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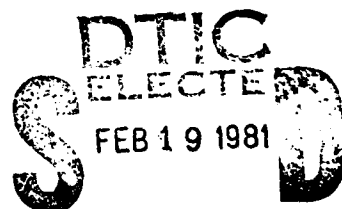
**AN ANALYSIS OF HYDROGRAPHIC DATA
FROM KNORR CRUISE 74 IN HEBBLE
AREA, SEPTEMBER-OCTOBER, 1979**

Technical Report

AD A095176

**Georges L. Weatherly
and**

Edward A. Kelley, Jr.



January 1981

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DEPARTMENT OF OCEANOGRAPHY
FLORIDA STATE UNIVERSITY
TALLAHASSEE, FLORIDA 32306

TECHNICAL REPORT

AN ANALYSIS OF HYDROGRAPHIC DATA FROM KNORR CRUISE 74 IN
HEBBLE AREA, SEPTEMBER - OCTOBER 1979

by

Georges L. Weatherly

and

Edward A. Kelley Jr.

PREPARED FOR THE OFFICE OF NAVAL RESEARCH UNDER

CONTRACT NUMBER N00014-75-C-0201

JANUARY 1981

ABSTRACT

We present in figure form some of the hydrographic data collected on the Scotian Rise in September - October, 1979 as part of the HEBBLE program (Hollister et al, 1980). Five full water column θ and S cross slope transects are presented together with one σ_t transect for comparison. Selected surface to bottom computed geostrophic velocity profiles are also presented.

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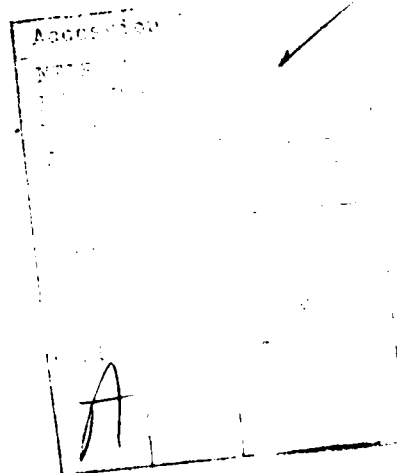


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DATA COLLECTION AND REDUCTION

The hydrographic data presented here were collected as part of the HEBBLE program (cf. Hollister *et al*, 1980) between 9 September 1979 and 1 October 1979 from the R/V KNORR (KNORR 74 cruise) by the Optical Oceanography Group at Oregon State University (OSU) using a Neil Brown Instrument System CTD provided by the Scripps Institute of Oceanography. Full water column continuous profiles of temperature and salinity were made at the 44 stations indicated in Fig. 1. The data were processed by the Optical Oceanography Group at OSU and made available to us by H. Pak in the computer form shown in Table 1. The printout conductivity data were offset at OSU to agree with the so-called Worthington-Metcalf line for the North Atlantic; we refer the interested reader to H. Pak or D. Menzies at OSU for further details.

Attached to the CTD was a transmissometer developed by the Optical Oceanography Group at OSU and transmissivity values obtained from this instrument were also listed in the data made available to us (cf. Table 1). We do not consider the transmissivity data in this report.

ANALYSIS AND DISCUSSION

Our basic objectives in examining the KNORR 74 hydrographic data were to provide input information for numerically modeling the bottom boundary layer in the Scotian Rise area and to assemble a set of bottom mixed layer observations for comparison to our numerical model (e.g. Weatherly and Martin, 1978) predictions. This is a report of this study.

A study of another benthic boundary layer over a continental margin (Weatherly and Martin, 1978) showed the necessity of knowing the background

hydrographic field above the boundary layer in a plane normal to the geostrophic flow. Previous studies in the Scotian Rise area indicate that the deep geostrophic currents there are aligned along isobaths. Hence transverse to deep geostrophic current hydrographic transects in the Scotian Rise area are approximately cross-isobath sections. Thus we decided to examine hydrographic transects normal to isobaths. To obtain more synoptic information we restricted ourselves to sections which were completed in several days time. We examined five transects (elapsed time in parentheses): (1) Stations 2-8 (3 days, 2 hours); (2) Stations 9, 10, 12, 13 (2 days, 14 hours); (3) Stations 18-23 (2 days, 15 hours); (4) Stations 30-34 (1 day, 21 hours); and (5) Stations 36-41 (2 days, 3 hours). Potential temperature and salinity were contoured for each transect (See Figures 2-11). The gross structures of the potential temperature and salinity are similar in the lowest several thousand meters for each transect. Sigma-4 data was also contoured for Stations 2-8 (Figure 12). Qualitatively the density data structure is similar to that of the potential temperatures (cf. Figures 2 and 12). Only data from down casts were used in these and subsequent analyses.

Profiles of potential temperature in the lowest 350 meters are shown for each station (Figures 13-25). The bottom potential temperature and depth are indicated under each plot. The potential temperature was plotted to the nearest meter for each data point. Due to wider ranges in potential temperature, the three shallowest stations required a more reduced temperature scale than the deeper stations. Generally the bottom mixed layer (BML) thickness ranges from about 10 meters to several ten's of meters. A notable exception is Station 42; the BML thickness there is 430 meters. The form of the profiles varies considerably.

Often, but with exceptions, the BML's near the base of the rise

(depth about 4900 m) are capped by larger temperature jumps (e.g. Station 19) than those further upslope (e.g. Station 18) and downslope (Station 22). Some of the layers capped by larger temperature jumps have a layered structure (Station 37).

Because of the generally larger temperature jumps capping the BML's near the base of the Scotian Rise, potential temperature transects were redone to give finer resolution near the base of the rise. The transect for Stations 2-8 was modified by eliminating Stations 2 and 3 (outside area of interest) and including Station 9 in order to obtain a station further into the Sohm Abyssal Plain. The transect of Stations 9, 10, 12, and 13 was extended to include Station 16 in order to have a shallower station taken in a comparable time frame (elapsed time: 3 days, 15 hours). The transect for Stations 42-46 (elapsed time: 2 days, 4 hours) was added to obtain a repeated section. The region of interest is near bottom and only isotherms 1.85°C and colder are presented. The contouring interval chosen was .005°C. The data are from discrete rather than yoyo'ing casts and the thickness of BML between stations is unknown. The contours intersecting the bottom between stations are dashed to emphasize this fact.

In all the transects a distinct body of cold water is found above the bottom near the base of the rise. In five of the transects this feature is centered about the 4850 m to 5000 m isobaths; in the remaining transect, Figure 27, it is centered further up the rise near the 4500 m isobath. The width and thickness of this feature is about 100 km and 50-100 m. Comparison of Figures 13-25 with Figures 26-31 show that, in all casts made in the core of this distinct body of cold water at the base of the rise, the BML is capped by a large temperature jump.

The Stations 18-23 section, Figure 28, extends furthest out onto the

Sohm Abyssal Plain. In this section another distinct body of cold water extending onto the abyssal plain is seen. Such a feature is often seen in other hydrographic sections extending onto the abyssal plain in this area (eg. McCarney et al, 1980, Fig. 3).

Using the dynamic height calculations provided by OSU (eg. Table 1), full water column geostrophic velocity profiles were calculated for selected stations. These are shown in Fig. 32. The level of no motion was selected arbitrarily as 1200 m.

ACKNOWLEDGEMENTS

The work of the Optical Oceanography Group at Oregon State University in deploying the CTD and processing its data is gratefully acknowledged, together with the efforts of all other HEBBLER'S aboard the 74th cruise of the R/V KNORR.

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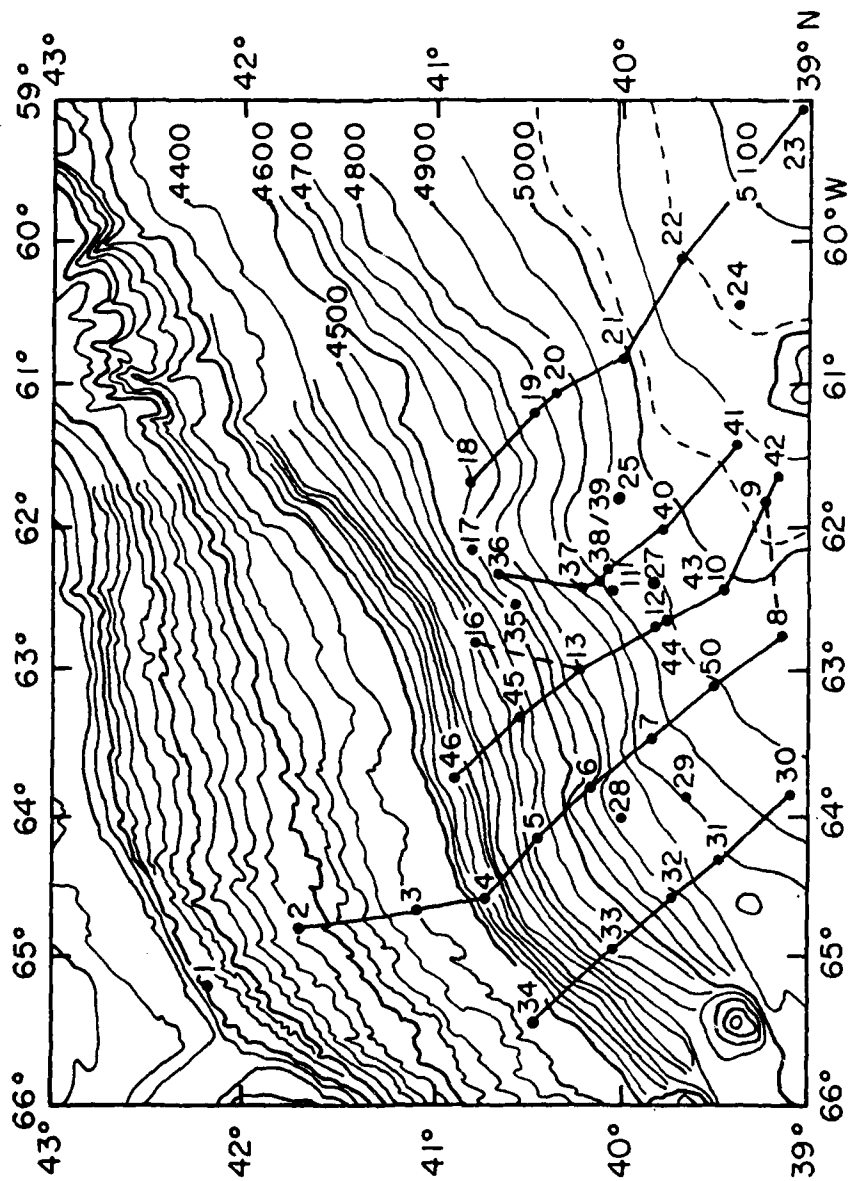


FIGURE 1

SATURDAY FEBRUARY 23, 1980

KNORR 74 CTD 00.0 00/02/79 2090 Z DOWN CAST

TIME	DEPTH	TEMP	THETA	COND	SALIN	SIGMAT	SIGMA	STRANS	PTRANS	C	DYN HT	PRESS
2210:24	7.1	14.603	14.602	39.661	32.380	24.039	40.991	50.83	50.80	0.677	0.03	7.2
2210:50	7.3	14.639	14.638	39.702	32.388	24.038	40.987	50.98	50.95	0.674	0.03	7.4
2211:16	12.3	14.417	14.415	39.493	32.381	24.079	41.044	50.86	50.83	0.677	0.05	12.5
2211:42	20.2	14.035	14.032	39.168	32.400	24.172	41.166	51.92	51.89	0.656	0.08	20.6
2212:08	28.7	13.562	13.558	38.771	32.428	24.291	41.318	52.49	52.46	0.645	0.11	29.2
2212:35	36.3	13.485	13.480	38.702	32.426	24.301	41.339	52.34	52.31	0.648	0.14	37.0
2213:01	43.7	13.459	13.453	38.690	32.434	24.315	41.352	52.74	52.71	0.640	0.16	44.5
2213:27	52.9	13.152	13.145	38.448	32.465	24.401	41.460	52.46	52.44	0.645	0.20	53.9
2213:53	60.1	13.074	13.066	38.367	32.453	24.406	41.471	51.70	51.68	0.660	0.22	61.2
2214:19	68.3	12.955	12.946	38.269	32.458	24.434	41.509	51.03	51.01	0.673	0.25	69.6
2214:45	70.8	12.931	12.922	38.250	32.459	24.440	41.516	50.68	50.66	0.680	0.26	72.1
2215:11	77.2	12.886	12.876	38.217	32.464	24.452	41.532	47.22	47.20	0.751	0.28	78.6
* 2215:37	78.2	12.880	12.869	38.213	32.465	24.455	41.535	25.07	25.07	1.383	0.29	79.7

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TABLE 1

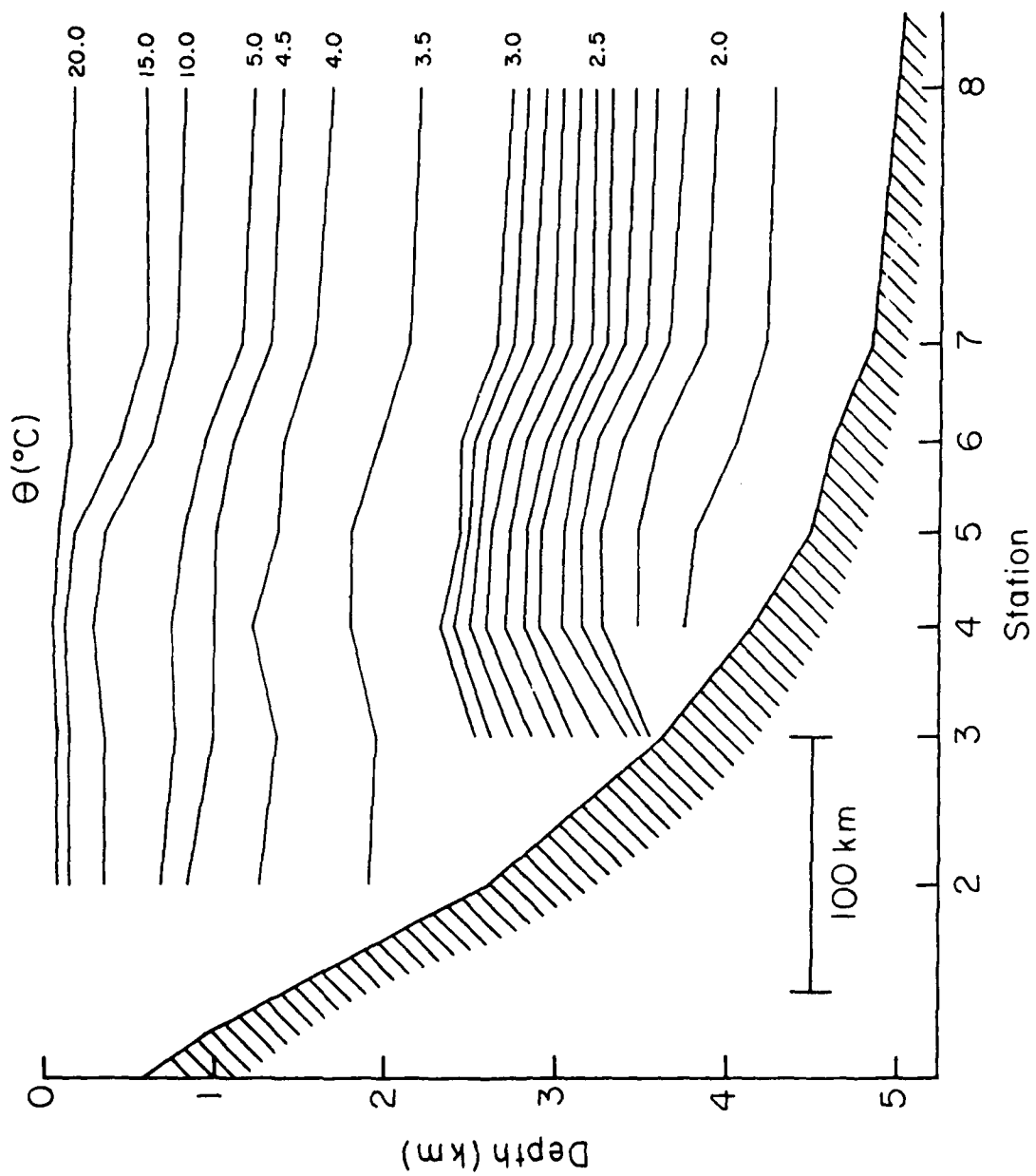


FIGURE 2

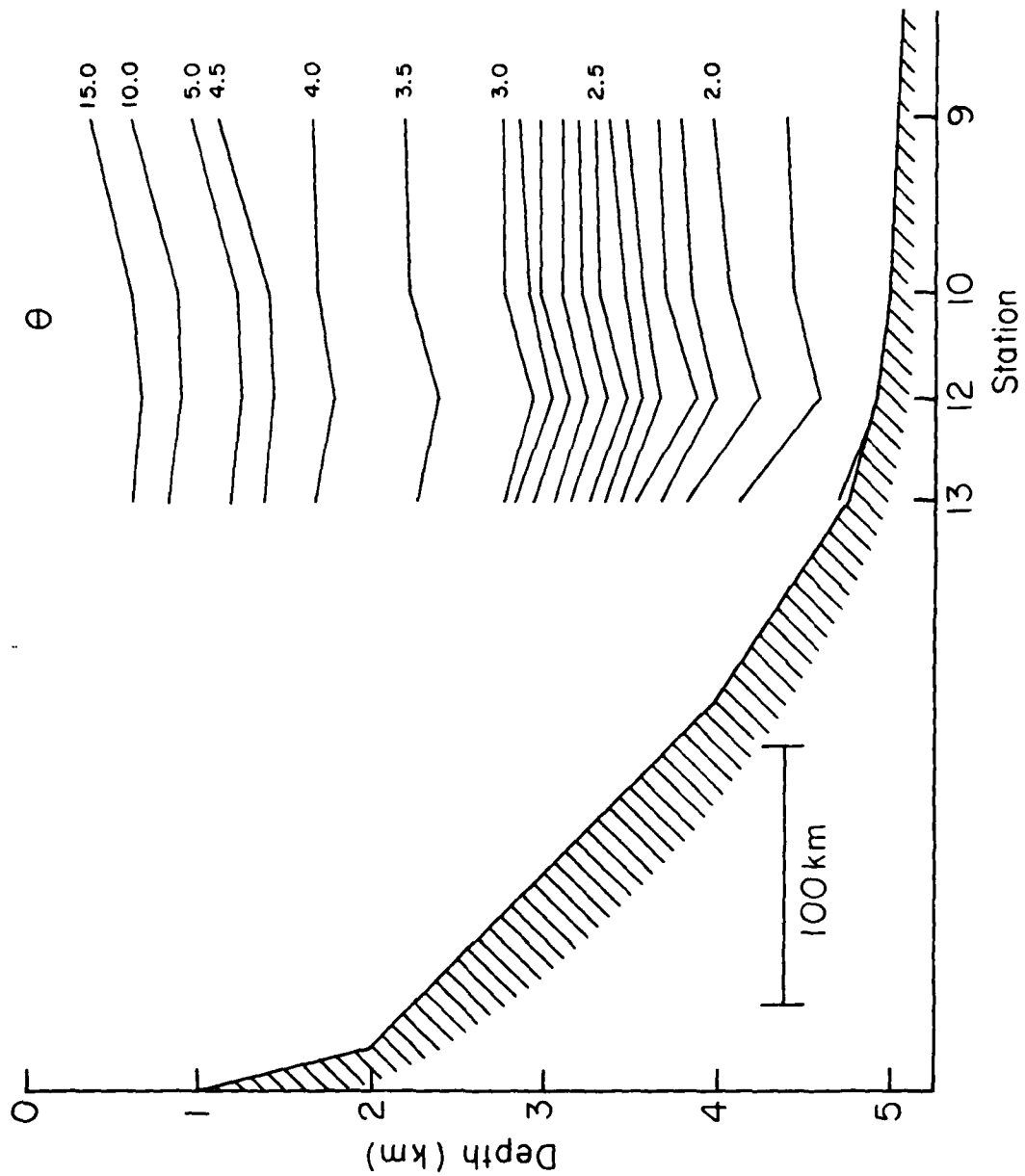


FIGURE 3

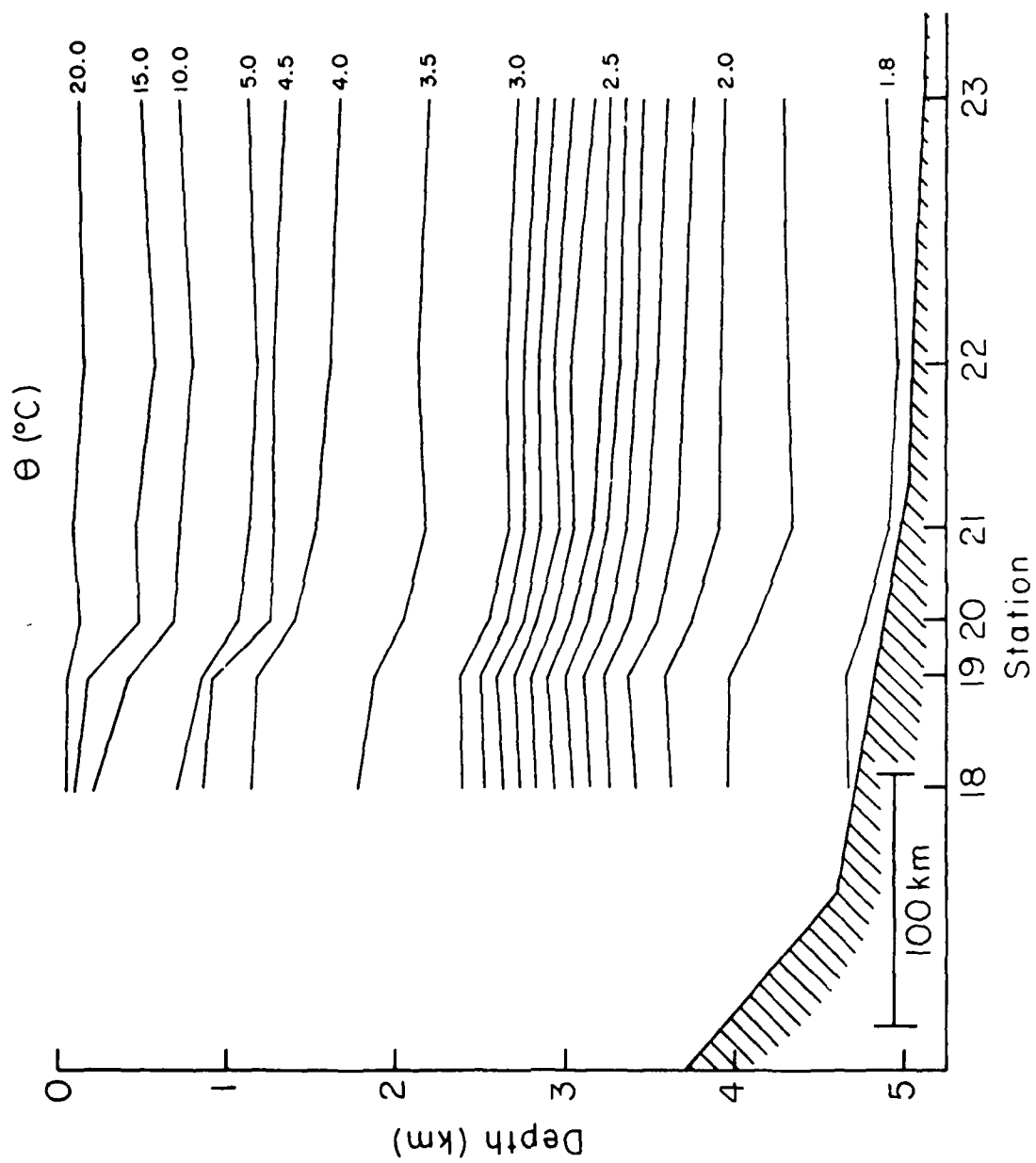


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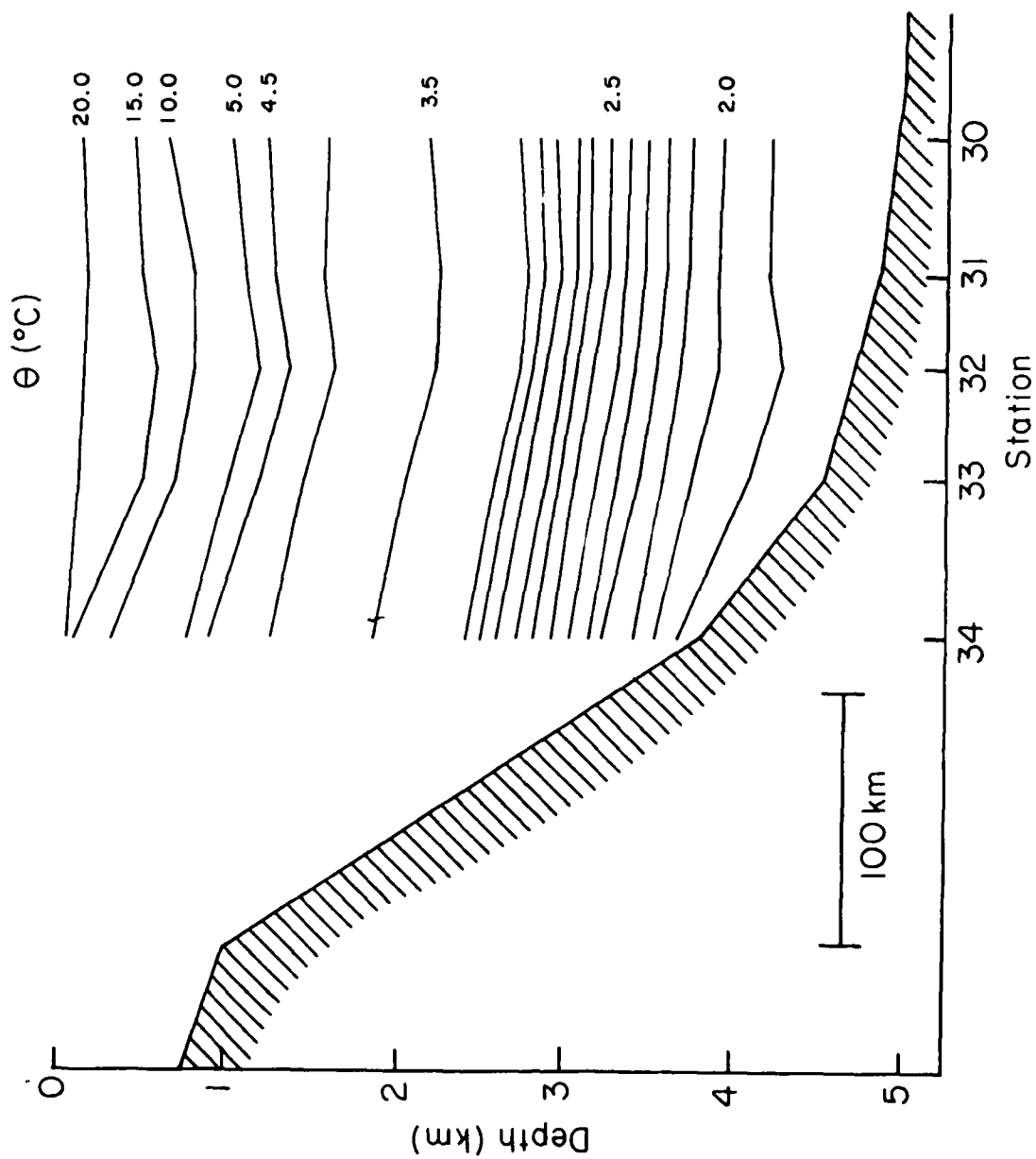


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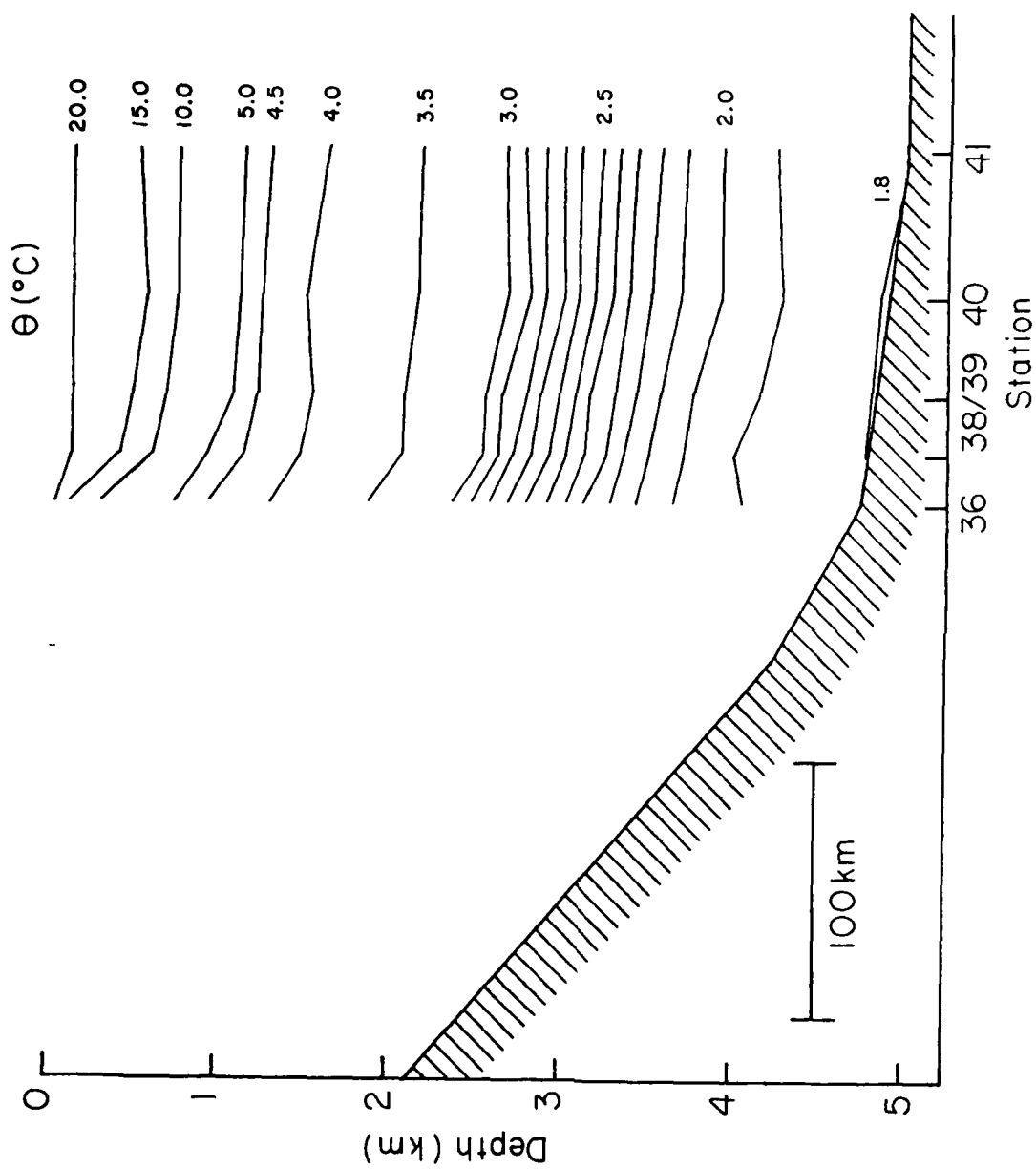


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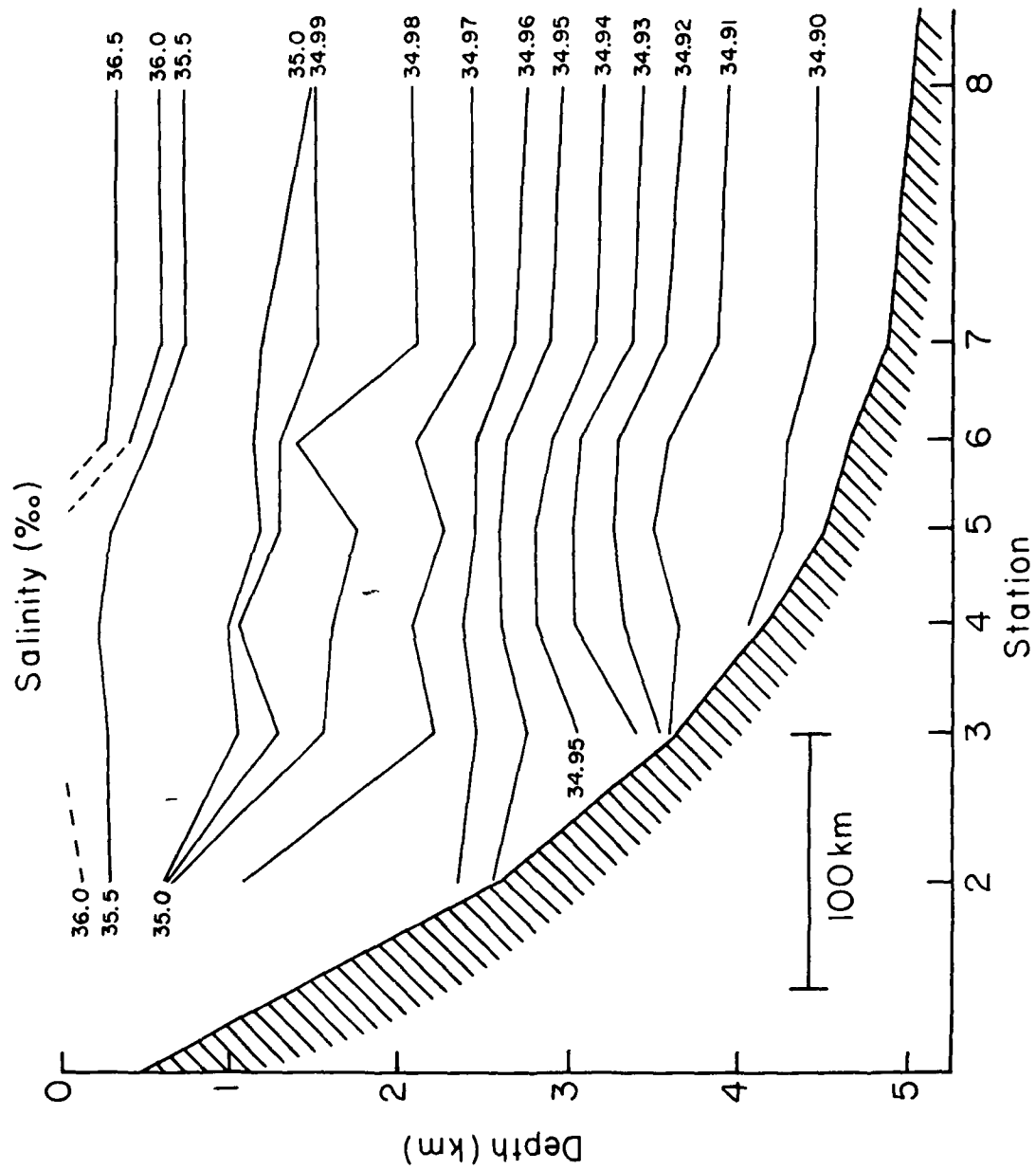


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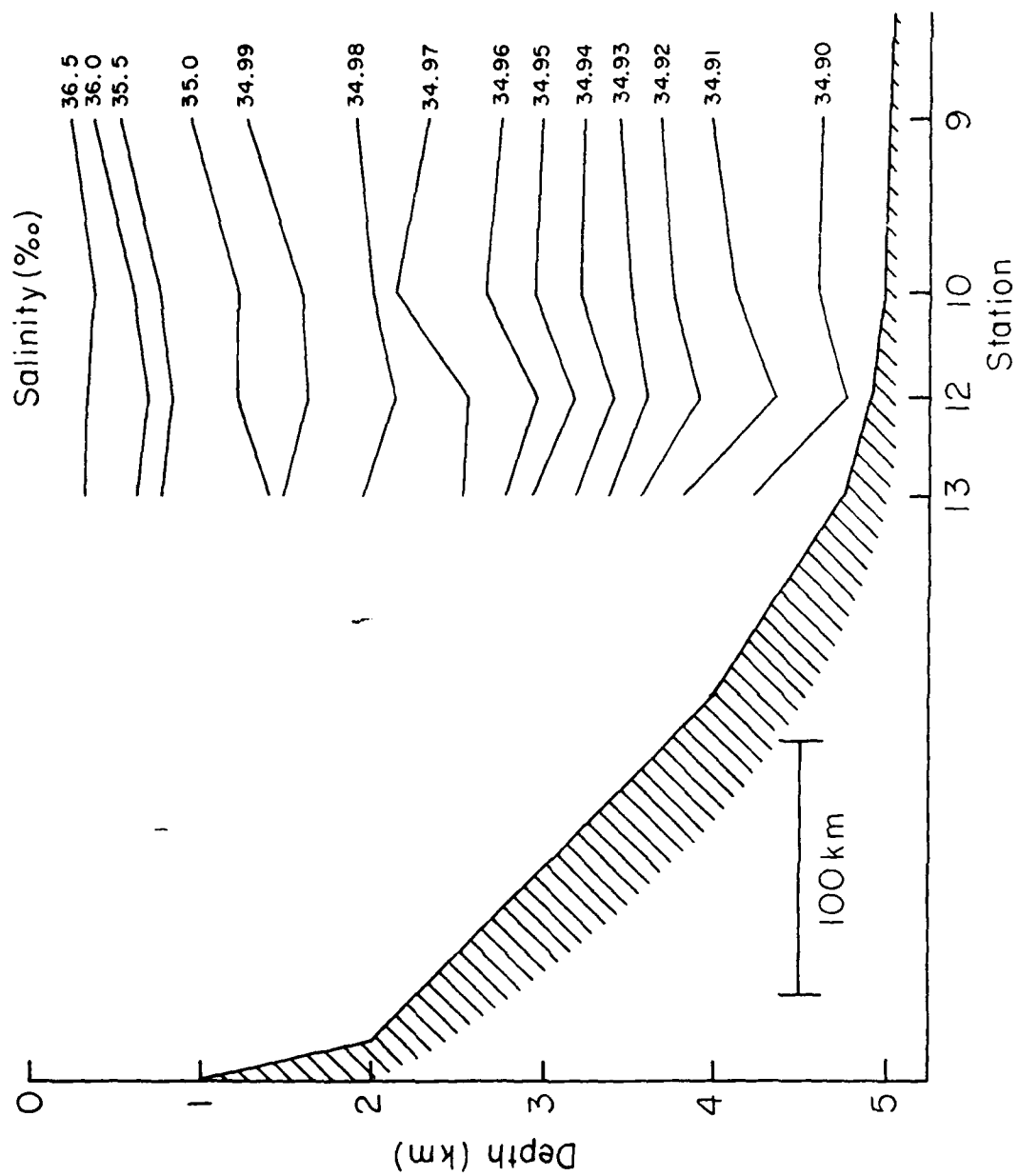


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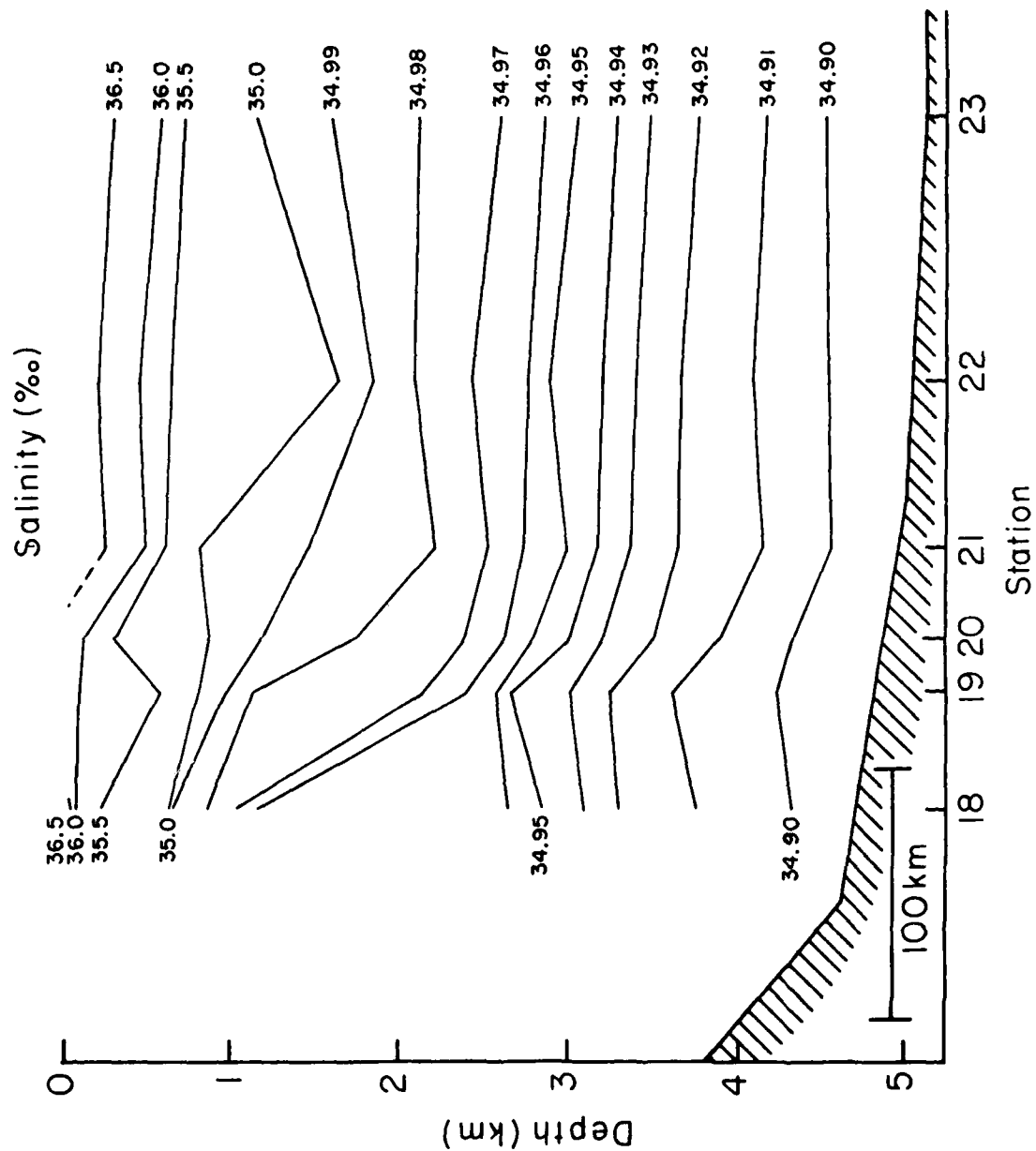


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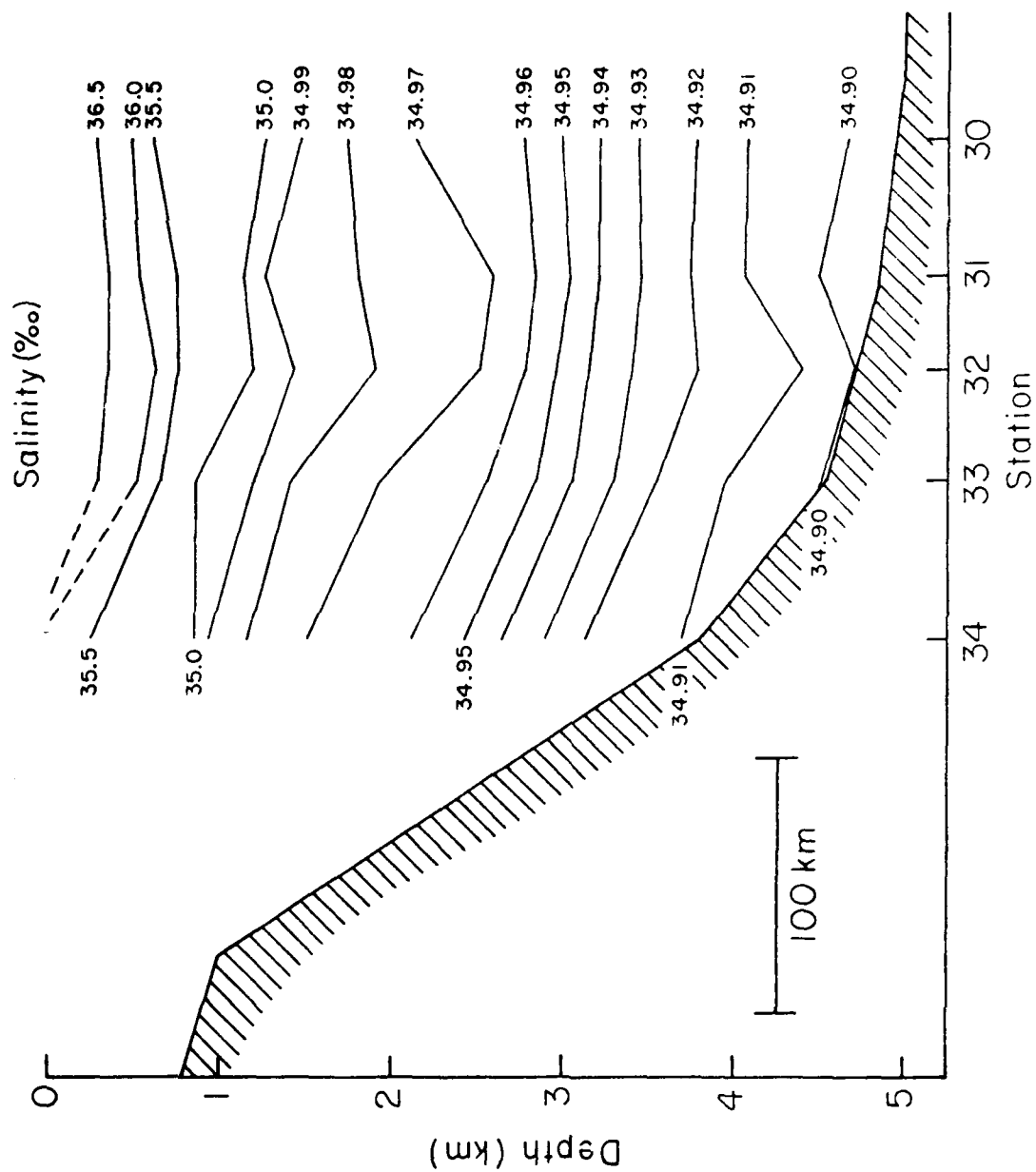


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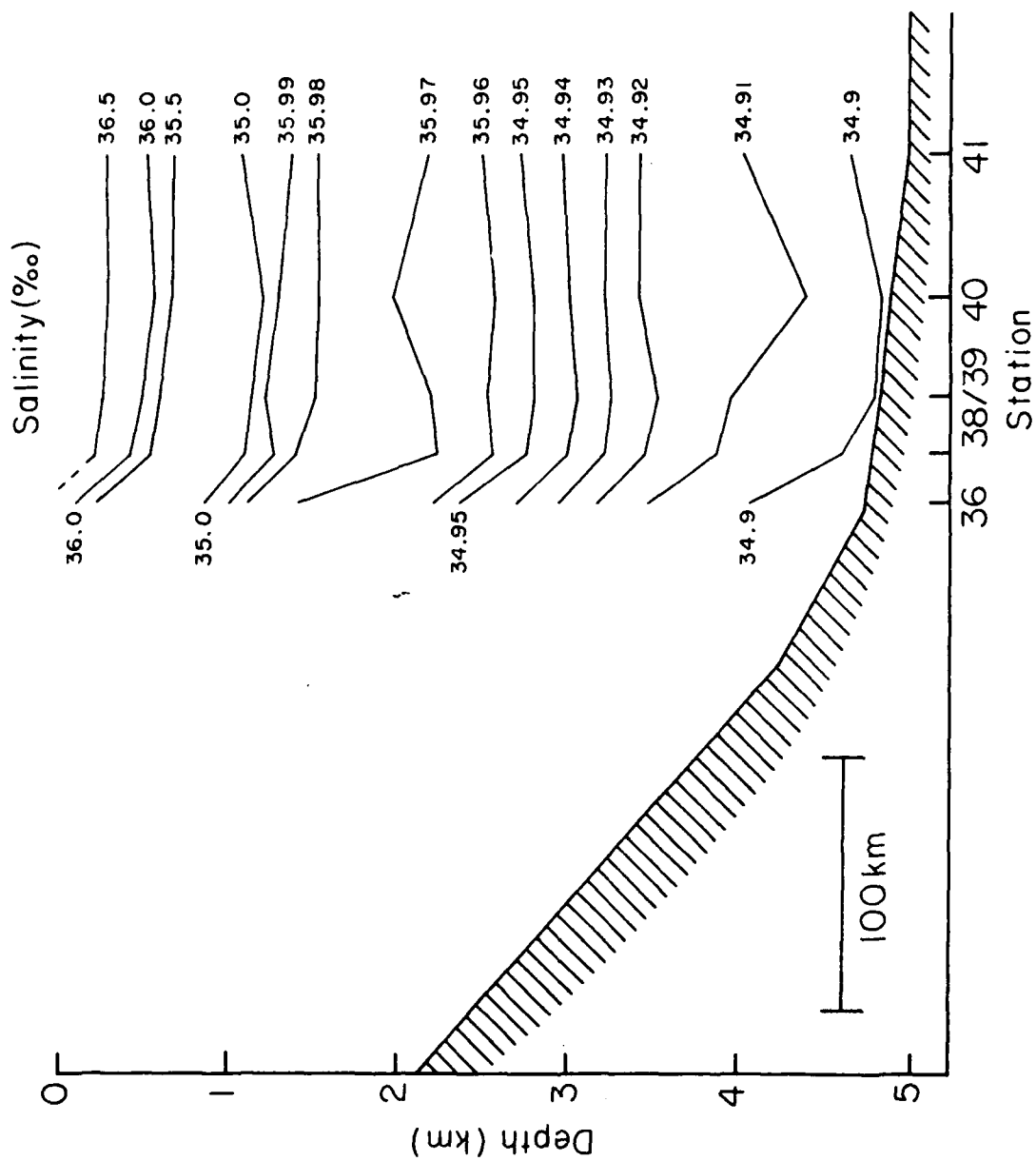


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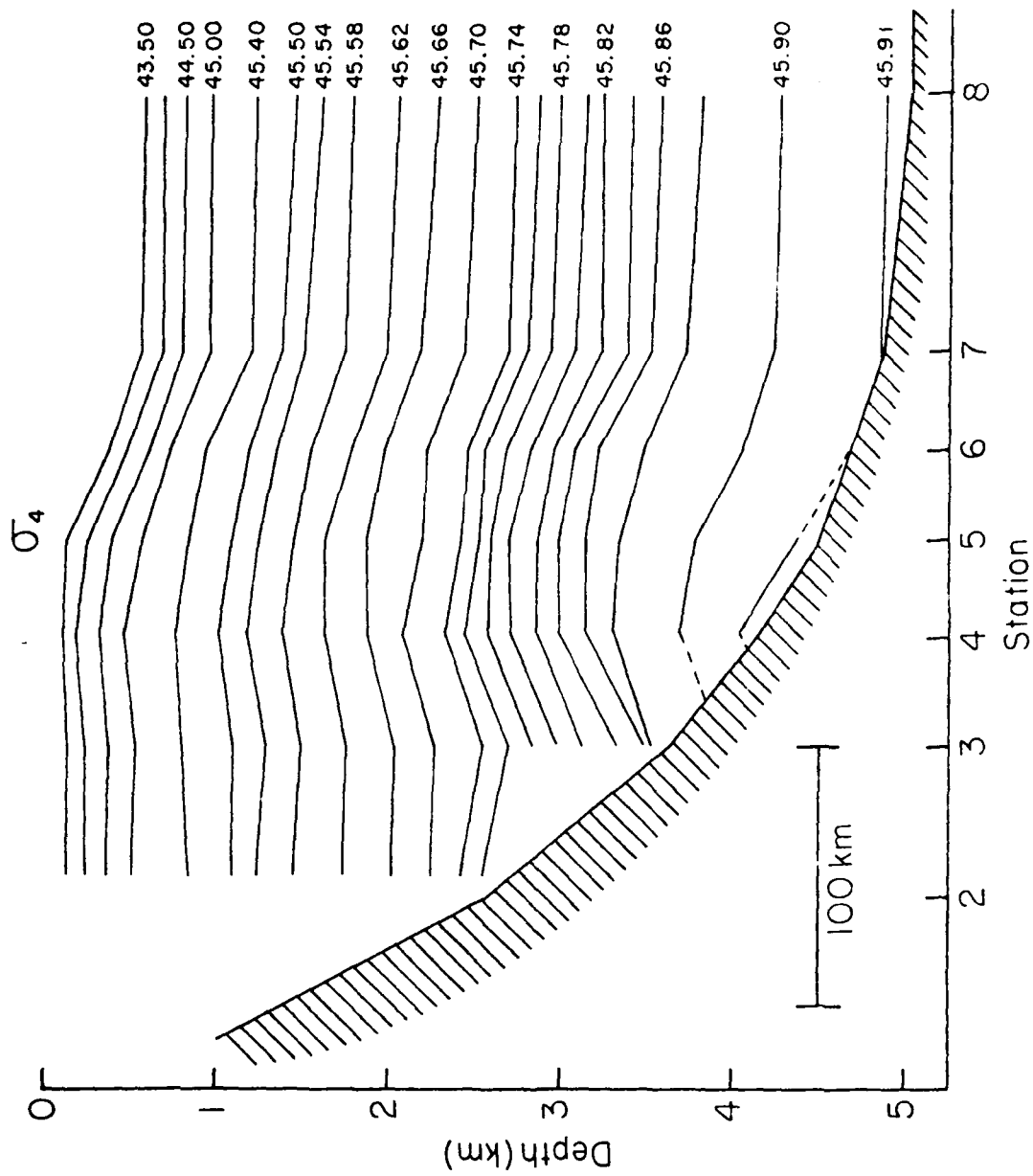


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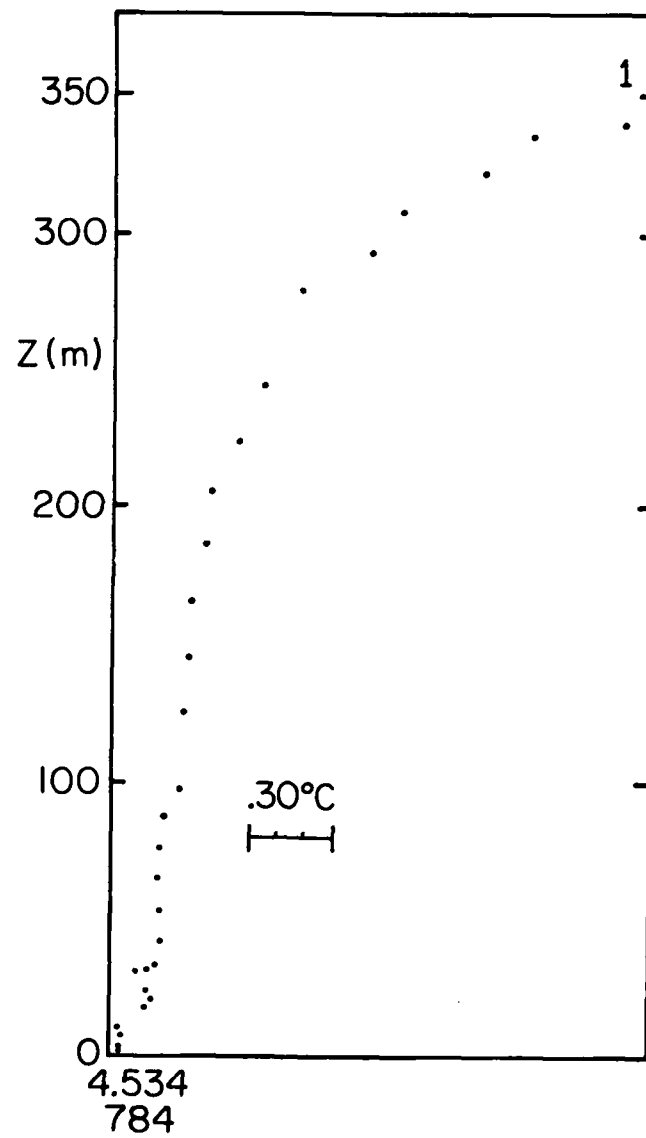


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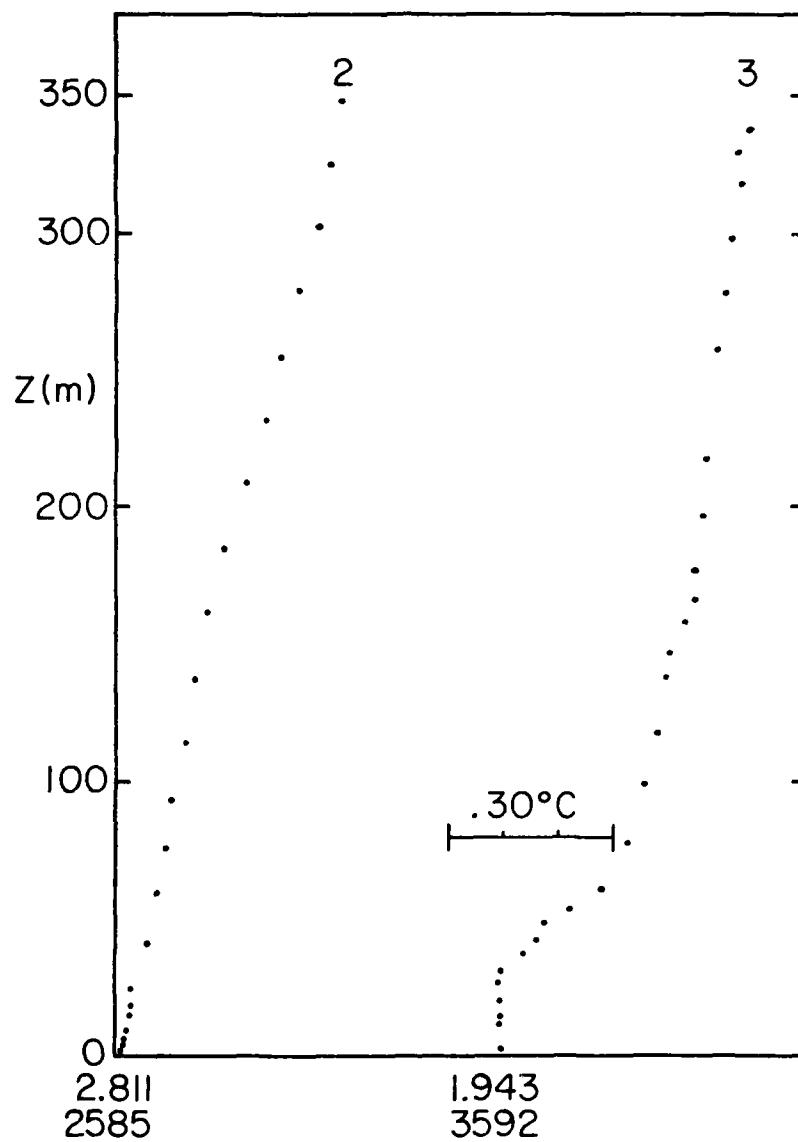


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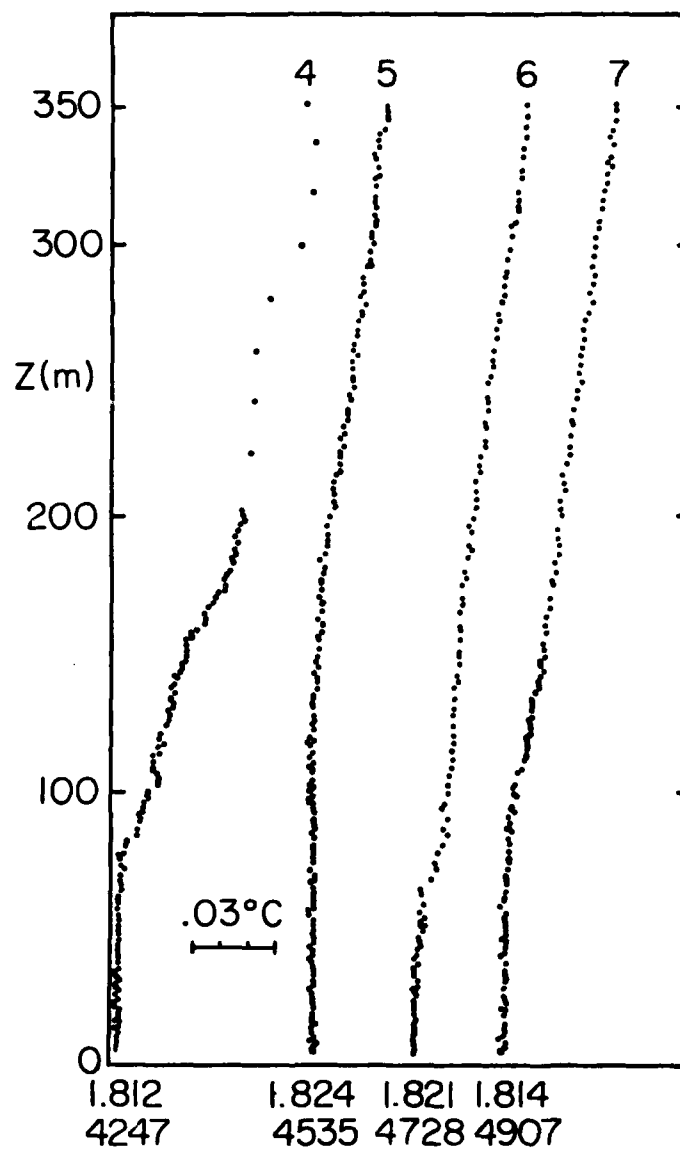


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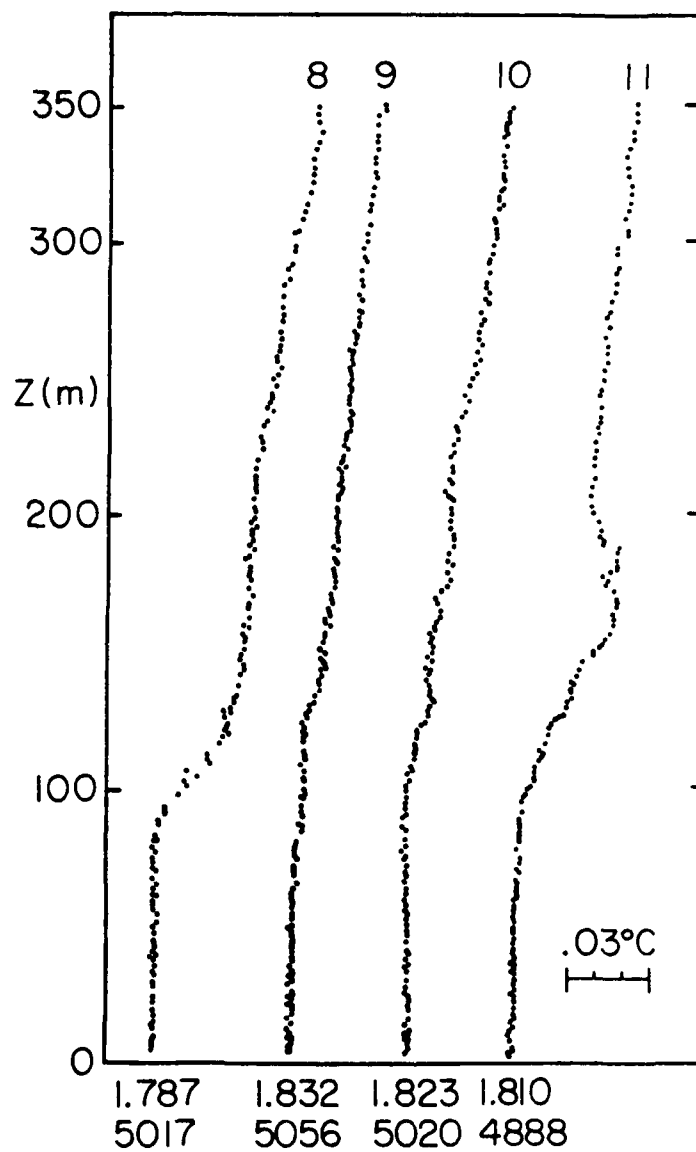


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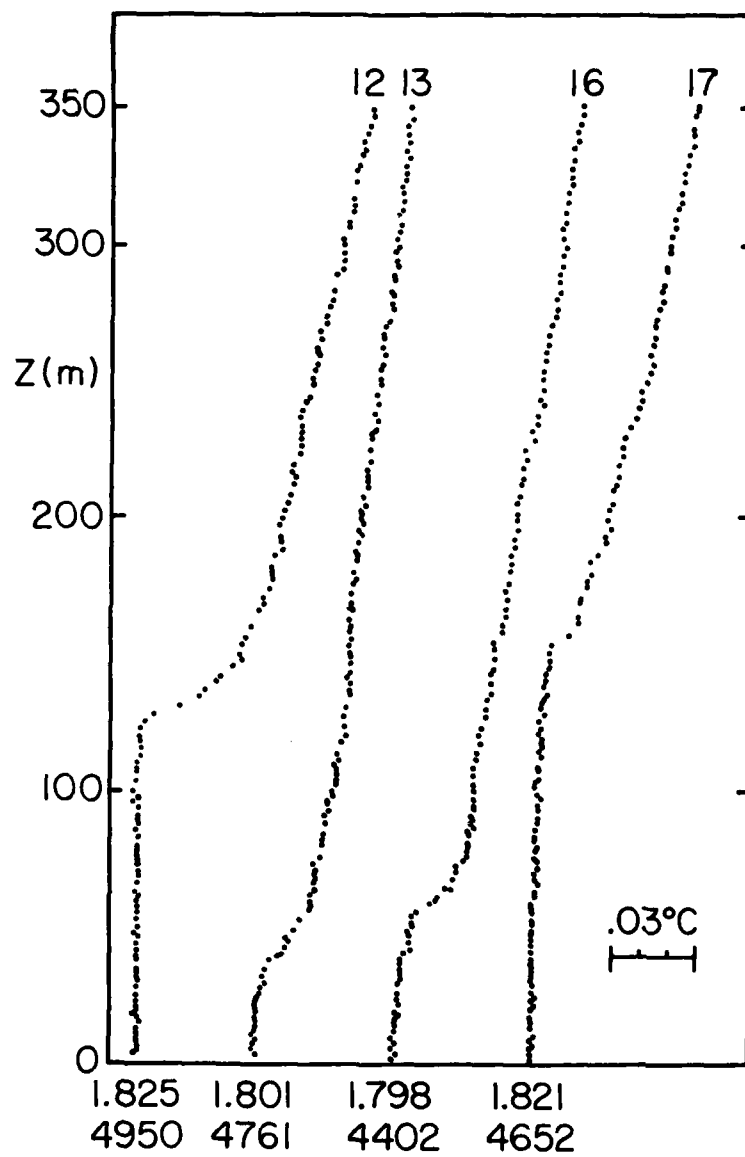


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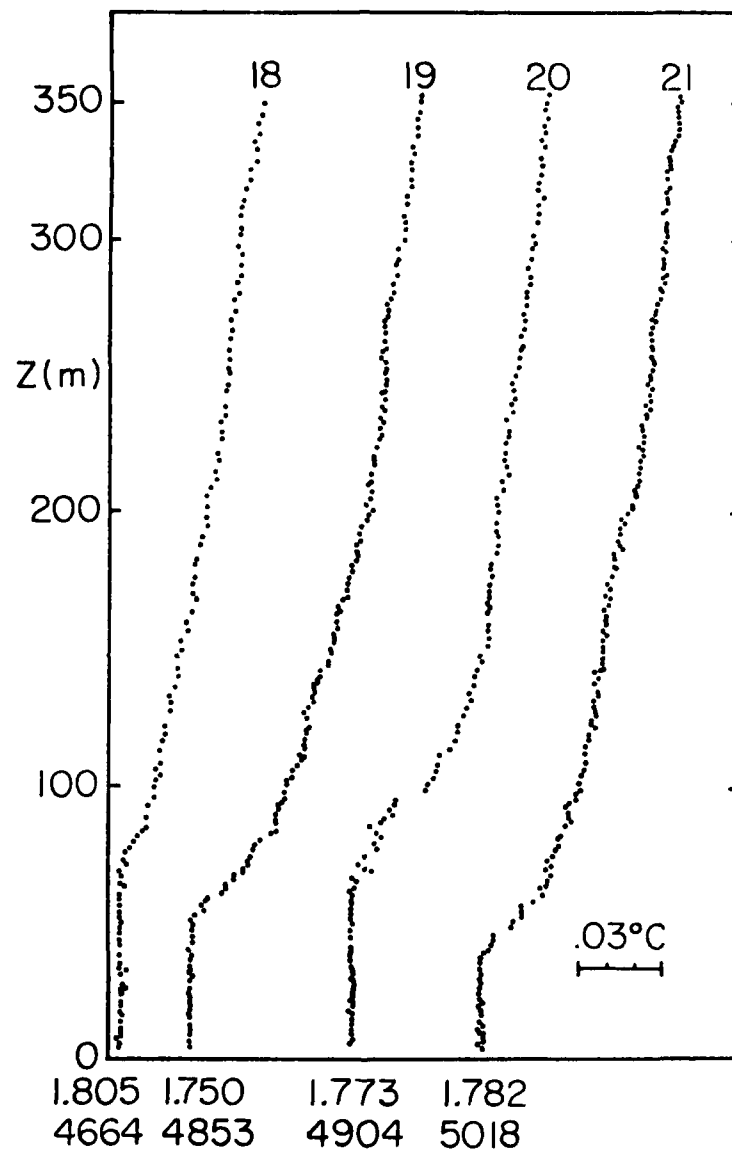


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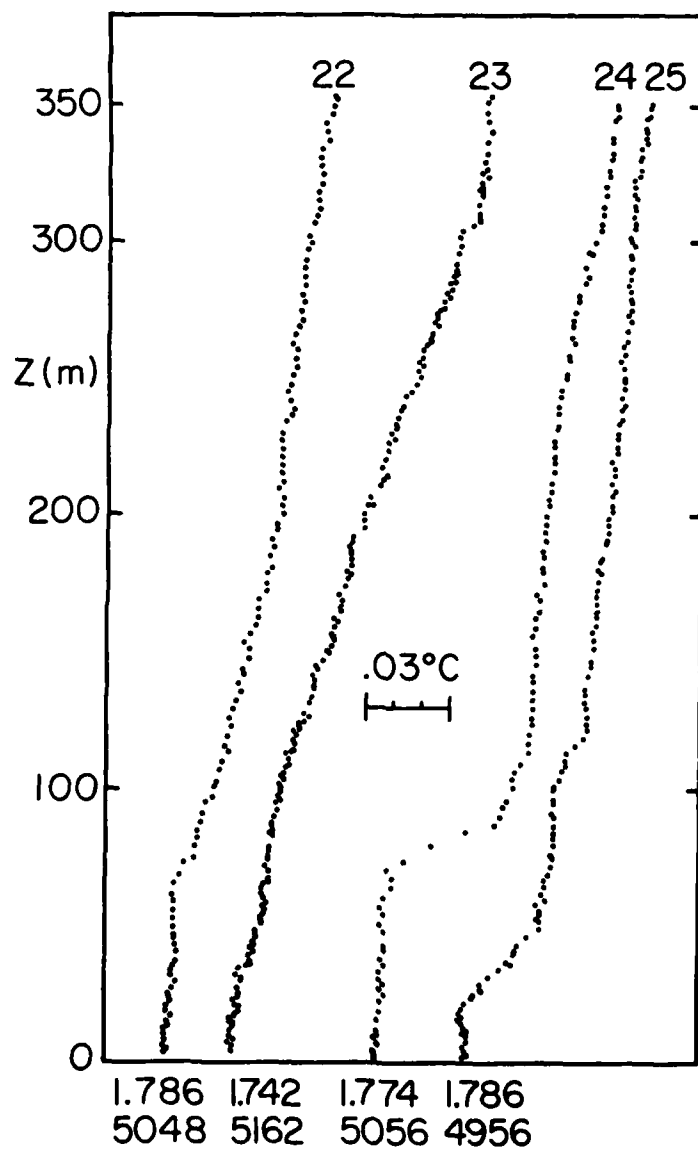


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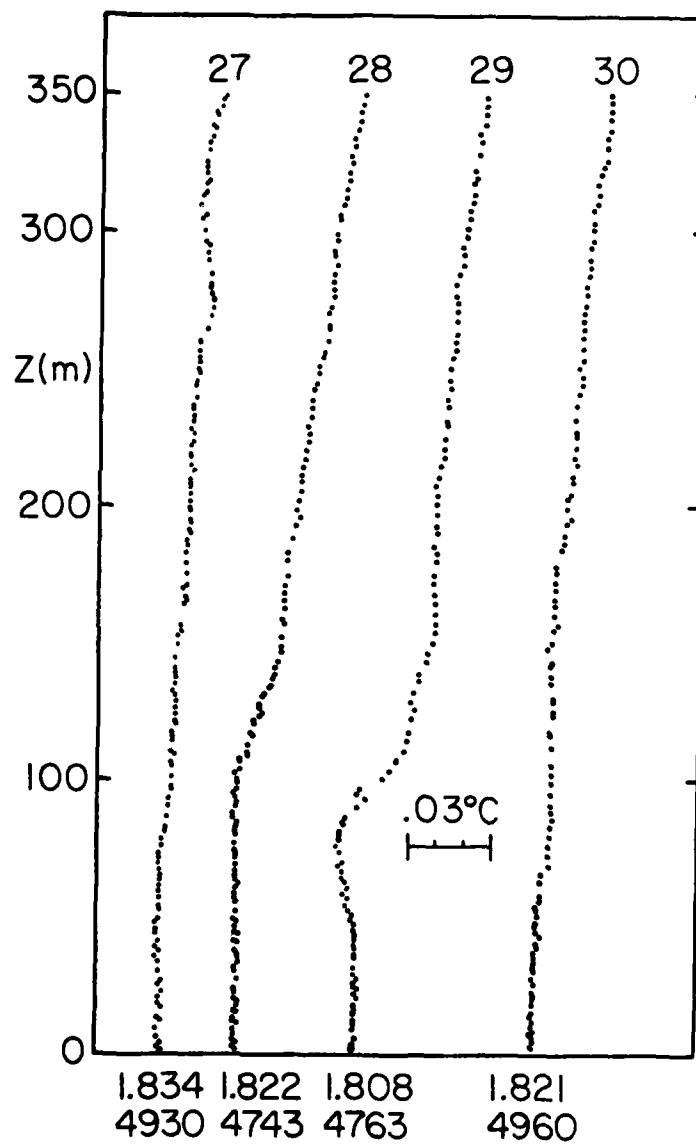


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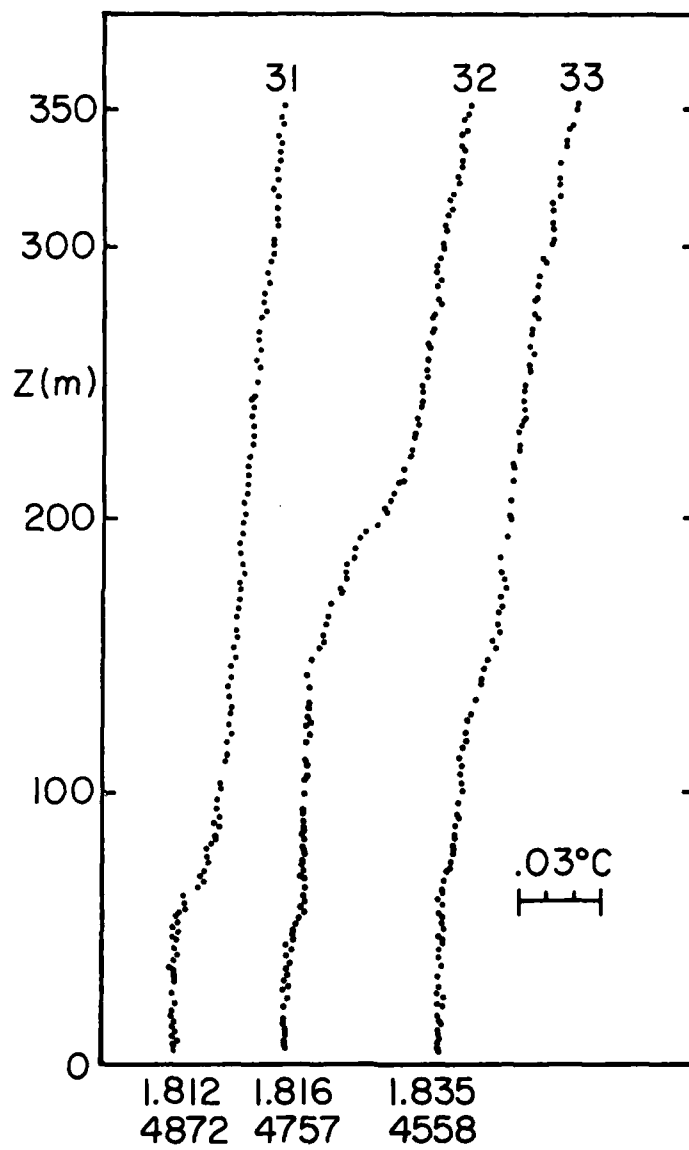


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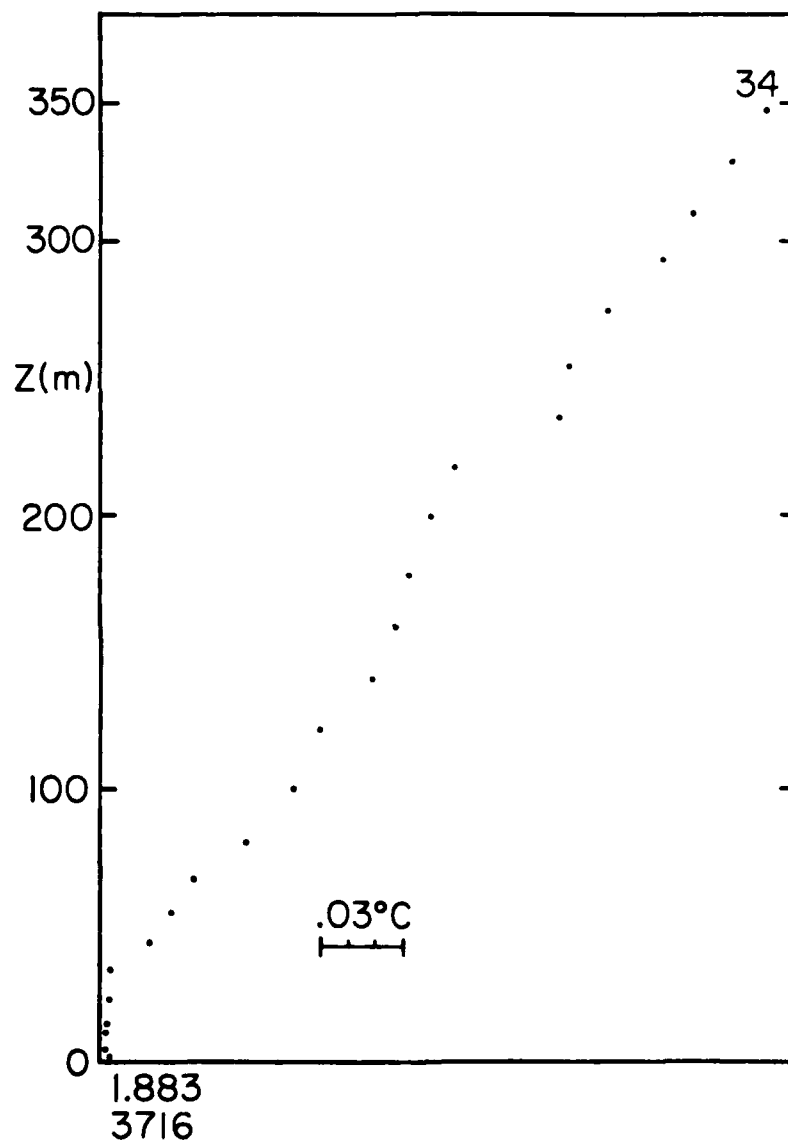


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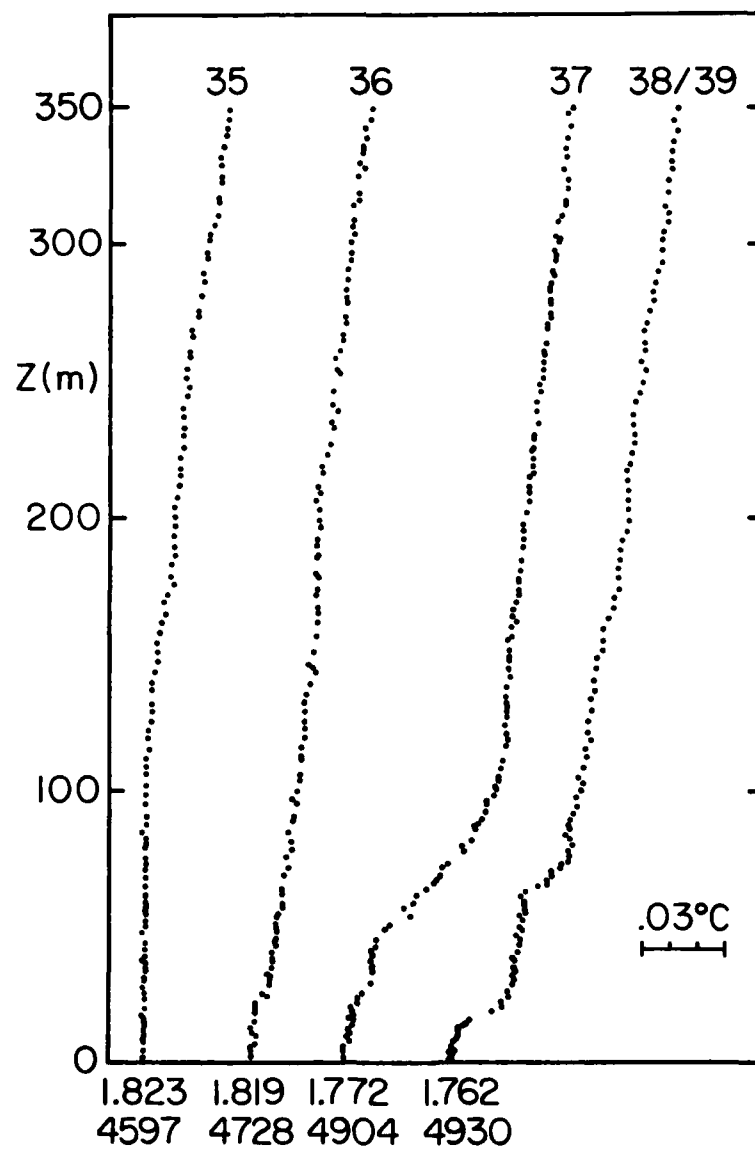


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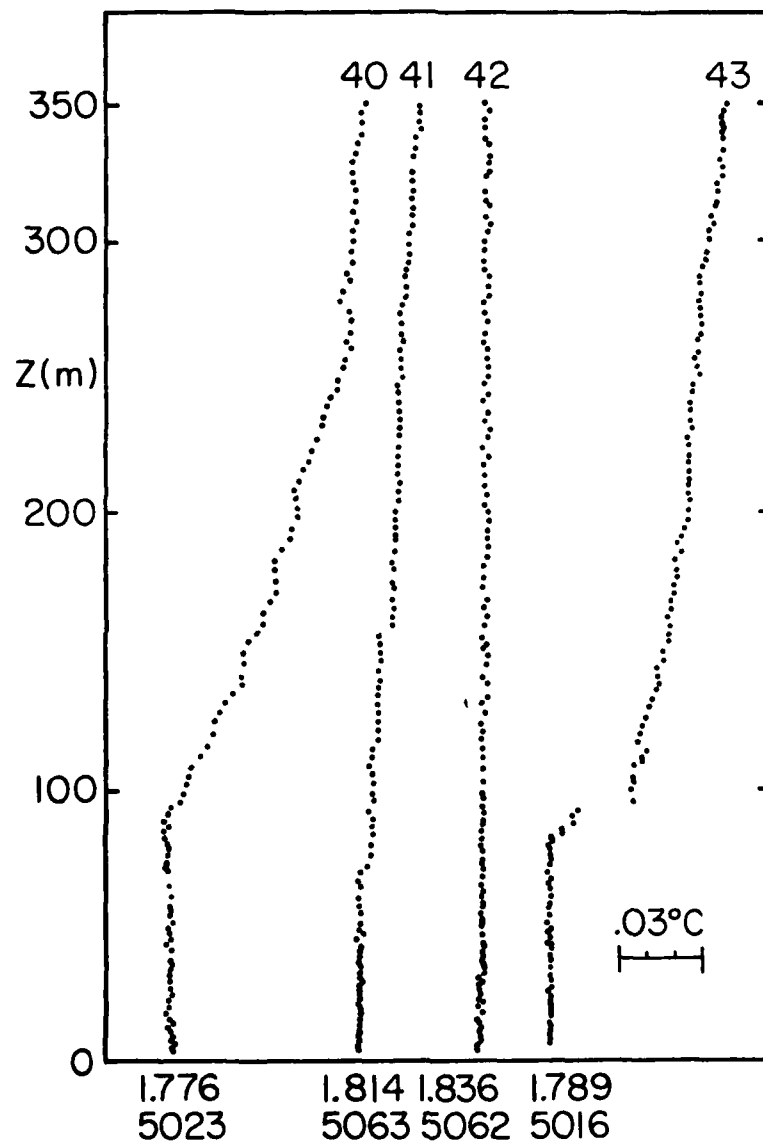


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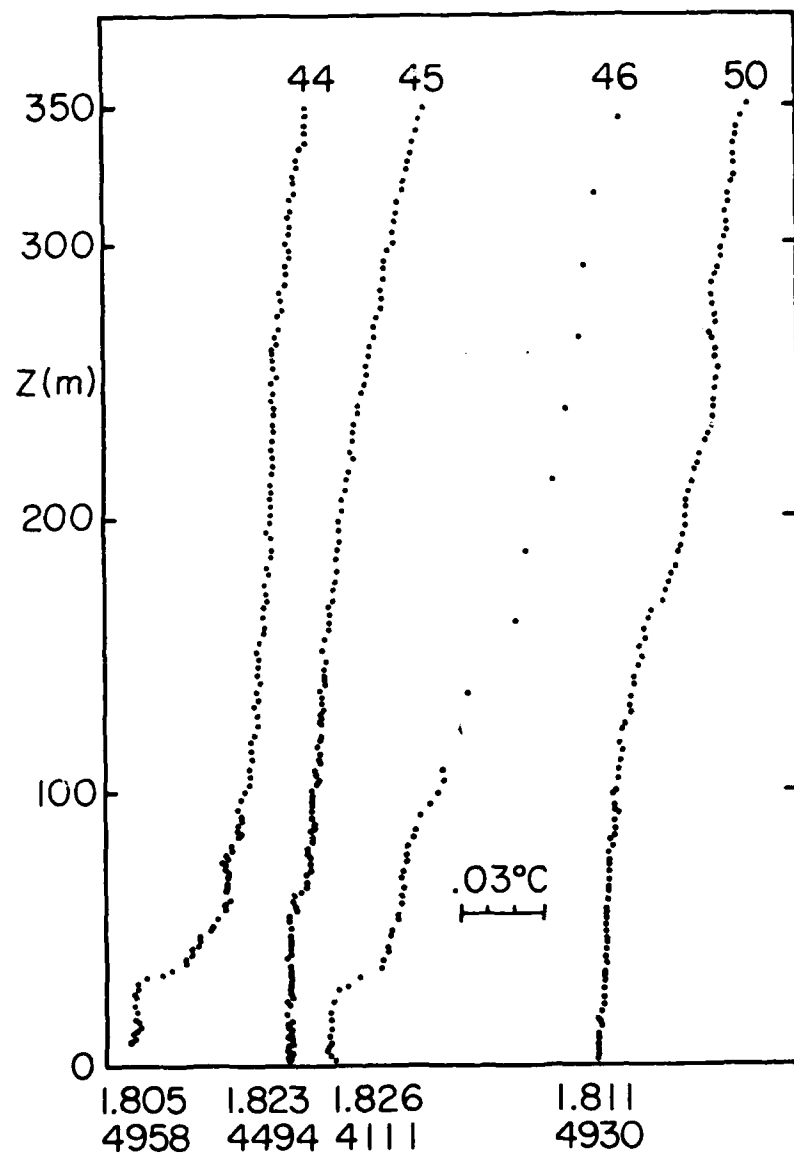


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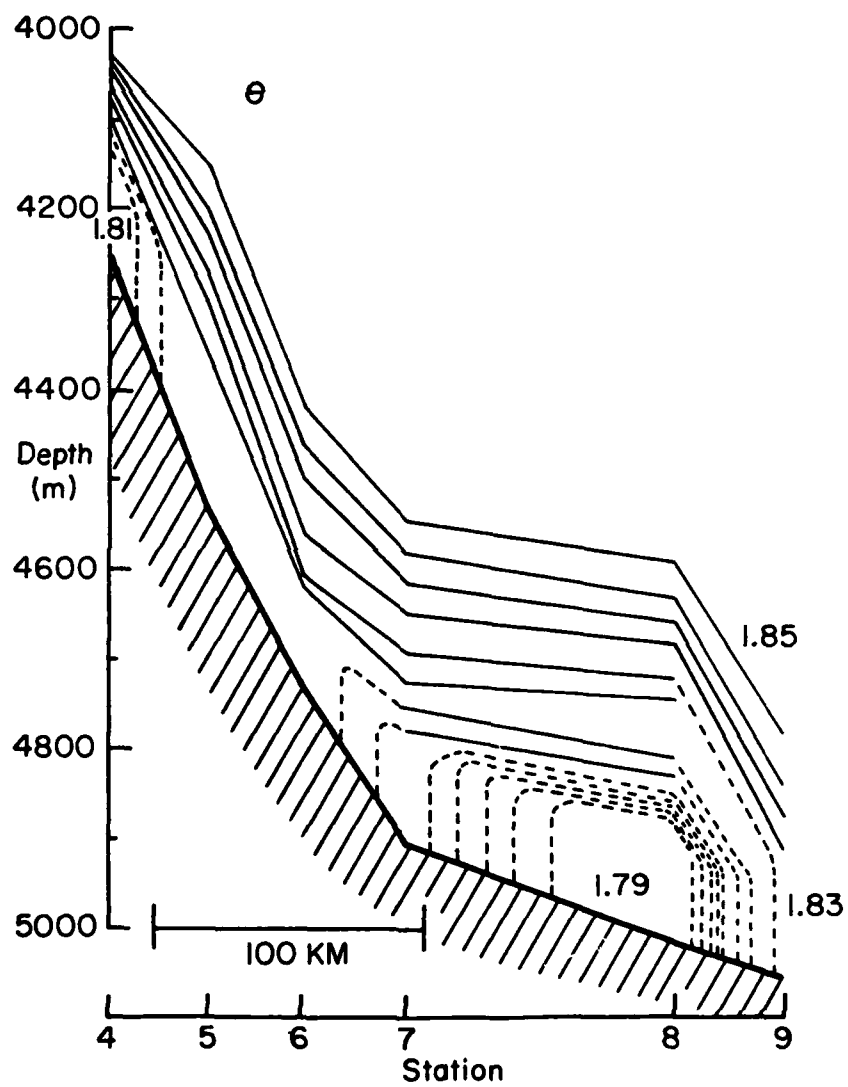


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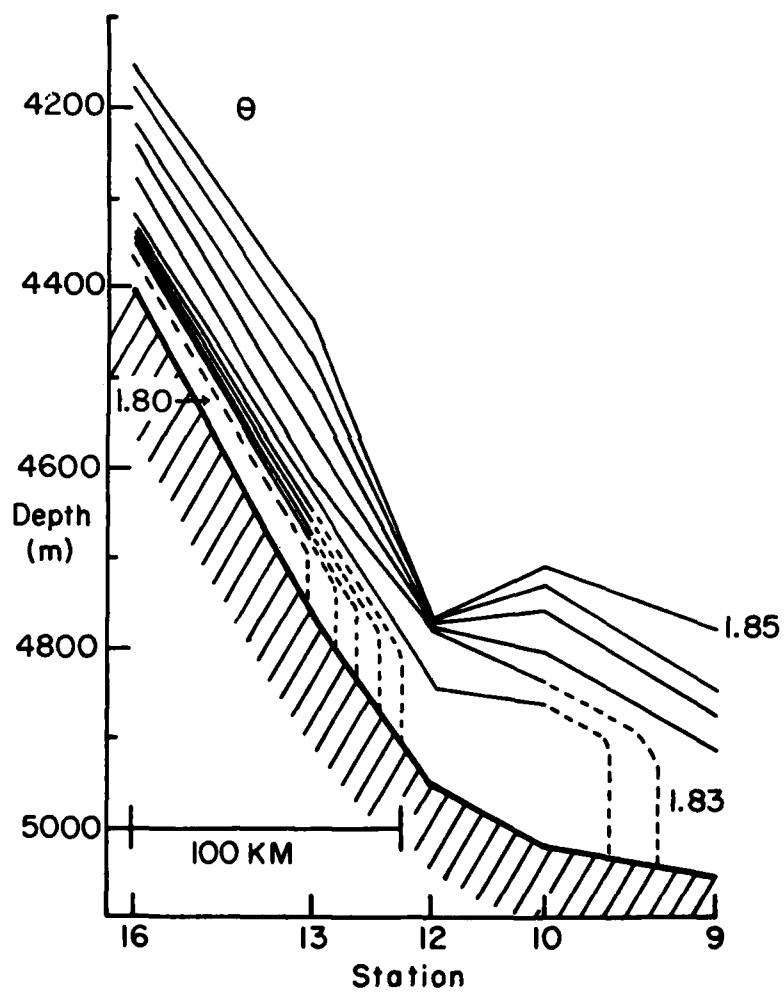


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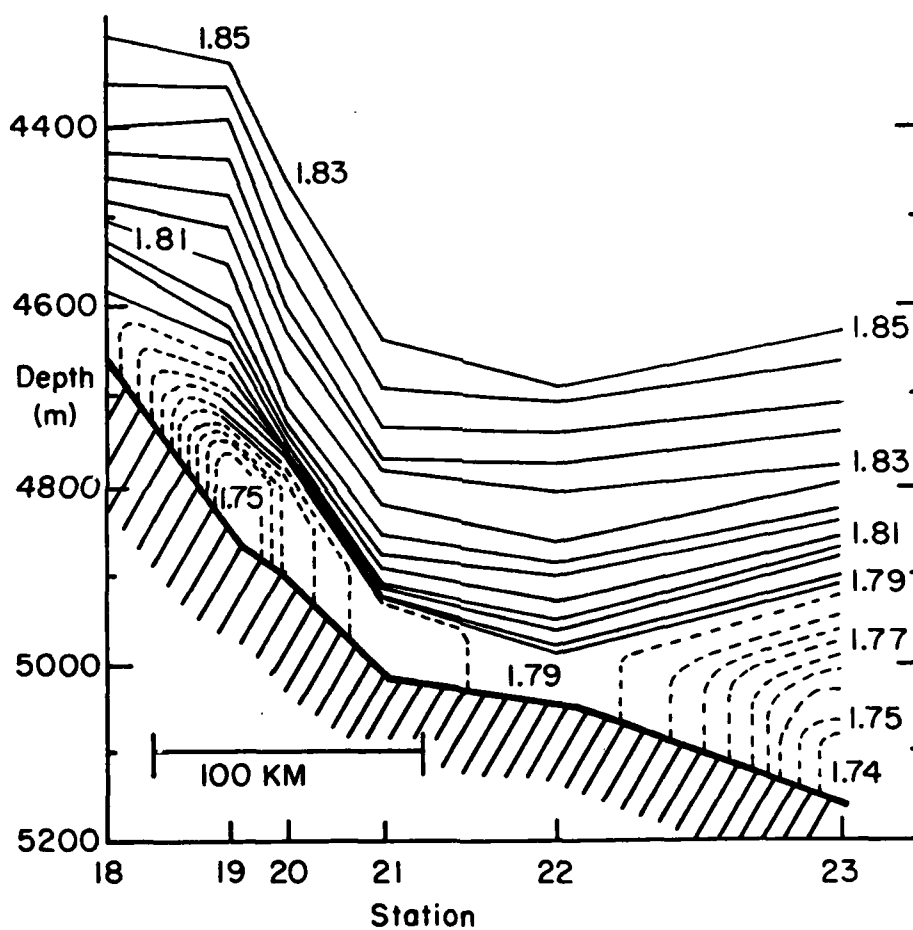


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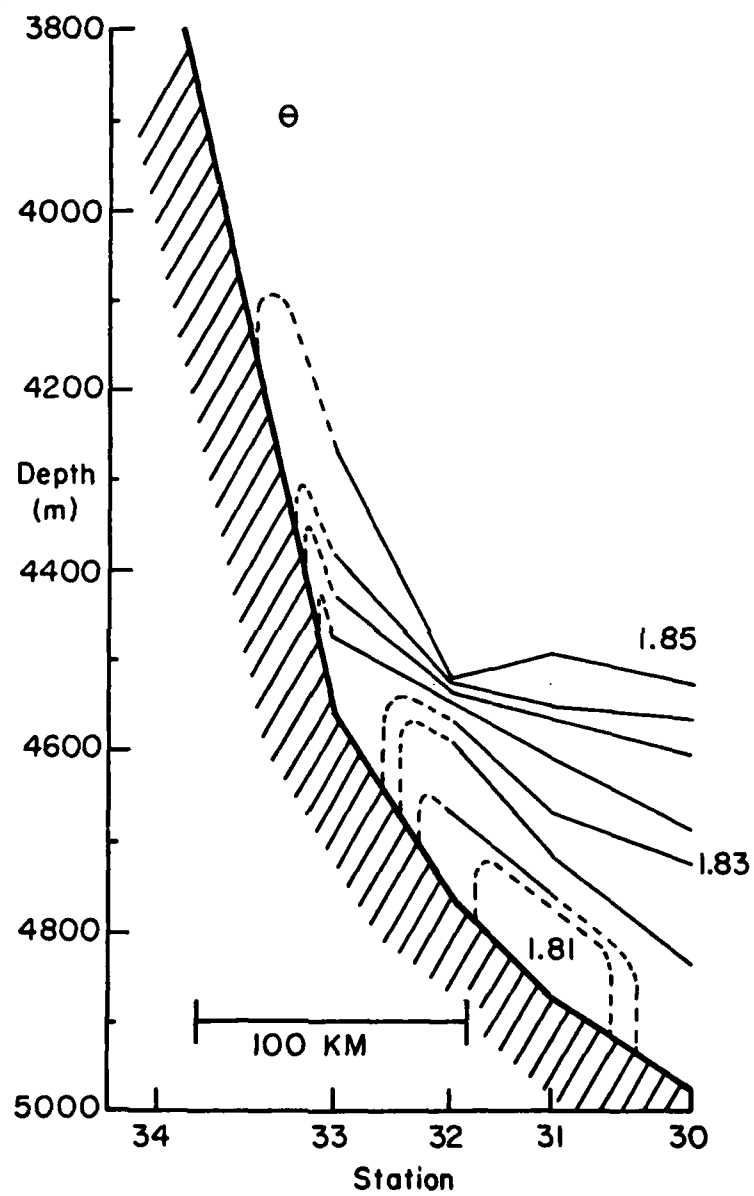


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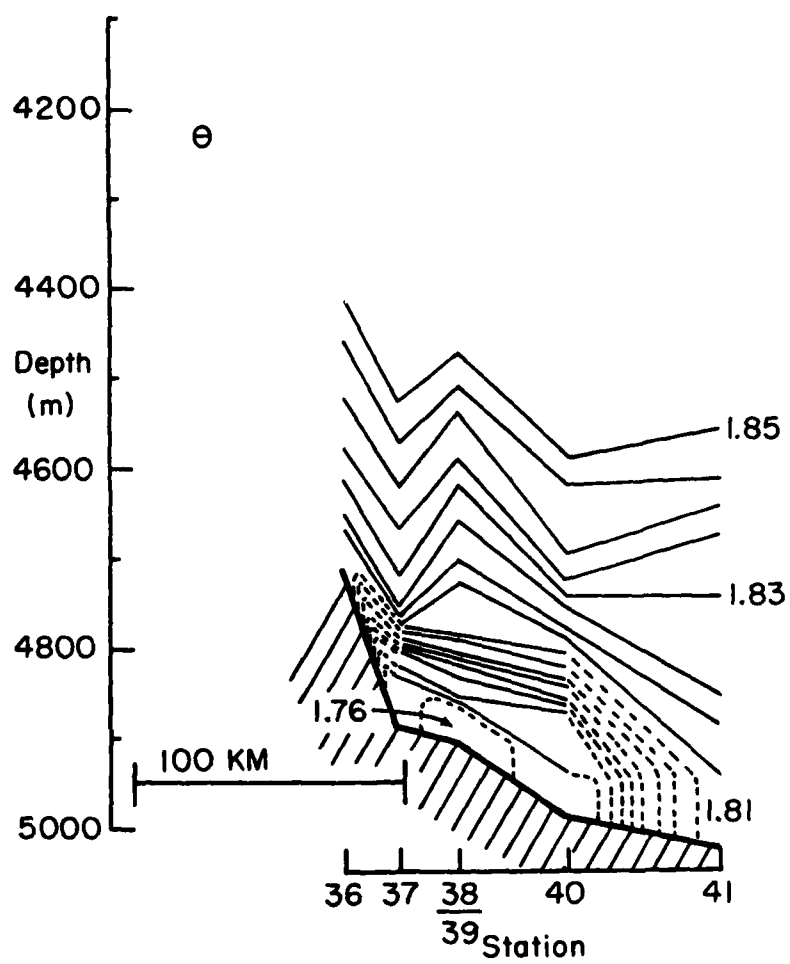


FIGURE 30

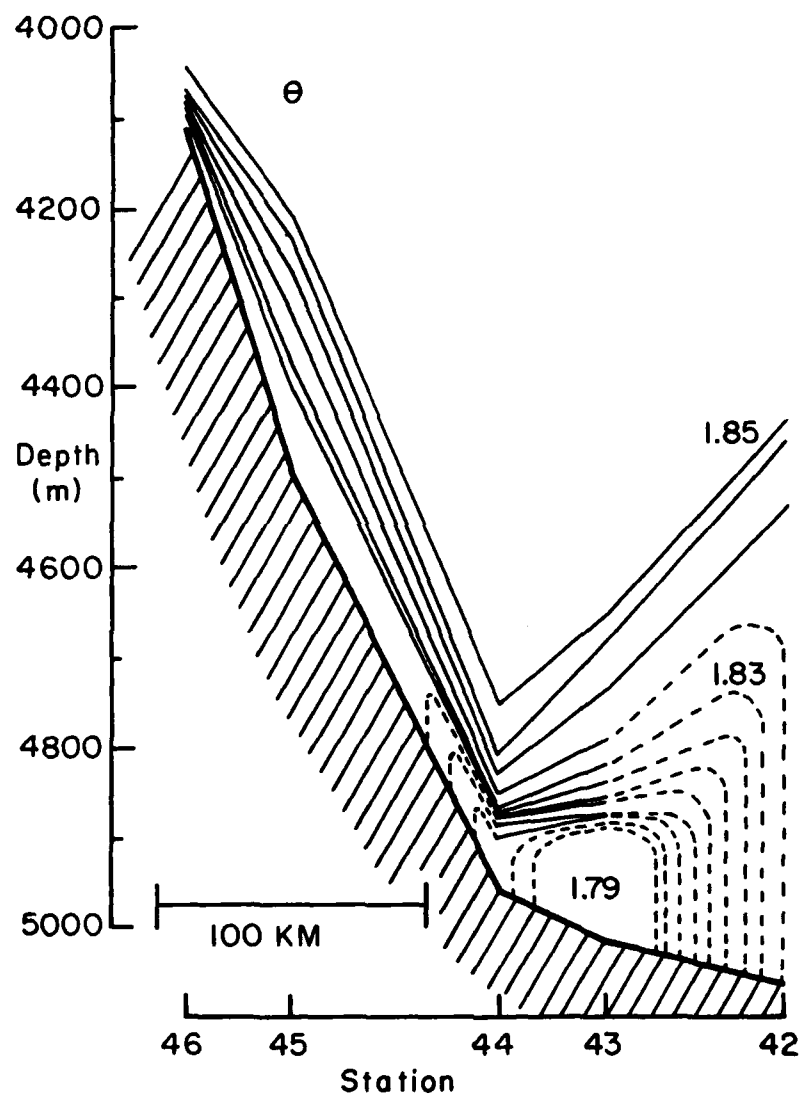


FIGURE 31

GESTROPHIC VELOCITY CALCULATED BETWEEN INDICATED SHIP STATIONS

Level of No Motion Assumed at 1200 m

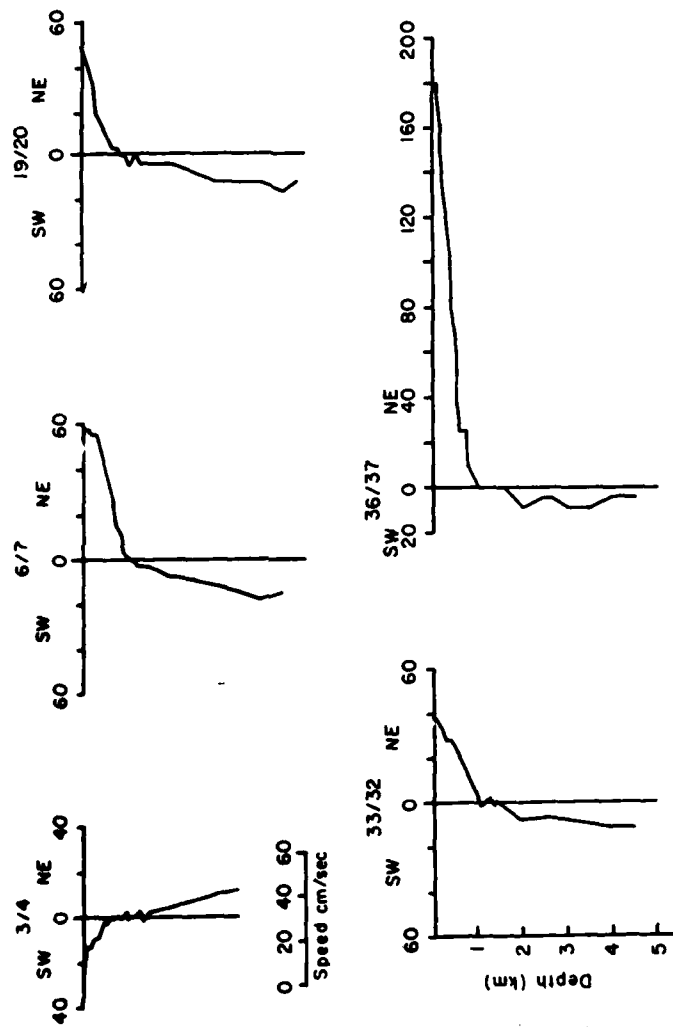


FIGURE 32

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