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Hydrography Committee

Oceanological investigations in the northern tropical Atlantic at 30° W between 2°N - 15°N

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In 1970 - 1973 the GDR r/v "Alexander v. Humboldt" of the Institute of Marine Research in Rostock-Warnemünde carried out oceanological investigations at 5 cruises in the northern tropical Atlantic. The investigations concerned the upper layer of the sea (about 1000 m) along the meridian 30° W between 2 to 15° N (table 1).

Table 1 Times of investigations along the meridian 30° W between 2 to 15° N

Times of investigations	Start of investigations in
12. 2. - 17. 2. 1973	S
3. 5. - 7. 5. 1971	N
29. 7. - 3. 8. 1970	N
17. 8. - 21. 8. 1972	S
12.10. - 16.10. 1970	N
25.11. - 30.11. 1971	S

In the area under investigation the distribution of the oceanological features in the surface layer is influenced by the seasonal dislocation of the wind and current regions respectively by seasonal variations of weather conditions. Though we have only data of 5 cruises, fig. 1 indicates that the lowest temperatures and the highest salinity as well as the highest density values exist at the whole section during winter and spring. At this time the greatest part of the area under investigation is situated in the zone of trade winds respectively in the region of the North Equatorial Current, where evaporation prevails precipitation.

In May, with the north dislocation of the calms, the surface temperatures increase whereas the salinity and the density of the surface water decreases, reaching their extreme values in autum, more exactly at the end of the rainy season. After that, with the south dislocation of the wind and current fields, the conditions change relatively quick to the wintry situation.

In contrast to the physical features the micro-nutrients indicate no seasonal variations on the sea surface, because their concentrations in the surface layer are only very small during the whole year. In 50 m the phosphate and nitrate content is still very small too during the greater part of the year. Higher values were observed in this depth in the southern part of the area in spring and in the northern part in summer and autum (fig. 2). The reason for this is the vertical dislocation of the discontinuity layer (see below).

The seasonal variations in the vertical structure of the water masses as well as the seasonal variations in the surface layer are caused first of all by the meridional dislocation of the wind and current fields. The greatest differences in the vertical distribution of the oceanological features are observed between spring and autum as well. A very important feature is the intermediate maximum of the salinity in the upper part of the pycnocline (fig. 3 and 4) which separates the isohaline surface layer from the week stratificated deep water. This high saline water comes directly from the Horse - Latitudes spreading equatorward or is transported eastward by the Equatorial Counter Current within the pycnocline.

The investigations in May 1971 (fig. 3) were carried out in a season as the Equatorial Counter Current at 30° W had stopped its eastward flow for about 6 months. Therefore the maximum of the salinity was disappeared completely in the area of 6 - 10° N. Only in the southern part between 4 - 5°N small amounts of more saline water (35.9°/oo) were observed. In October-November, when the Equatorial Counter Current flowed eastward for about 5 months, the intermediate maximum reached its biggest extent and strongest intensity in this current region (fig. 4).

The seasonal differences in the vertical distribution of the physical and chemical features result from space-temporal variations in the depth of the discontinuity layer respectively in the thickness of the homogenous surface layer. As fig. 3 indicates, the surface layer has its smallest extent (30-40 m) in the southern part of the area under investigation in spring. With increasing geographical latitude its thickness slowly increases reaching in the northern part an order of magnitute of about 70 - 80 m. In analogy with this the pycnocline has its lowest depth in the south and its greatest depth in the north. In autum the conditions are inverse (fig. 4). In this season the extent of the homogenous surface layer is 90-100m in the south and 30 - 40 m in the north.

Fig. 5 indicates the seasonal variations of the depth of the discontinuity layer at one station in the south (4^{o} N) and one in the north (13^{o} N). These variations are demonstrated by the σ_{Stp}-level of 26.0 which is situated within the pycnocline during the whole year.

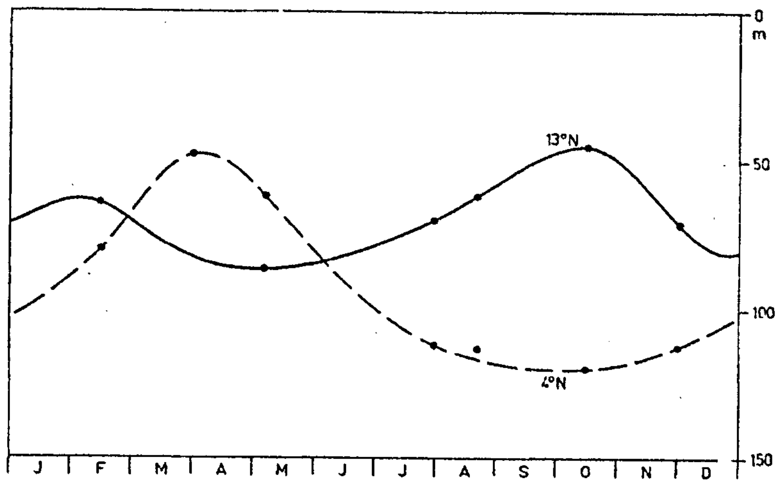


Fig. 5 Seasonal variations of the pycnocline (σ_{Stp}-level of 26.0) in the north and in the south of the 30^{o} W section

At the southern station the pycnocline has its smallest depth in spring, whereas in the north it reaches the lowest distance to the surface in summer and autum. The amplitude of the seasonal vertical dislocation amounts to about 40 m in the north and 70 m in the south.

Well defined relations between the vertical dislocation of the discontinuity layer and the size of primary production could not be proved. But distinct differences in the size of the primary production exist between the seasons. From November to April we observed a mean productivity of 0.33gC/m^2d and from May to October of 0.16 g C/m^2d.
These differences may be caused by the seasonal dislocation of the wind and weather zones in the area under investigation.

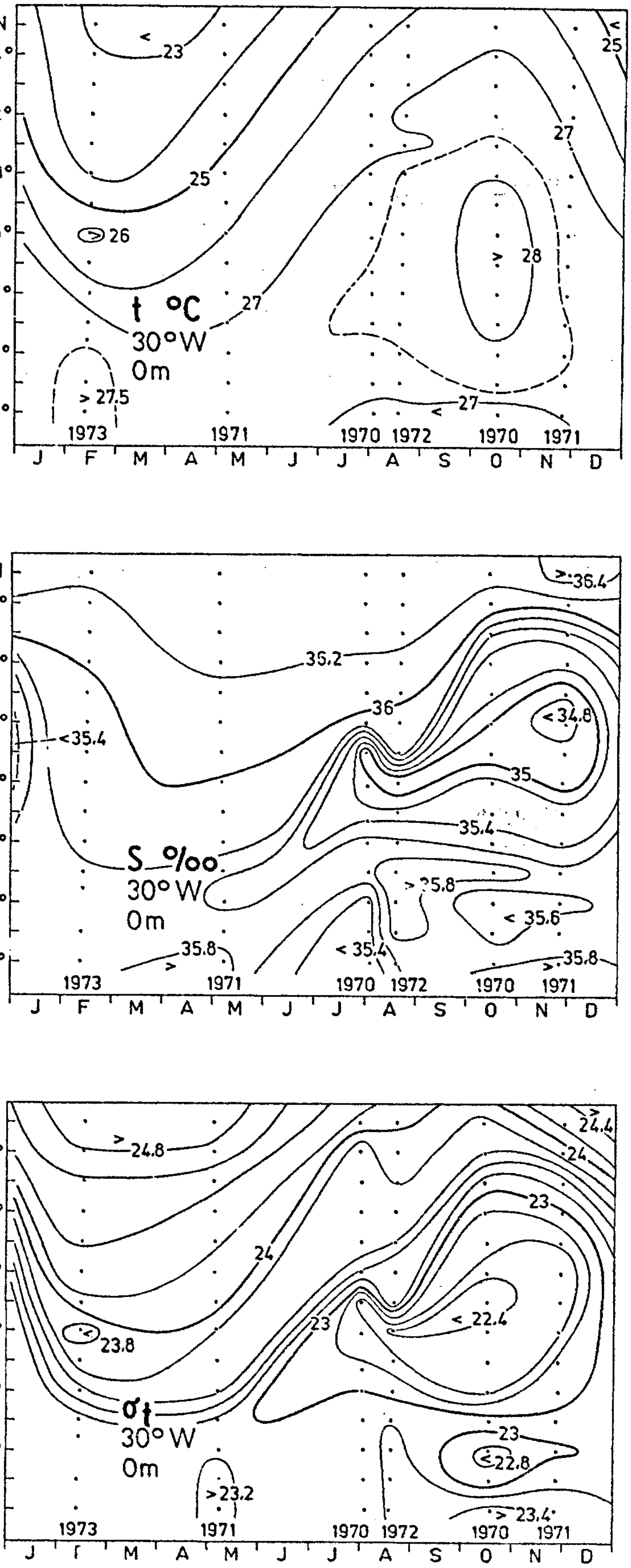

N
14°
12°
10°
8°
6°
4°
2°
23
25
26
27
28
27.5
25
27
27
t °C
30° W
0m
1973
1971
1970
1972
1970
1971
J F M A M J J A S O N D
36.4
35.2
36
35.4
34.8
35
35.4
35.8
35.6
35.8
35.4
35.8
S ‰
30° W
0m
1973
1971
1970
1972
1970
1971
J F M A M J J A S O N D
24.4
24.8
24
23
24
23
22.4
23.8
23
22.8
23.2
23.4
σt
30° W
0m
1973
1971
1970
1972
1970
1971
J F M A M J J A S O N D

Fig. 1

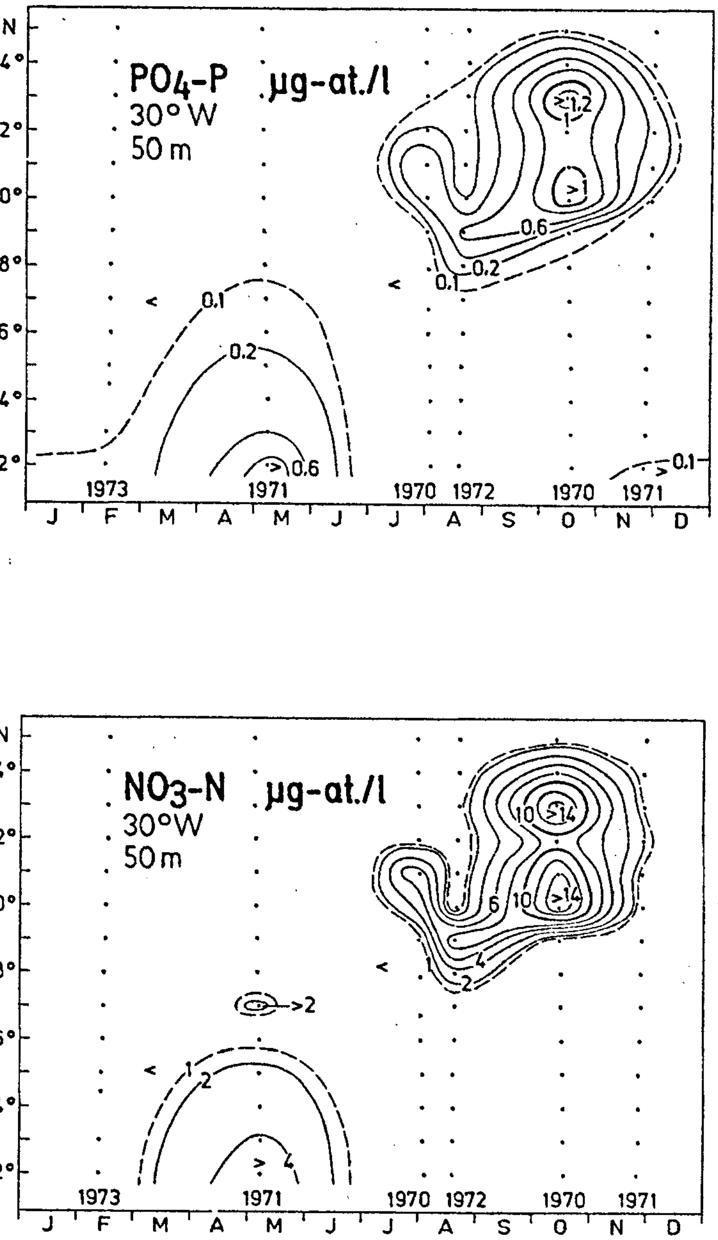
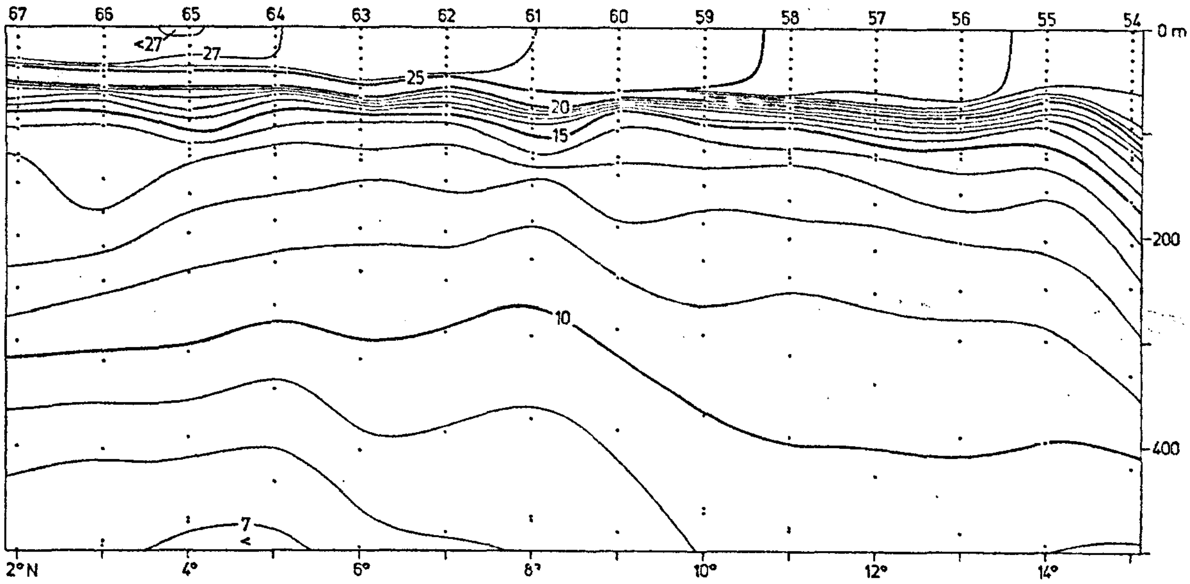
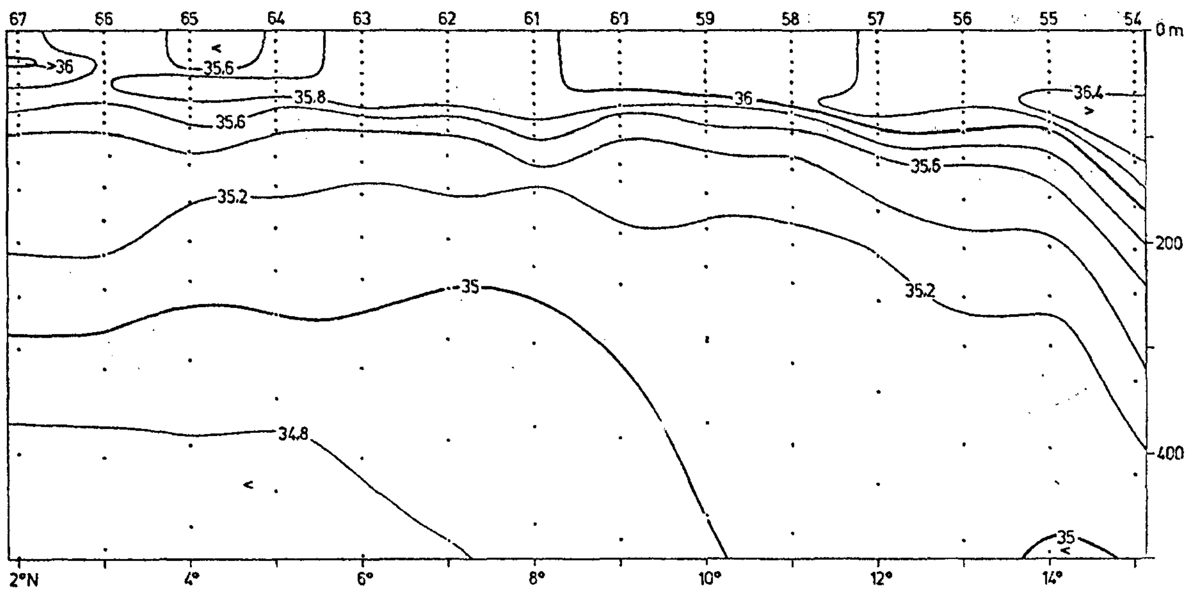

PO4-P µg-at./l
30° W
50 m
N
14°
12°
10°
8°
6°
4°
2°
0.1
0.2
0.6
>1
>1.2
1973
1971
1970
1972
1970
1971
J F M A M J J A S O N D
NO3-N µg-at./l
30°W
50m
>2
1
2
>4
4
6
10
>14
1973
1971
1970
1972
1970
1971

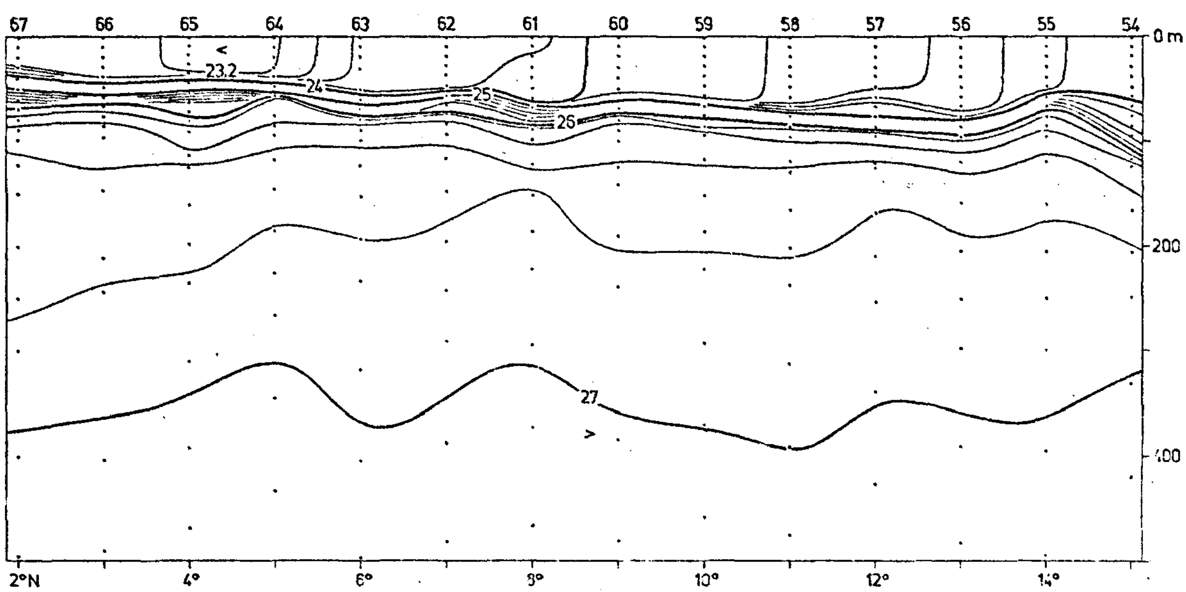
Fig. 2



t °C auf 30°W „A.v.Humboldt" 3.5.-7.5.1971

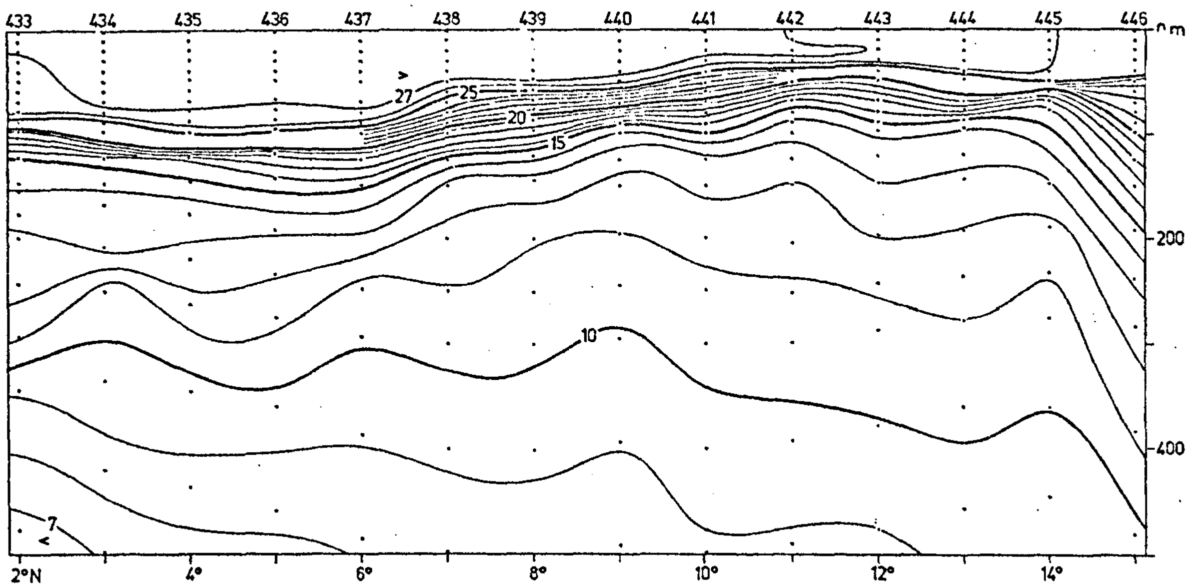


S ‰ auf 30°W „A.v.Humboldt" 3.5.-7.5.1971



σ_t auf 30°W „A.v.Humboldt" 3.5.-7.5.1971

Fig. 3



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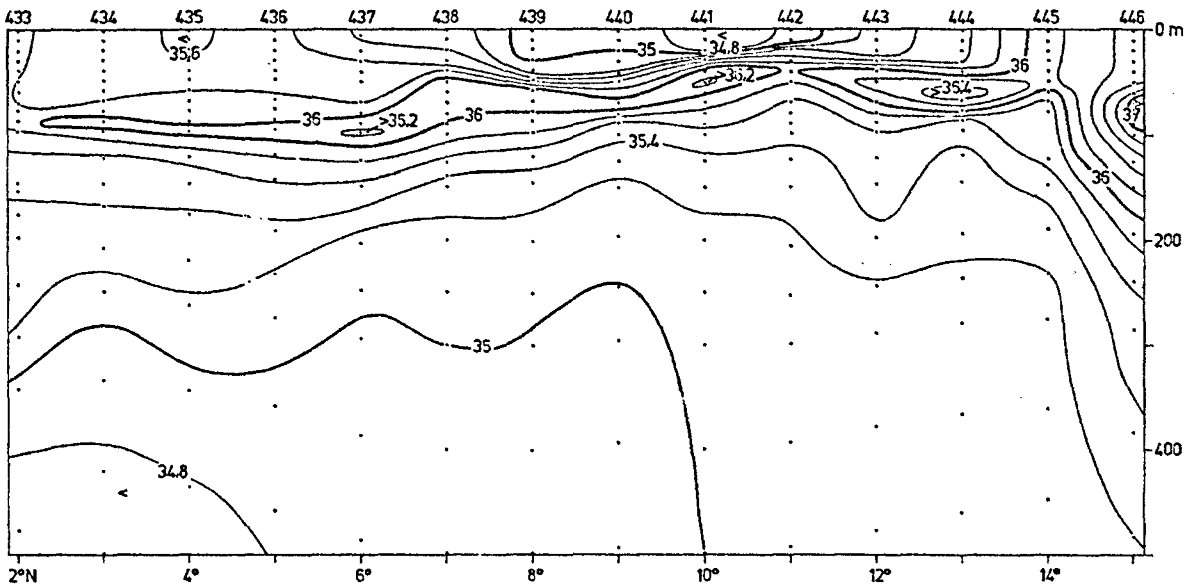
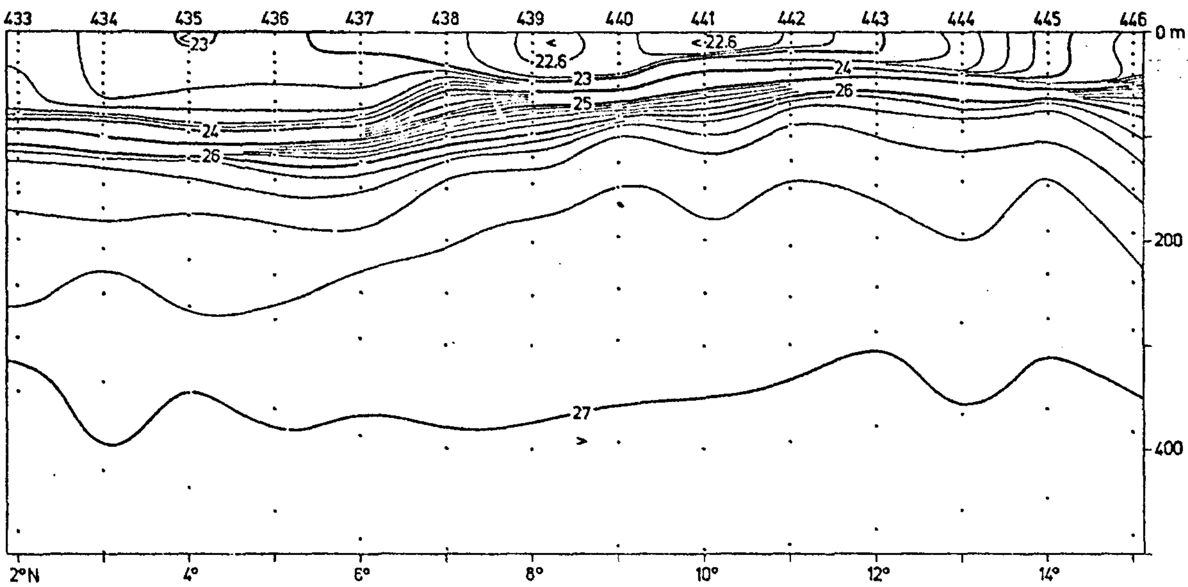


S ‰ auf 30°W „A.v.Humboldt" 25.11.-30.11.1971



σ_t auf 30°W „A.v.Humboldt" 25.11.-30.11.1971

Fig. 4