DOE/EV/00936-4

# BIOLOGICAL PROCESSES IN THE WATER COLUMN OF THE SOUTH ATLANTIC BIGHT



A Progress Report Submitted to
U. S. Department of Energy

Contract EY-76-S-09-0936

Annual Progress Report for 1979

BY



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31 January 1980

## DISCLAIMER

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Skidaway Institute of Oceanography
PROGRESS REPORT

SUMMER INTRUSION STUDY 1979

A study of Summer Intrusions, consisting of 7 weekly cruises between 28°50' and 31°00'N, was conducted from July 5 to August 17, 1979. Additional chlorophyll and nutrient samples were collected in the study area during the week of August 23. Our goal was to follow a newly intruded water mass for several seeks to determine rates and magnitudes of phyto- and zooplankton for development.

The initiation of shelfbreak upwelling was observed on July 31 (Fig. 1a) after and during a period of winds from the south to west. By August 6-7 (Fig. 1b) the upwelled water had moved towards shore and by August 13-14 (Fig. 1c) was almost completely isolated.

Maximum nitrate concentrations in the upwelled water were 8.0 (17.0°C) on August 1; 12.8 (16.3°C) on August 7; and 8.3 μ-moles (17.4°C) on August 15.

The preliminary analysis of results confirm our earlier conclusion that nitrate within an intrusion is depleted within 2-3 weeks. We have also discovered that resident shelf water contains relatively high levels of particulate nitrogen (PN), but nitrogen/chlorophyll ratios of particulate matter are extremely high, suggesting a low phytoplankton component. In contrast, PN/chlorophyll ratios of newly intruded water show that phytoplankton comprise a high proportion of PN. Dissolved organic nitrogen (DON) of resident shelf water is about double that of newly intruded water. Surprisingly, the total nitrogen concentration of resident shelf water is of comparable magnitude to that of newly intruded water. Intrusions differ in that nitrate is rapidly converted into phytoplankton PN, principally diatoms, whereas resident shelf water is

characterized by high levels of DON and PN not associated with phytoplankton. On an average, the DON and PN pool sizes of resident shelf water are fairly constant with time suggesting equilibrium between pools or little inter-pool transfer.

Figure 2 and Table 1 illustrate the effect of the summer, 1979, intrusion on middle shelf (near the 30 m isobath) phytoplankton. Table 1 gives bottom depth and temperature for stations at which the vertical distribution of chlorophyll is illustrated in Figure 2. Coincident with a drop in bottom temperature of about 8°C between July 17 and August 14 caused by a Gulf Stream intrusion (Table 1), subsurface chlorophyll concentration increased dramatically (Figure 2, stations 442 and 530). The intrusion moved north during the study. The final station (21) shown in Figure 2 was very close to stations 534 and 541 which showed high subsurface chlorophyll, but high bottom temperatures at station 21 show that the intrusion was no longer located in this area. The chlorophyll profile at station 21 is similar to those obtained before the intrusion moved onto the shelf (i.e., stations 43, 168, and 298).

We sampled zooplankton throughout the water column from just below surface to 1 m above the seafloor during day and night at positions of lowest bottom temperatures. On August 6-9 and 13-16 these were near the center of the intruding water. Our pump samples (105 μm mesh) revealed the following taxa were dominant: Oikopleuridae, Doliolida, the cephalochordate Branchiostoma caribaeum, Temora turbinata, and Oncaea sp.

High abundances of B. caribaeum and Oncaea sp. in young intrusions were also observed in summer 1978 when temperatures were close to 20°C.

In this year's colder intrusion the abundance of doliolids may have resulted from seed assemblages or because of more favorable temperatures. Similar low temperatures were observed during doliolid blooms near the shelfbreak during Spring 1978 (D. Deibel, Ph.D. Thesis). Doliolids, because of fast growth and high reproductive rates, are able to respond quicker than copepods to developing phytoplankton blooms. Temora turbinata reproduces only at high phytoplankton concentrations, such as found offshore during the summer in intruded water masses.

Table 1

| Date | Station Number | Bottom Depth (m) | Bottom Temperature (C) |
|---|---|---|---|
| Jul 11 | 43 | 29 | 26.7 |
| 17 | 168 | 32 | 25.8 |
| 23 | 298 | 29 | 24.2 |
| Aug 2 | 373 | 35 | 23.2 |
| 8 | 442 | 34 | 22.5 |
| 14 | 530 | 33 | 17.6 |
| 15 | 534 | 32 | 18.3 |
| 16 | 541 | 35 | 19.4 |
| 23 | 21 | 31 | 25.0 |

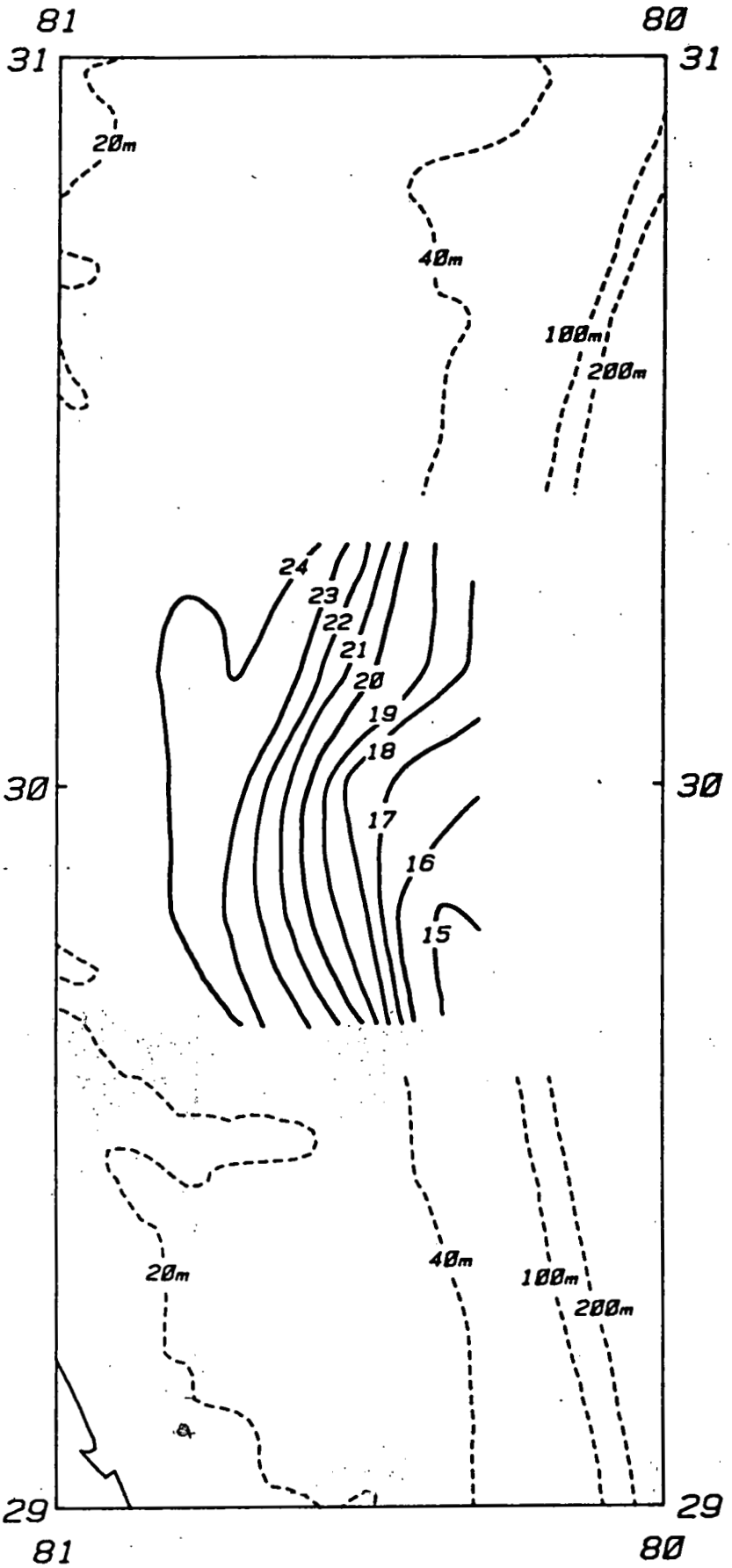



Fig. 1 a. Horizontal distribution of near bottom temperature off northeastern Florida: July 31, 1979.

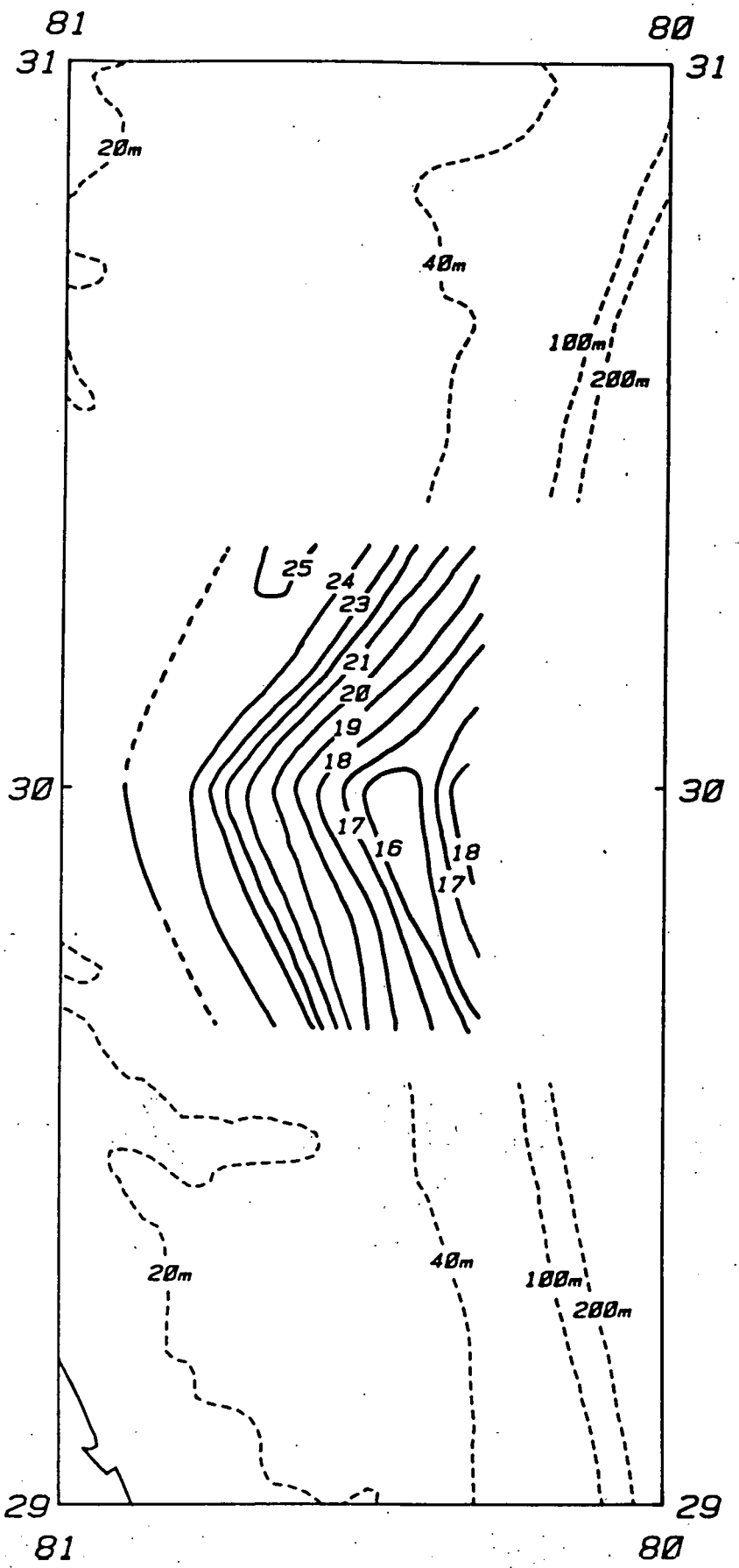



Fig. 1 b. Horizontal distribution of near bottom temperature off northeastern Florida: August 6 - 7, 1979.

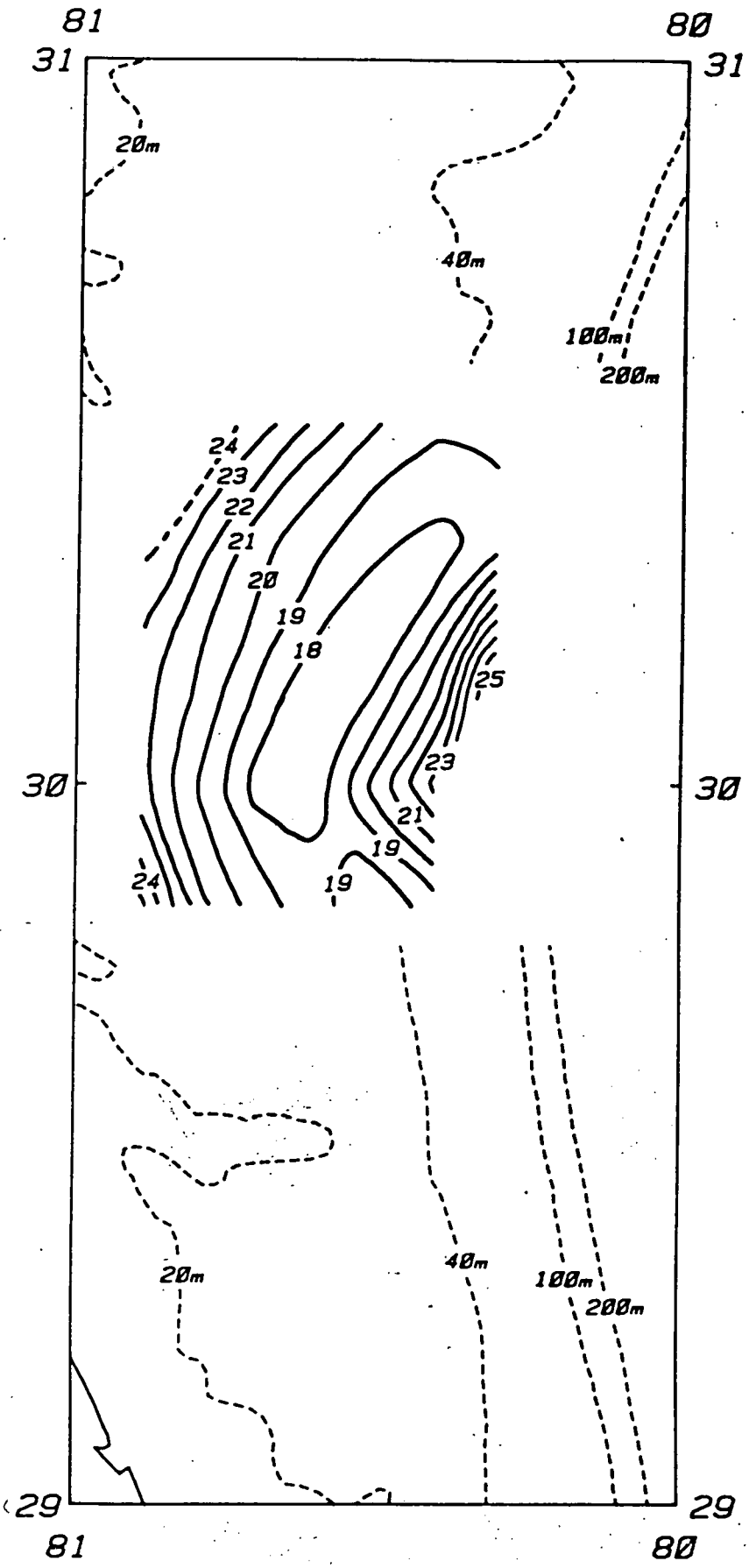
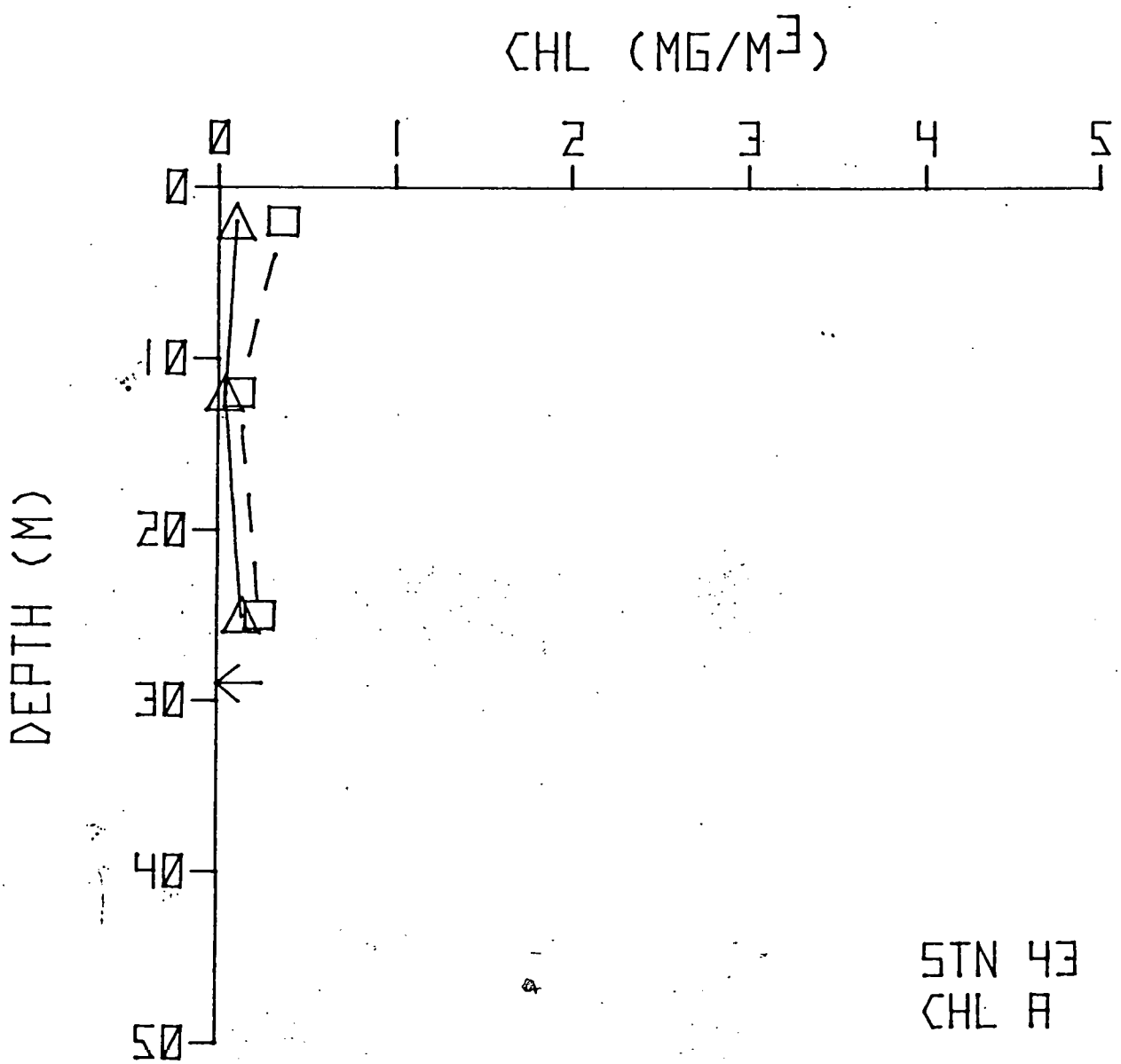
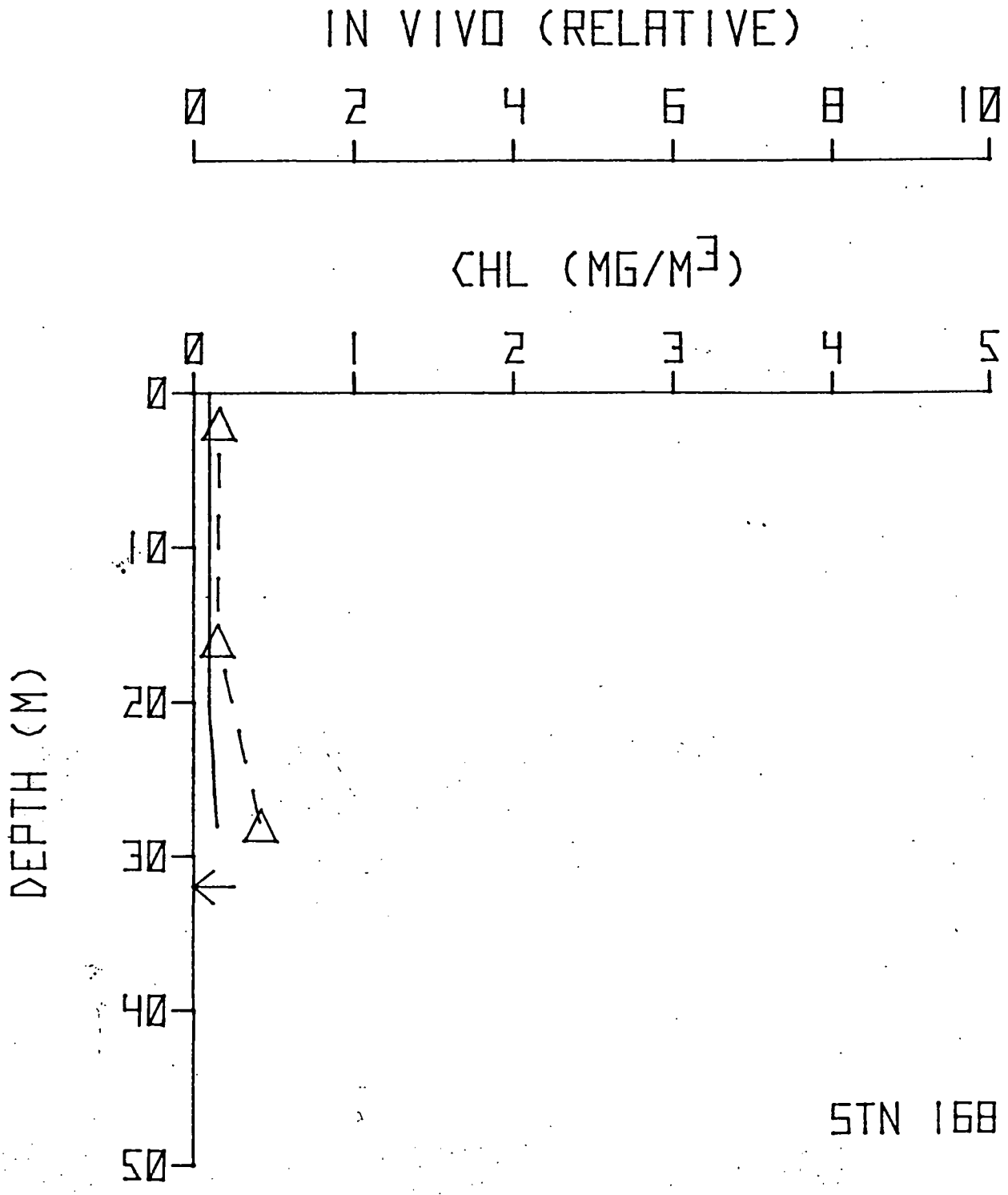



Fig. 1.c. Horizontal distribution of near bottom temperature off northeastern Florida: August 13 - 14, 1979.

Figure 2. Vertical profiles of chlorophyll at stations identified by Table 1. Where 2 different symbols are shown on the same plate (stations 43, 530, and 21), the larger value is chlorophyll *a* + phaeopigment, whereas the smaller is chlorophyll *a*. Where only one set of symbols is used (stations 168, 298, 373, 442, 534, and 541), the solid line is a continuous vertical profile of relative chlorophyll fluorescence, whereas the dashed line connects discrete depth values of chlorophyll *a* + phaeopigment.

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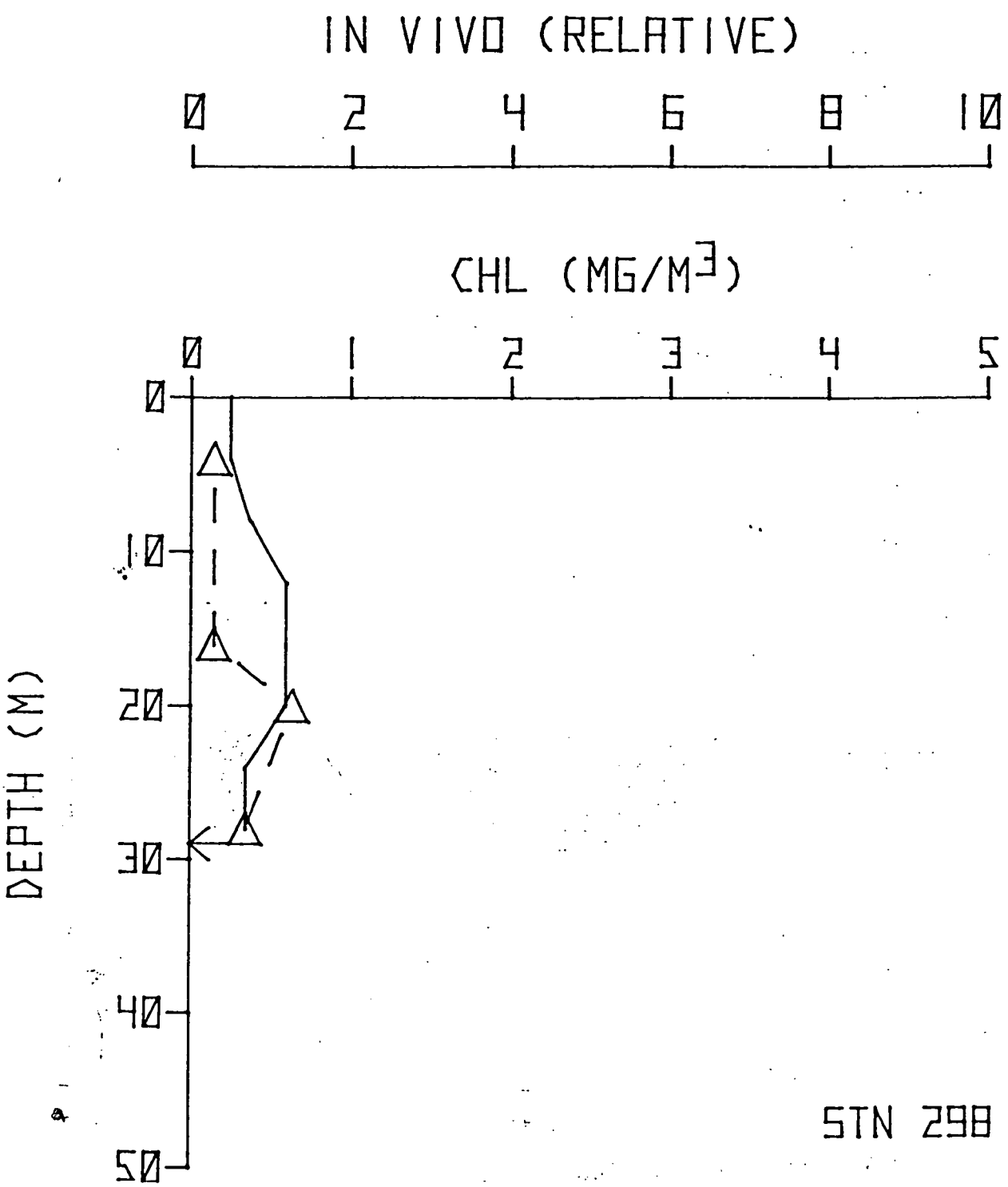
0
2
4
6
8
10
CHL (MG/M3)
0
1
2
3
4
5
DEPTH (M)
0
10
20
30
40
50
STN 168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4
6
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CHL (MG/M3)
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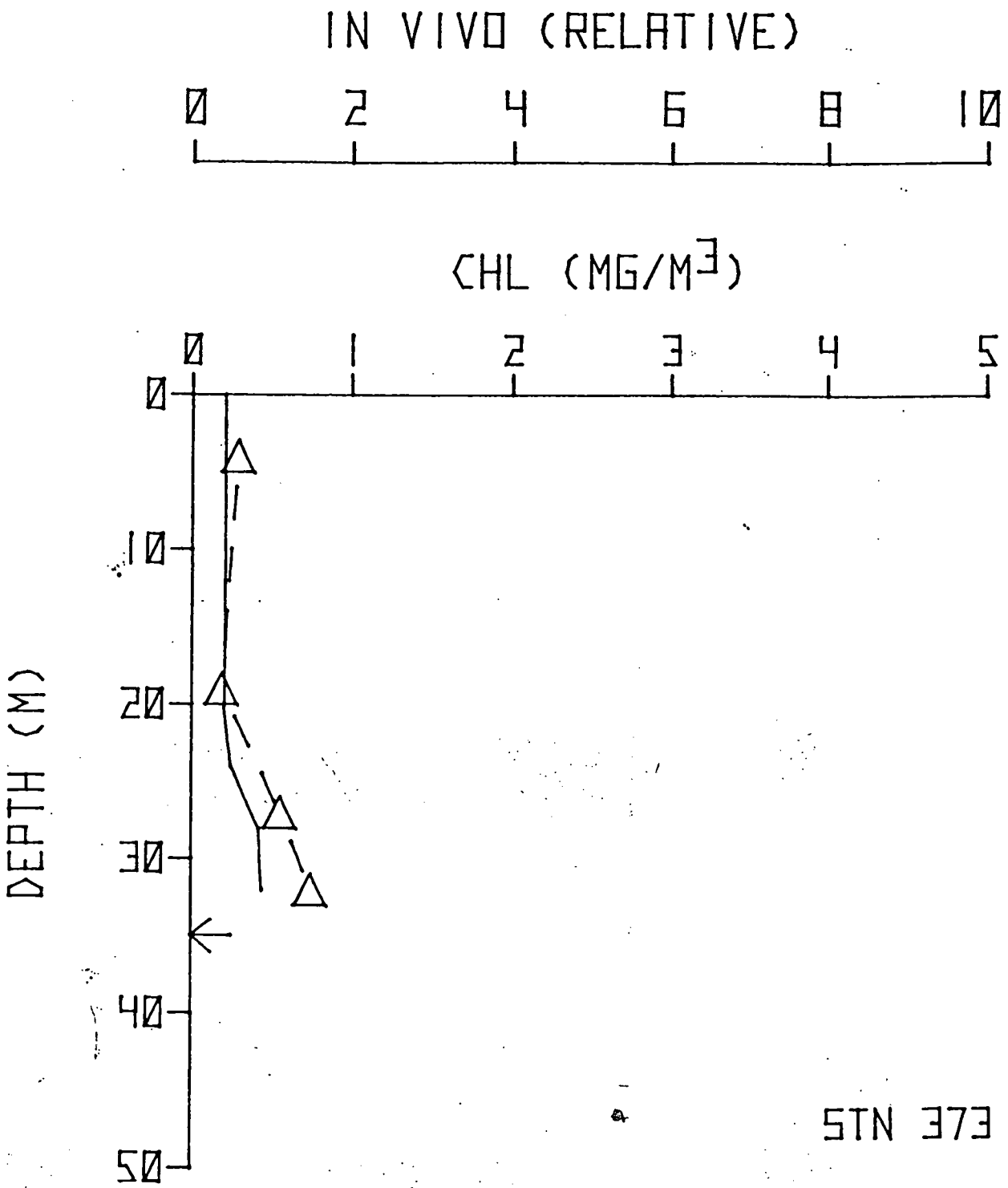
20
30
40
50
DEPTH (M)
STN 298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20
30
40
50
DEPTH (M)
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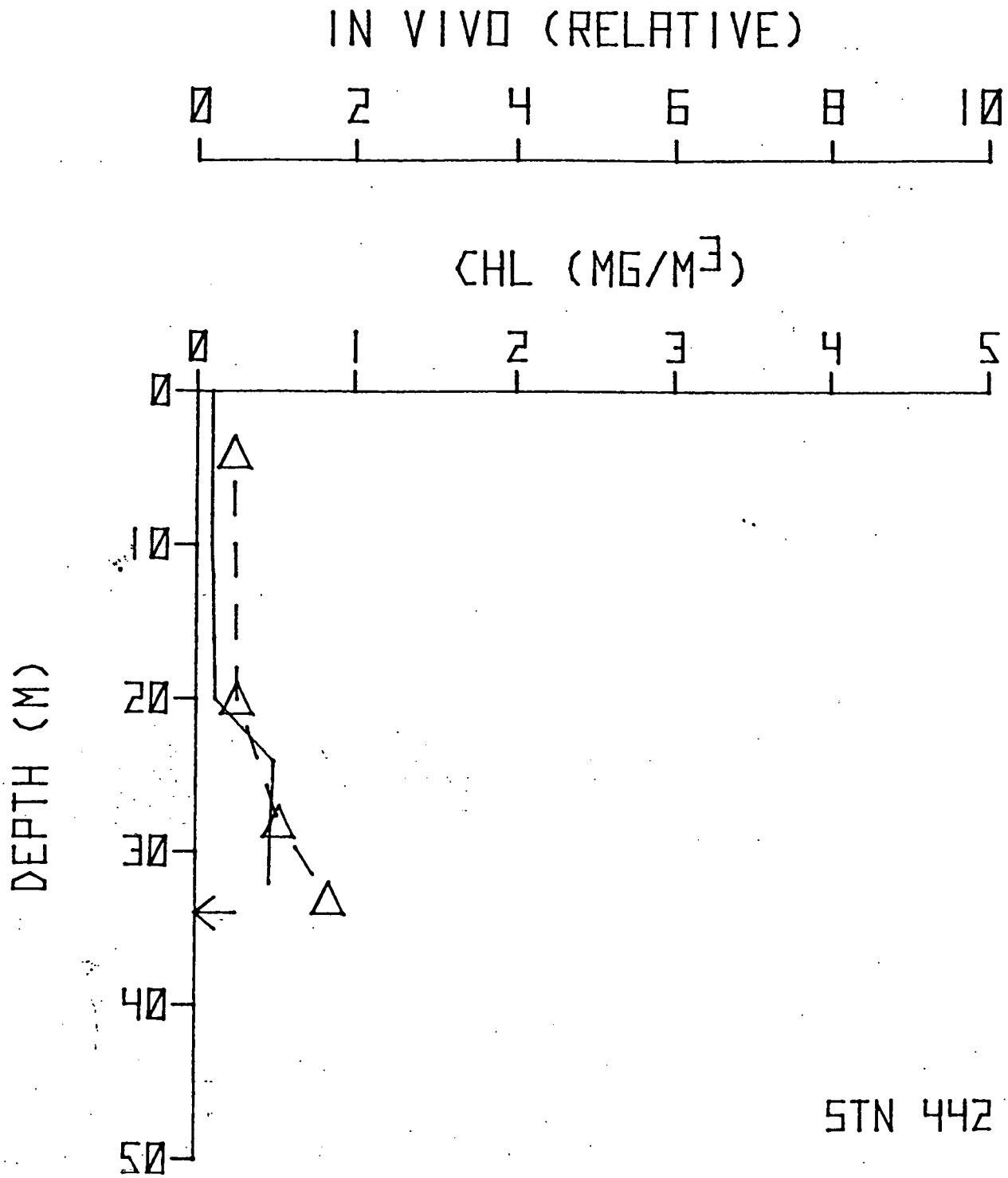
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DEPTH (M)
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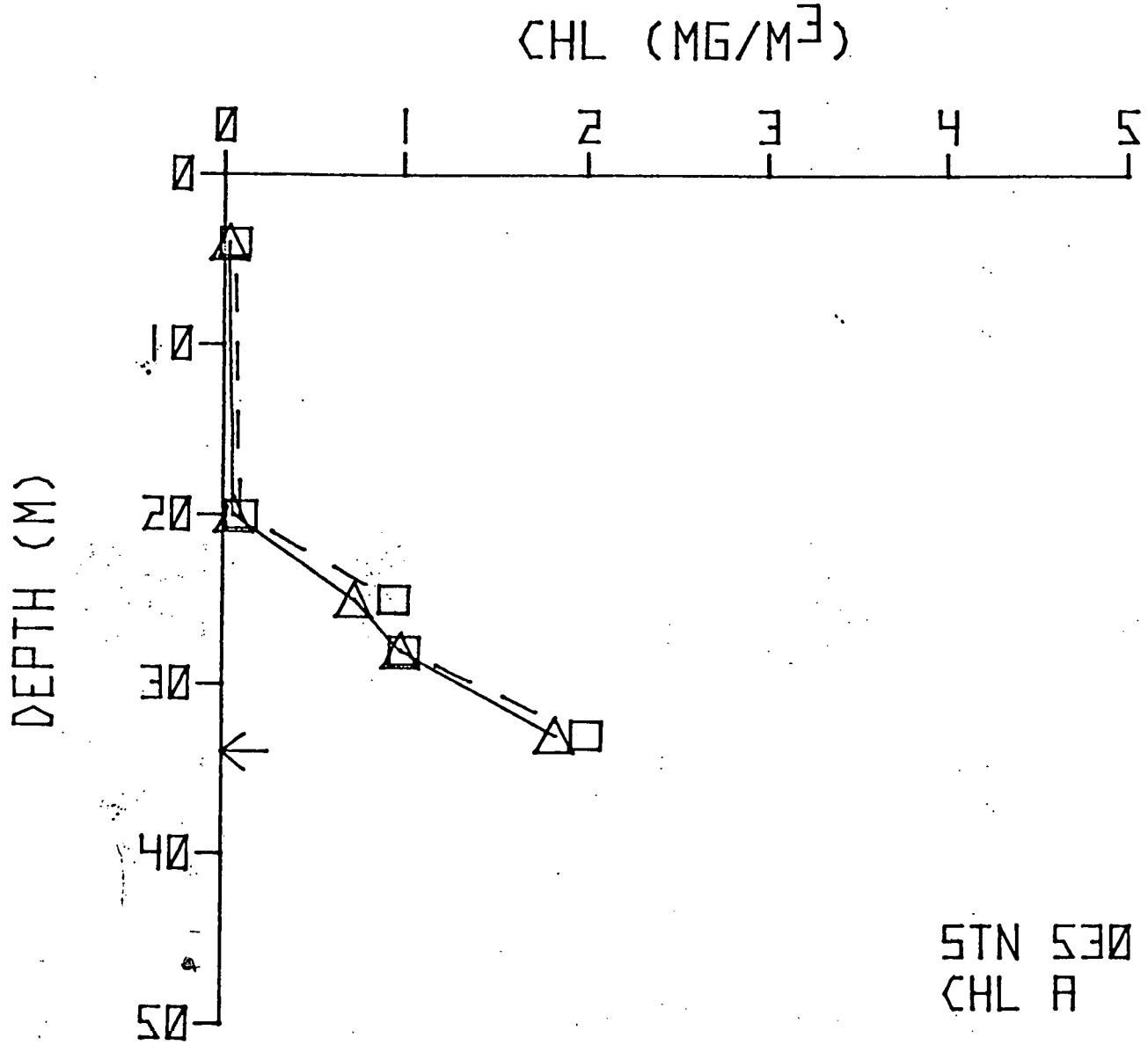
30
40
50
STN 442


CHL (MG/M3)
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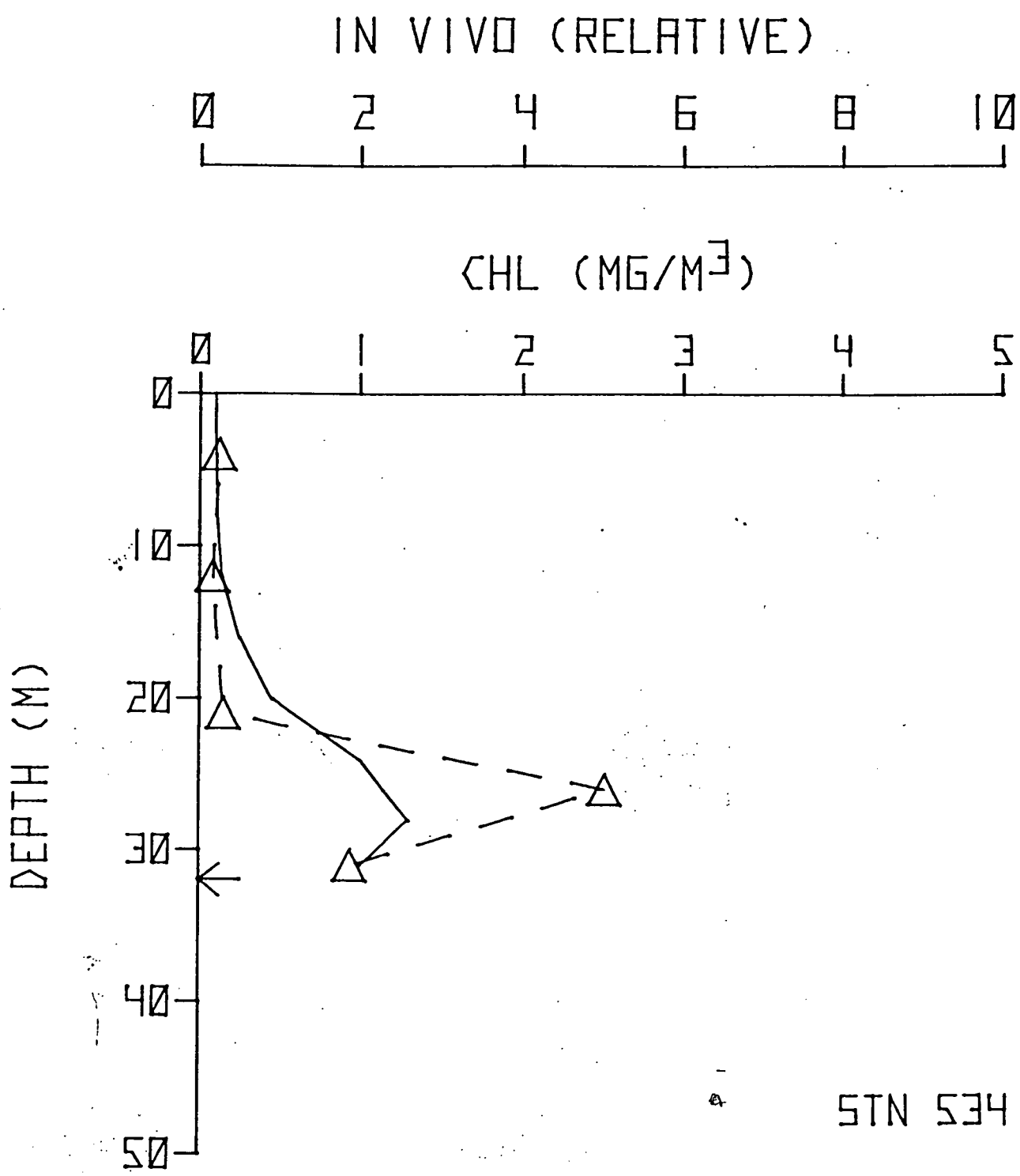
1
2
3
4
5
0
10
20
30
40
50
DEPTH (M)
STN 530
CHL A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0
2
4
6
8
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20
30
40
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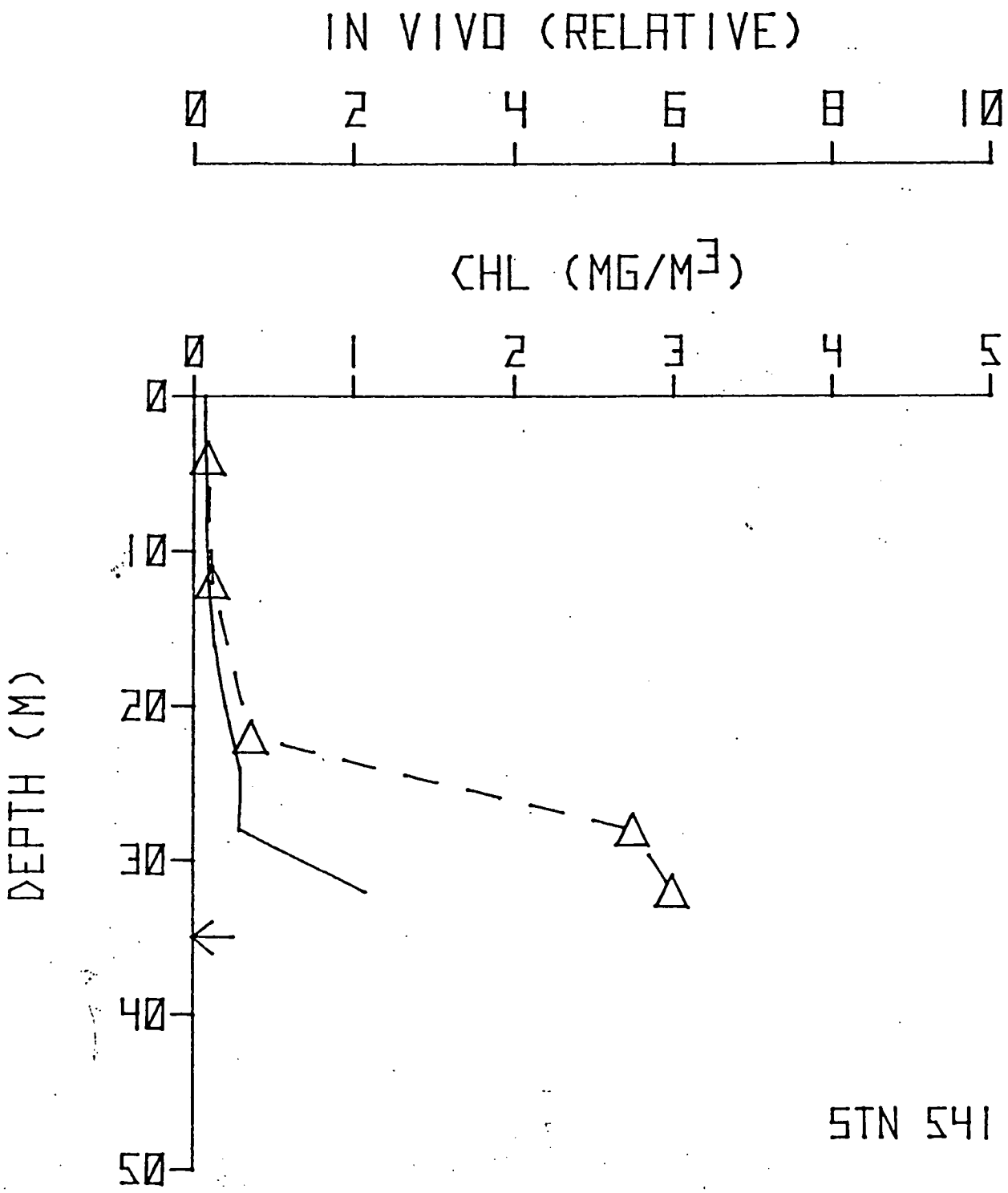
STN 534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4
6
8
10
CHL (MG/M3)
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4
5
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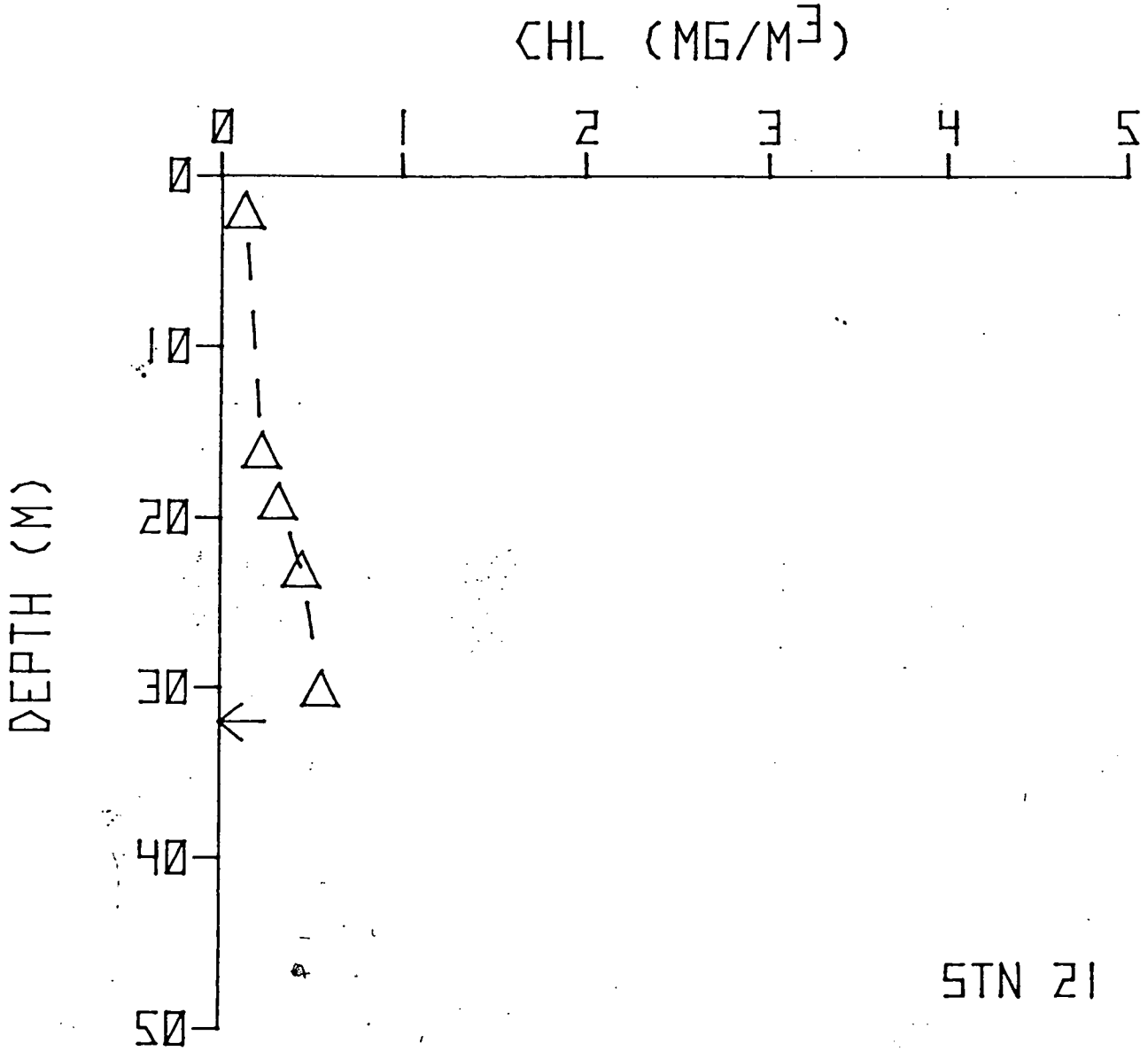
10
20
30
40
50
DEPTH (M)
STN 541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1
2
3
4
5
0
10
20
30
40
50
DEPTH (M)
STN 21