrador Sea Water south of Iceland dealt with in this report could be an important factor for the distribution and migration of marine life such as the rattail or other organisms in the deep water south of Iceland. Combined hydro-biological studies in the area in question and farther south along the eastern slope of the Reykjanes Ridge could possible throw light on the relationship between the hydrographic conditions and distribution of marine life in the region.

It can thus be concluded that oceanographic studies - biological, geological and physical - in the deep waters south of Iceland outside the shelf area seem to be of great interest for future utilization in this region.

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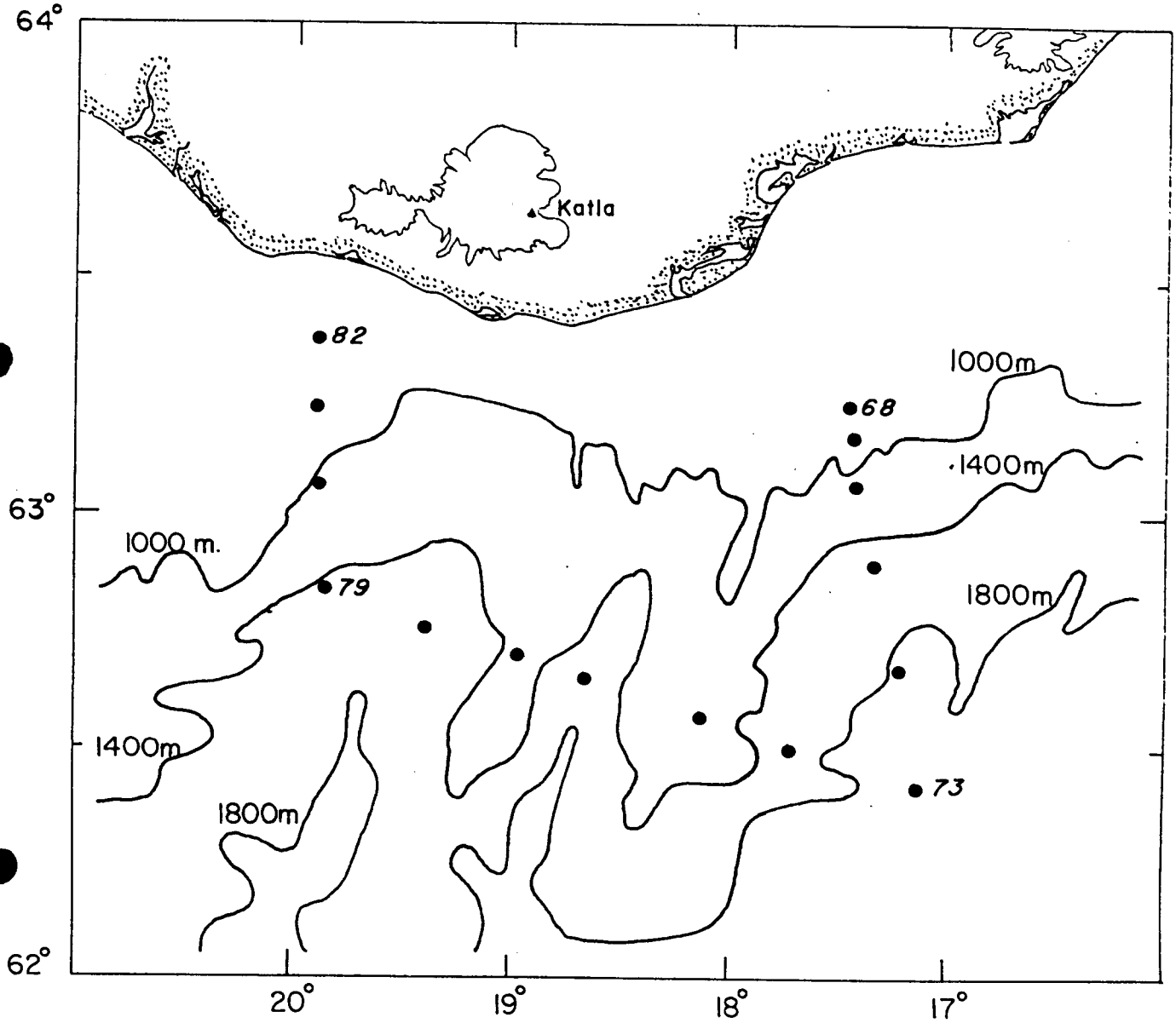

Fig. 1 Location of stations and depth contours.
(Icelandic Hydrographic Service, Reykjavík 1971).

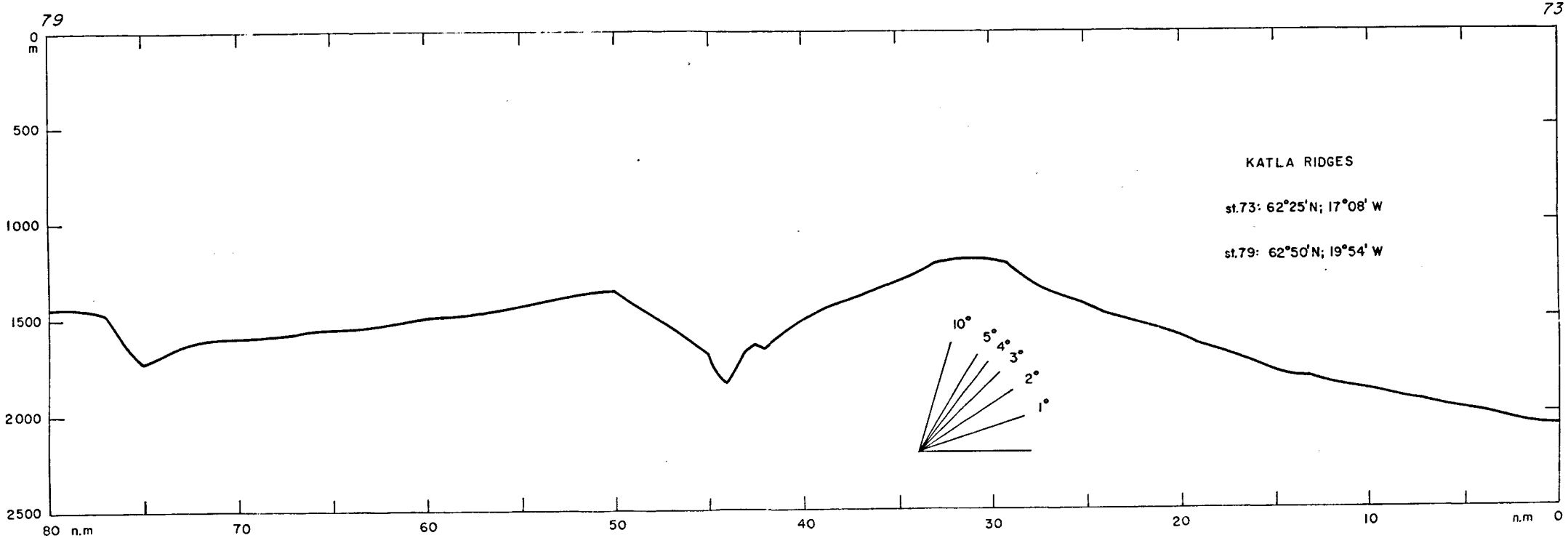

Fig. 2 A profile across the Katla Ridges. For location see Figs. 1 and 3.

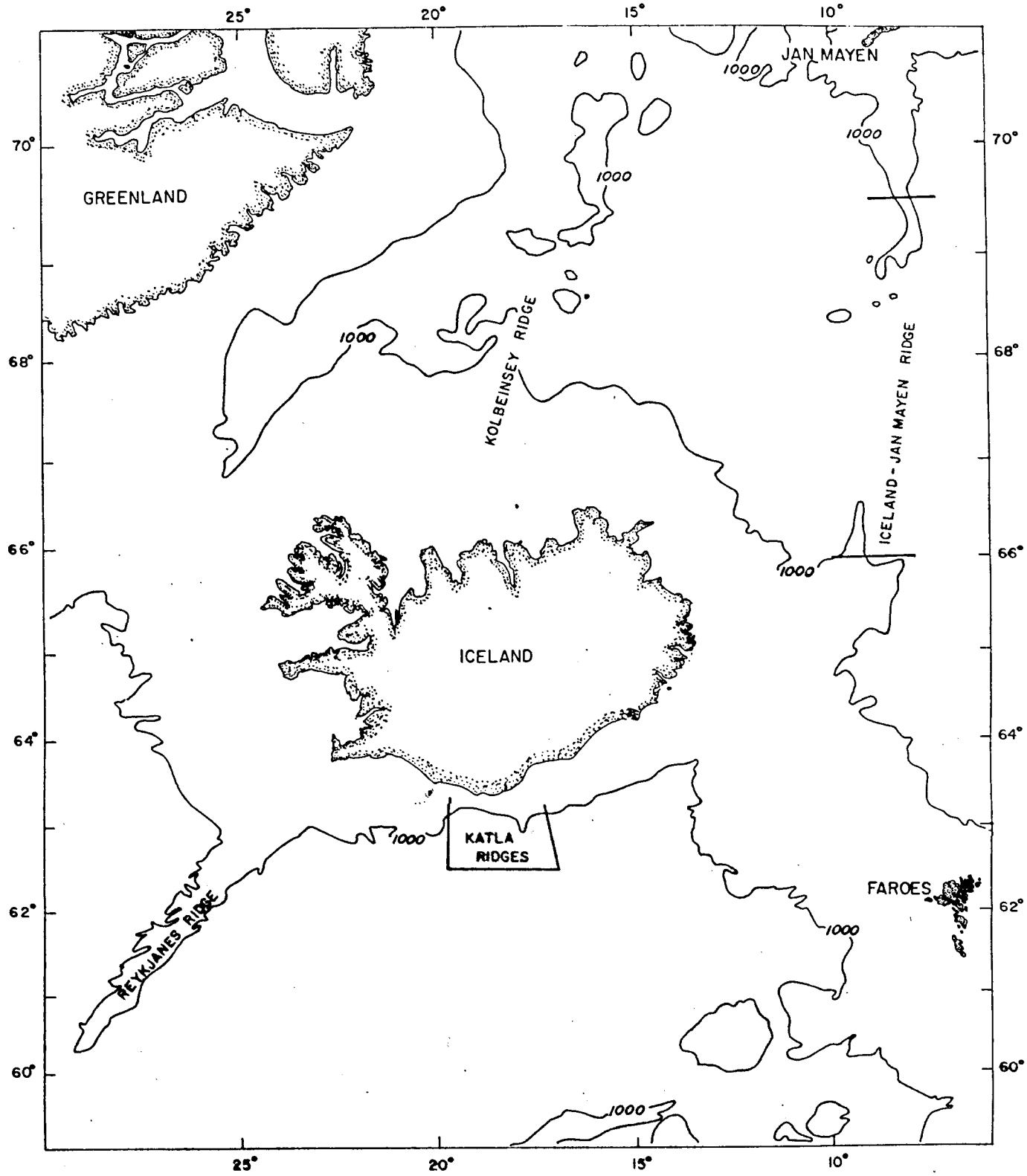

Fig. 3 Location of sounding profiles (Figs. 2, 4 and 5). and submarine ridges in the waters around Iceland.

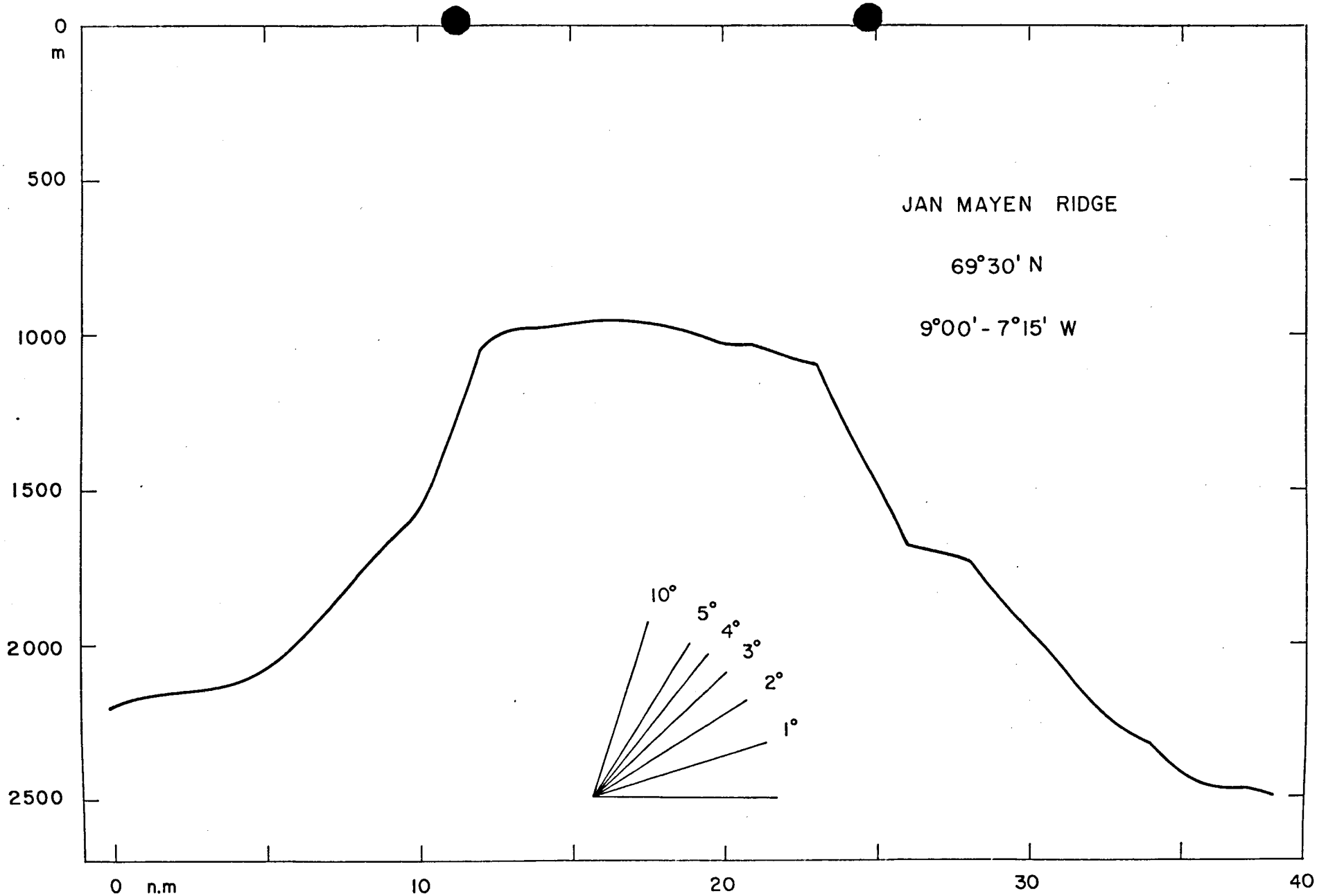

Fig. 4 A profile across the Jan Mayen Ridge at 67° 30'N.
For location see Fig. 3.

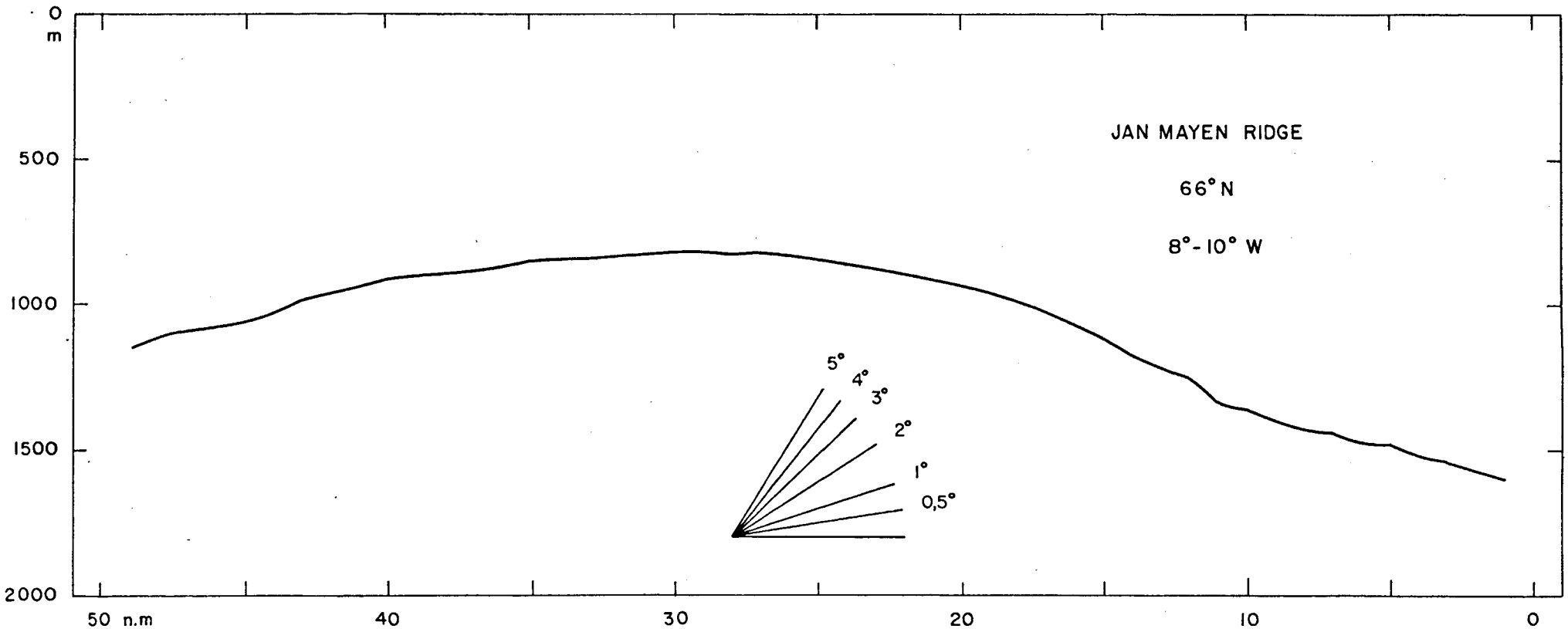

Fig. 5 A profile across the Iceland- Jan Mayen Ridge at 66°N. For location see Fig. 3.

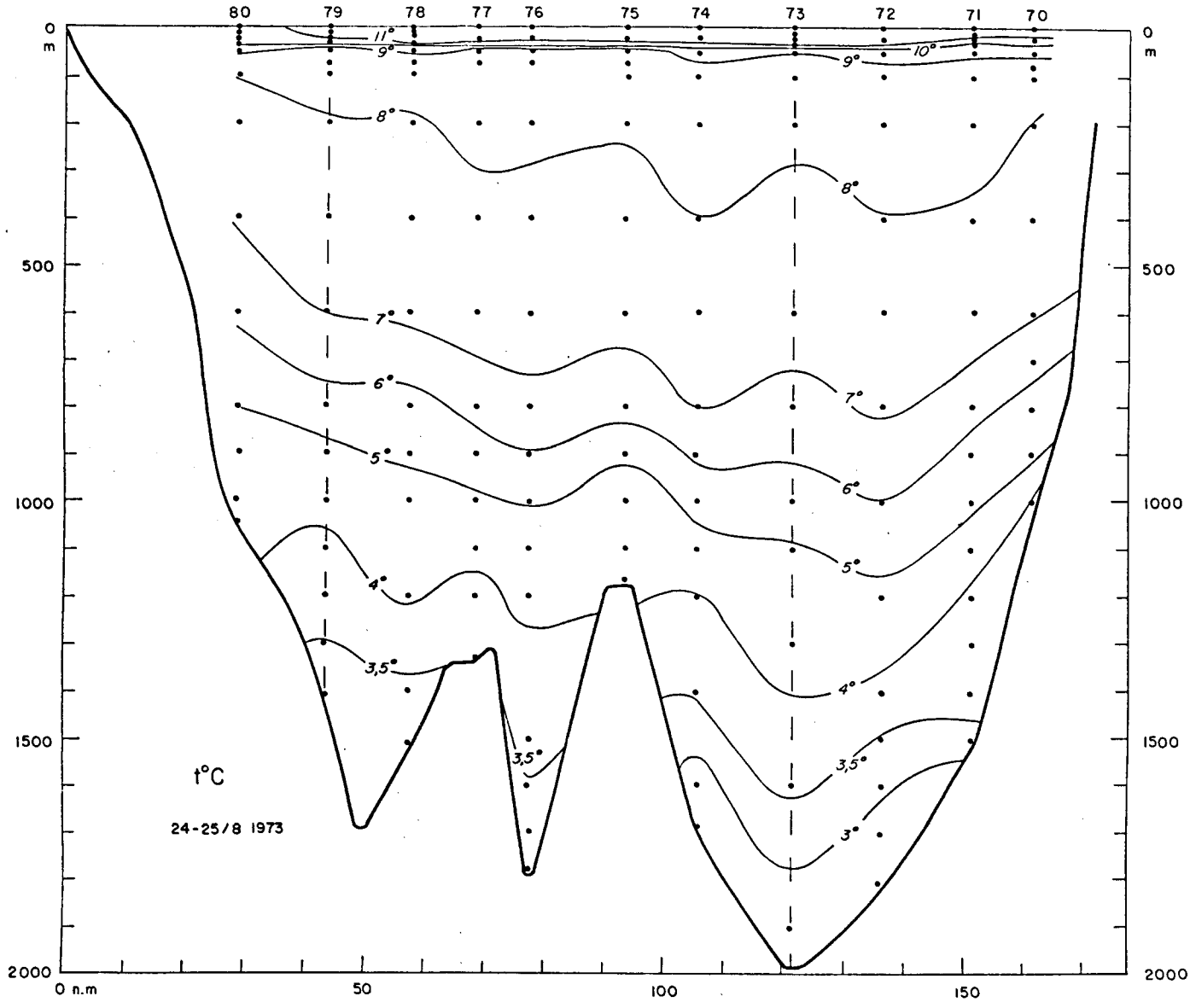

Fig. 6 Temperature profile of a section south of Iceland.
For location see Fig. 1.

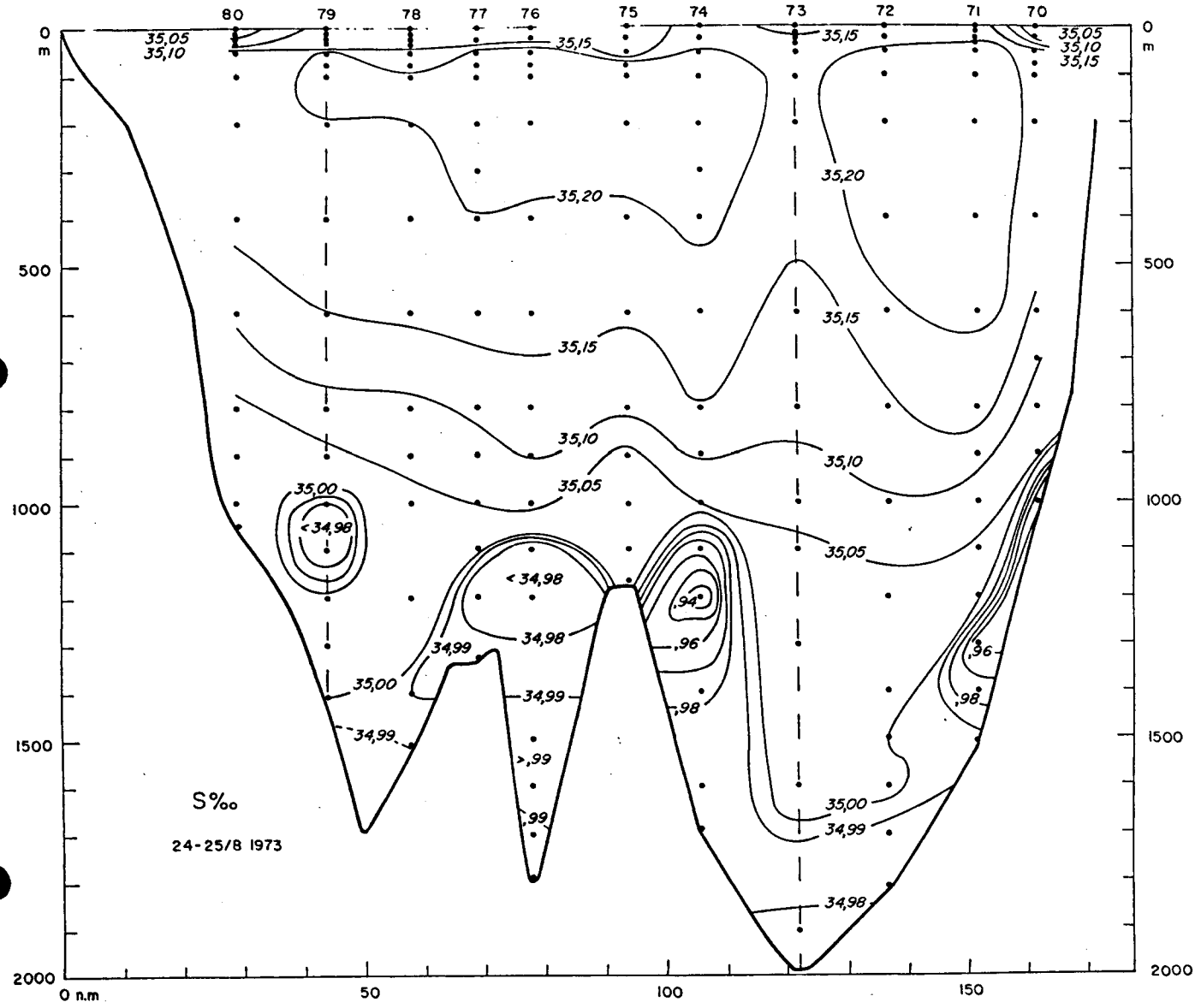

Fig. 7 Salinity profile of a section south of Iceland.
For location see Fig. 1.

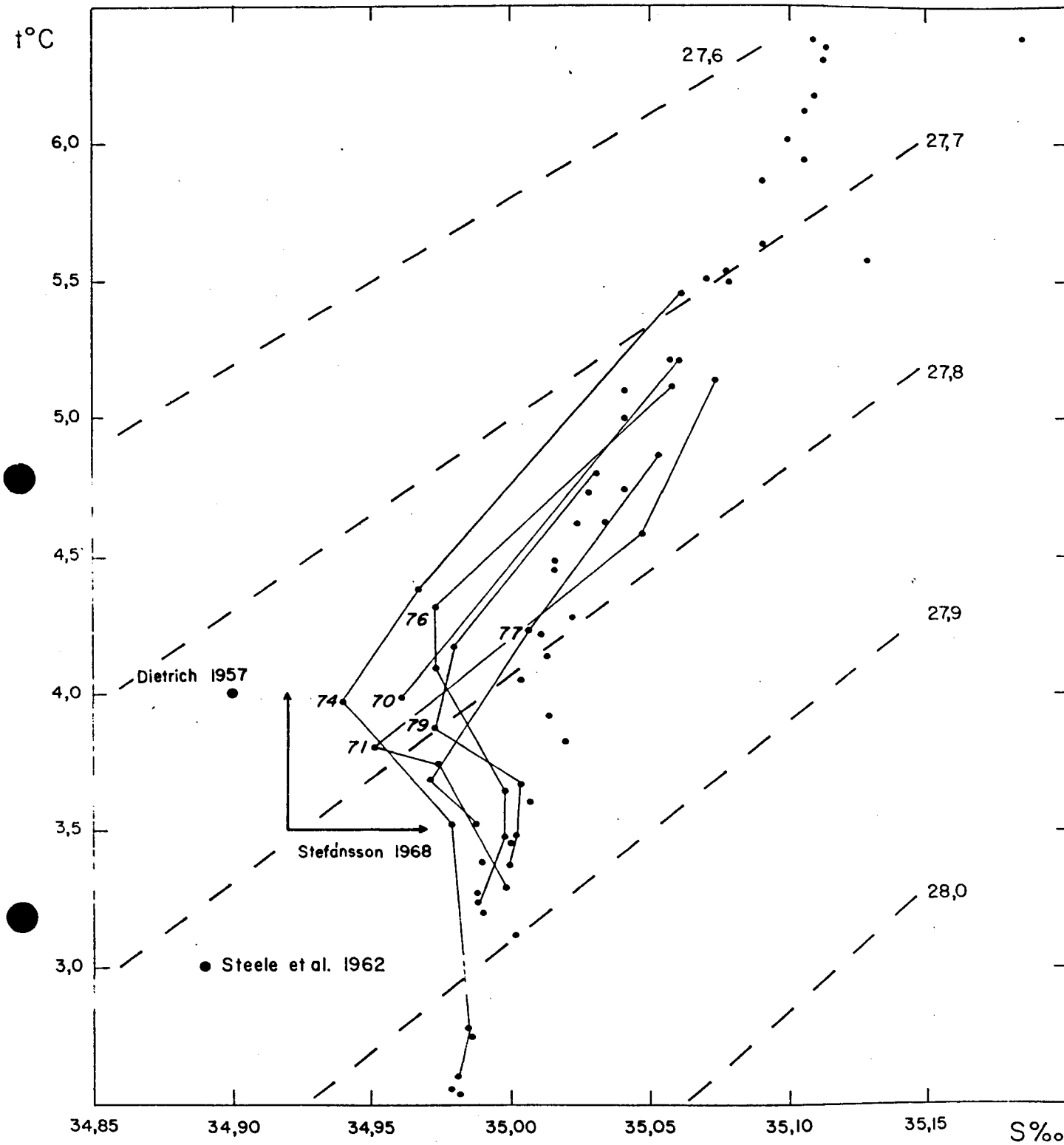

Fig. 8 Temperature- Salinity diagrams for all hydrographic observations shown in Figs. 6 and 7 with temperatures below 6.5° C, and the characteristics of Irminger Sea Water according to Dietrich (1957), Steel et al. (1962) and Stefánsson (1968).