NEW RESULTS ON THE CHEMICAL OCEANOGRAPHY OF NORTHEASTERN MEDITERRANEAN

İ. Salihoğlu, A. Yılmaz, C. Saydam and Ö. Baştürk

Institute of Marine Sciences
Middle East Technical University
P.O. Box 28 Erdemli 33731
İçel-TURKEY

ABSTRACT:

The studies on the chemical oceanography of the Northeastern Mediterranean has been started in some detail in April, 1986. The "Chemical Oceanography Group" of the Institute of Marine Sciences collect the samples from the fixed station (Figure 1) which coincide with the NE Mediterranean POEM Project stations. This combined program opened new horizons in the oceanography of the NE Mediterranean since the previous studies on the marine chemistry were restricted only to the coastal regions and limited to few chemical parameters.

Among the most curious aspects of the chemistry of the Mediterranean Sea are the general depletion of nutrient sources and the decline in concentration as one goes eastward. The nutrient elements measured in the NE Mediterranean, namely inorganic phosphate and nitrate have their lowest concentration values at the surface and concentration increases slightly with increasing depth (Figure 2). The nutrient profiles obtained at such a station (Figure 2a) which is generally located in the center of the Rhodes cyclonic gyre had the nutricline very close to surface, at around 75 m. As Özsoy *et al*, (1989), reported that Rhodes cyclonic gyre persistently covers a large area in the Rhodes Basin and at its center a cold dome with uniform properties indicates permanent upwelling. Generally a relatively large scale anticyclonic gyre surrounds the Rhodes gyre in the south and the permanent and relatively small scale ones are observed in different parts of NE Mediterranean such as south and east of Cyprus. Anticyclonic eddies and the peripheries of both gyre systems have downwelling characteristics since Levantine Intermediate Water (LIW) is locally generated in the NE Mediterranean and along the peripheries of the Rhodes gyre. Thus downwelling areas cause the surface waters to be poor in nutrient elements and as is seen from Figure 2b, the depth of nutricline lowered down to 250-300 m at a station located in center of anticyclonic gyre. The nutrient and salinity transect couples (Figure 3) help to explain the phenomenon in some detail since high nutrient concentration contours rise up towards the surface at the central parts of the cyclonic systems and the reverse trends were consistently observed at the peripheries of the gyre systems and the central parts of the anticyclones with lower concentration contours below the euphotic layer.

The nutrient concentration distribution gowerns the spatial distribution of chlorophyll-a (standing stock density) (Figure 4). When the nutricline rises up to 70-75 m at the central parts of the cyclonic systems by local upwelling the depth of maximum chlorophyll-a could be observed at the same depth. At the peripheries of the cyclones and at the centers of

anticyclonic systems, the depth of chlorophyll-a maxima drops as deep as 100 m. On the other hand maximum fluorescence intensities due to chlorophyll-a could be observed at the central parts of cyclonic gyres *e.g.* Rhodes cyclonic gyre, and lower values at the peripheries and at the central parts of anticyclonic systems.

The circulation patterns and other physical processes in the NE Mediterranean are influenced on the dispersion and distribution of pollutants, such example is illustrated (Figure 5) for Dissolved/Dispersed Petroleum Hydrocarbons measured for the same time period. Saydam *et al.*, (1984) have reported high concentration of total suspended fine material at the off shore stations rather than coastal stations between Rhodes and Cyprus. The same type distribution characteristics for total mercury were observed in the region (Salihoğlu, 1989) confirming the responsibility of physical processes for the transport and dispersion of pollutants.

REFERENCES:

Özsoy, E., Hecht, A. and Ü. Ünlüata, 1989, "Circulation and hydrography of the Levantine Basin, results of POEM coordinated experiments 1985/1986", Progress in Oceanography, Vol. 22, pp. 125-170.

Salihoğlu, İ., 1989, "Mercury Concentrations in the Seawater of Northern Levantine" Rev. Int. Oceanogr. Med. Tomes LXXXXIII-LXXXXIV.

Saydam, C., İ. Salihoğlu, M. Sakarya and A. Yılmaz, 1984, "Dissolved/Dispersed Petroleum Hydrocarbons, Suspended Sediments, Plastic, Pelagic Tar and Other Litter in the Northeastern Mediterranean", VII es Journees Etud. Pollutions, pp.509-518, CIESM, Lucerne 1984.

FIGURE CAPTIONS:

Figure 1. Sampling stations in the Northeastern Mediterranean March, 1989

Figure 2. Vertical distribution of inorganic phosphate and nitrate
U: Upwelling region D: Downwelling region

Figure 3. Salinity and nutrient transects along the west-east direction in the Norteastern Mediterranean, March, 1989

Figure 4. a. Surface circulation patterns in the Northeastern Mediterranean March, 1989, (Özsoy *et al.*, 1989 *personel communication*)

b. Depth of maximum chlorophyll-a, March, 1989

c. Relative maximum fluorescence intensities ($X 10^{-2}$) due to chlorophyll-a measured by *in situ* fluorometers at depths illustrated in Fig. 4.b., March, 1989

Figure 5. Surface distribution of Dissolved/Dispersed Petroleum Hydrocarbons in the Northeastern Mediterranean, March, 1989

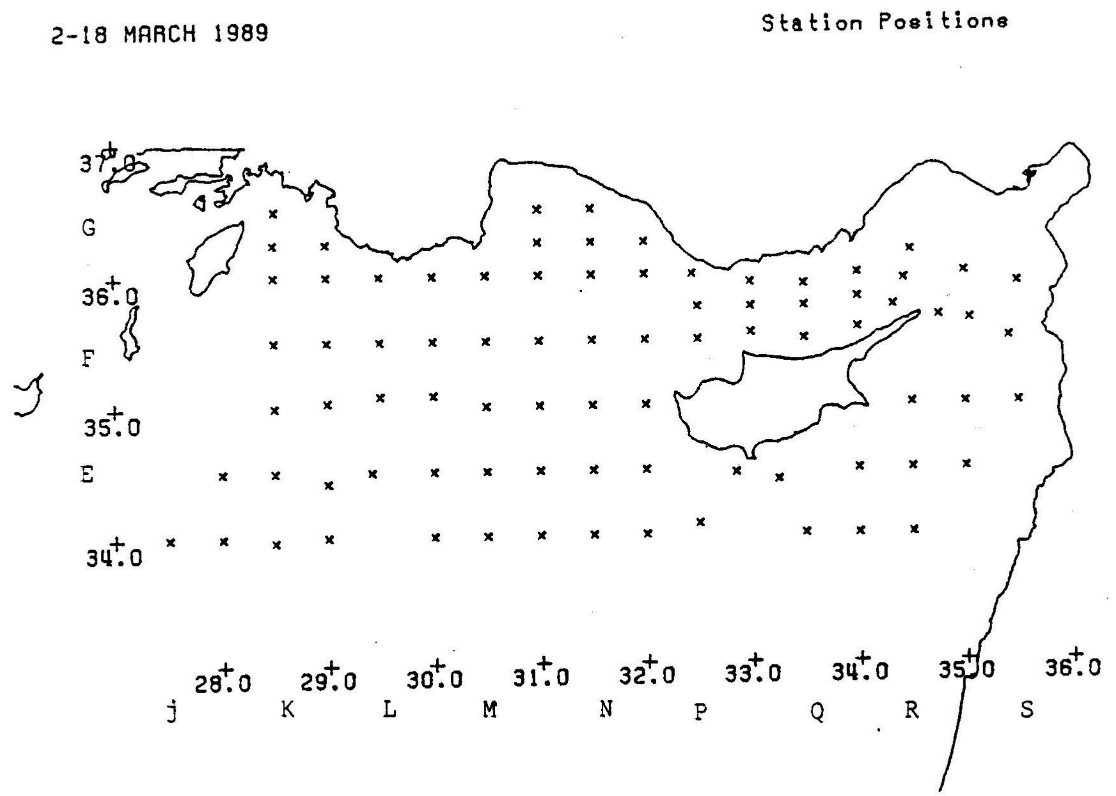
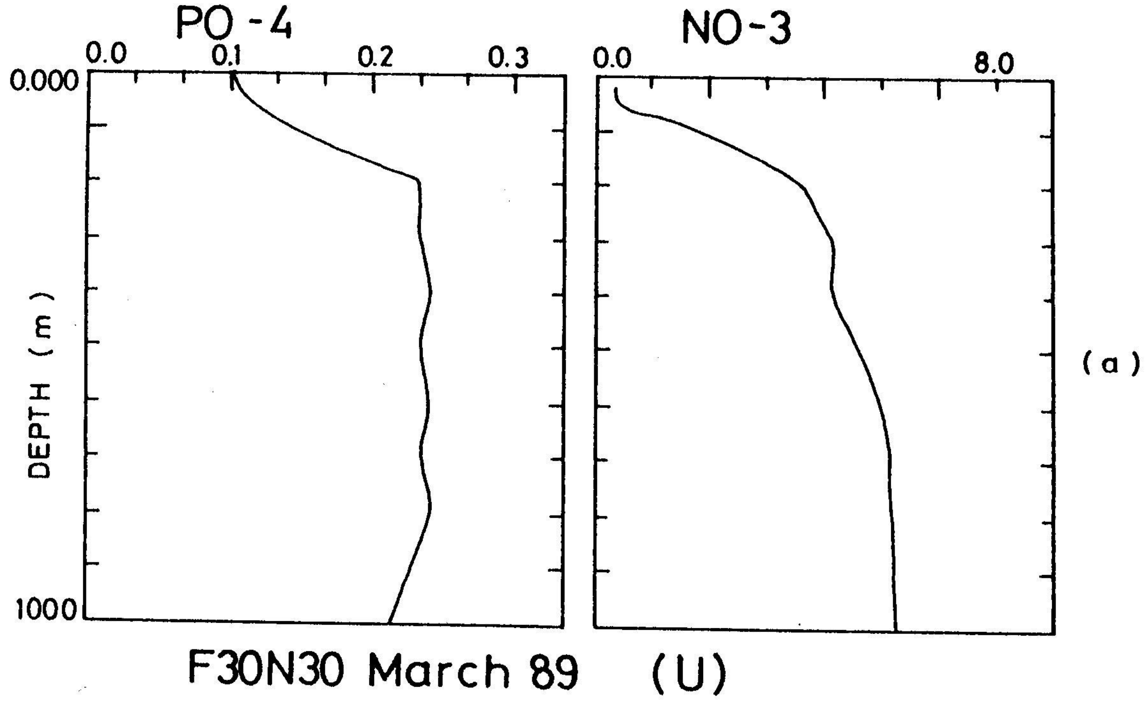

2-18 MARCH 1989
Station Positions
37.0
G
36.0
F
35.0
E
34.0
28.0
29.0
30.0
31.0
32.0
33.0
34.0
35.0
36.0
j
K
L
M
N
P
Q
R
S

Figure 1


PO -4
NO-3
0.0
0.1
0.2
0.3
0.0
8.0
0.000
1000
DEPTH (m)
(a)
F30N30 March 89 (U)

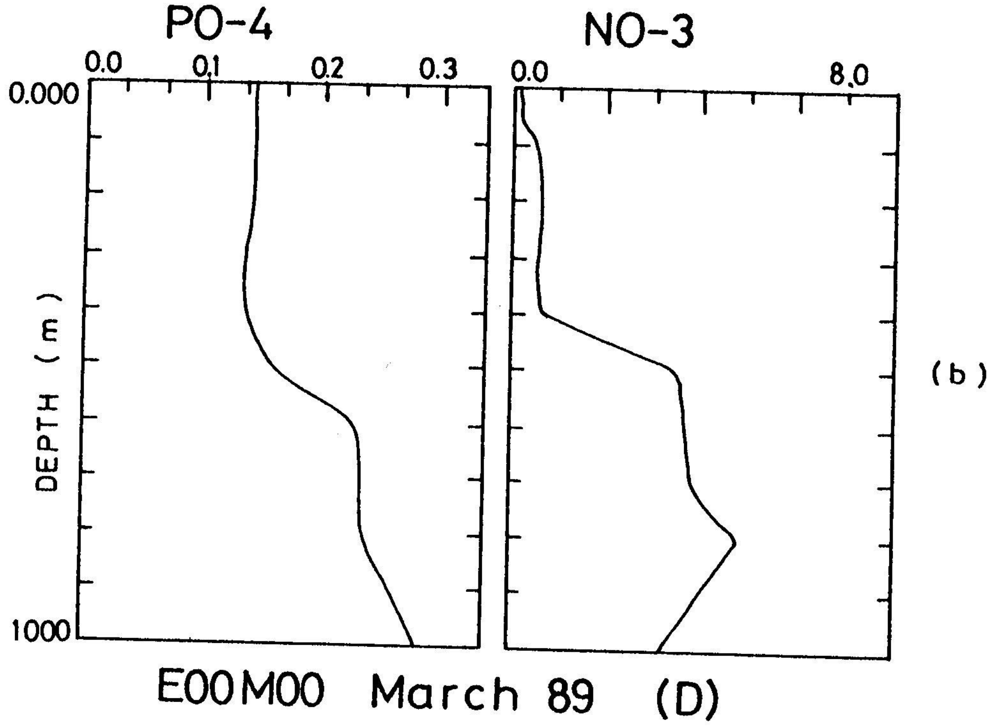

PO-4
NO-3
0.0
0.1
0.2
0.3
0.0
8.0
0.000
1000
DEPTH (m)
(b)
E00M00 March 89 (D)

Figure 2

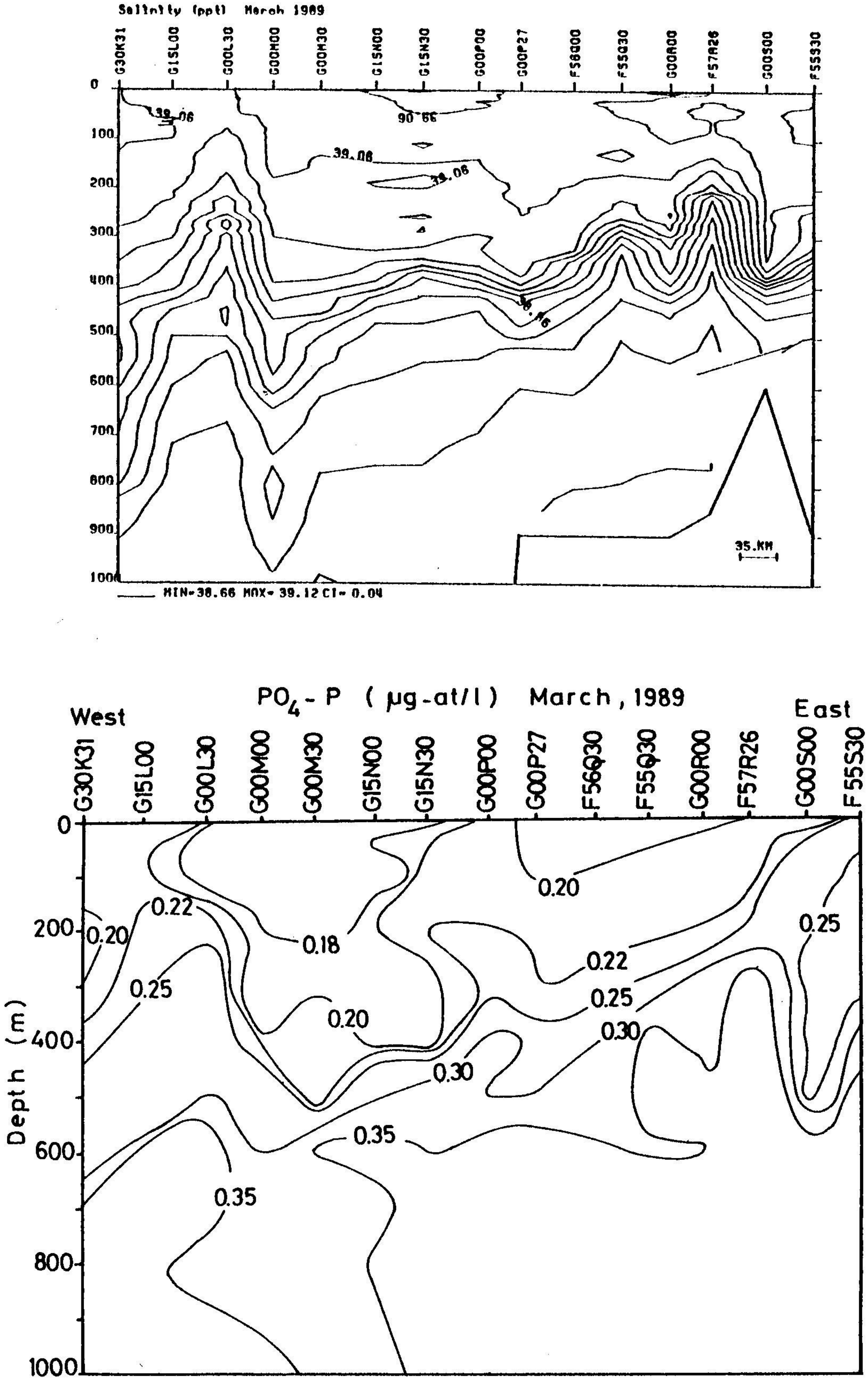
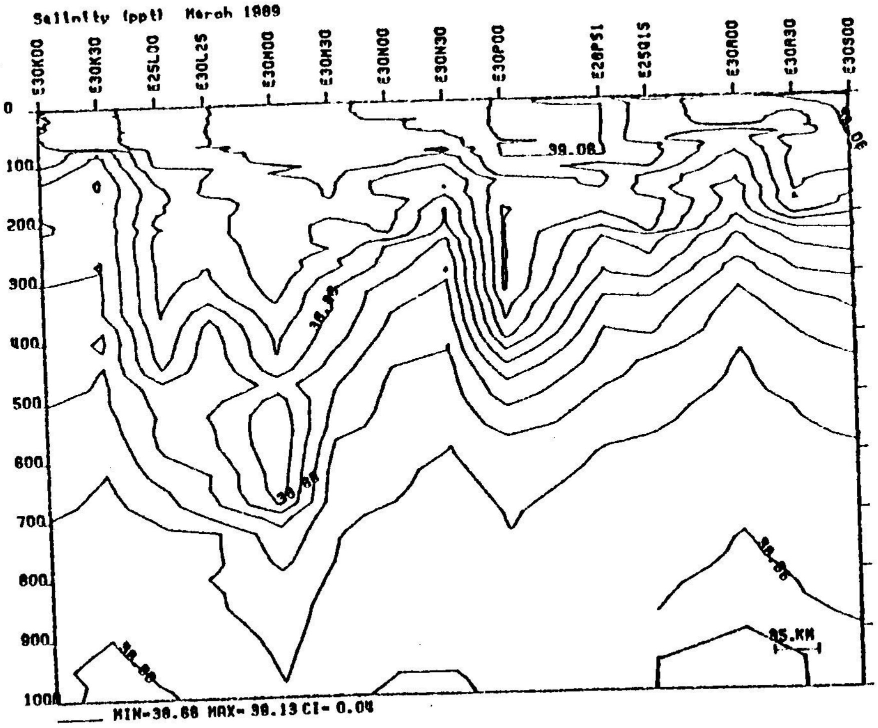

Salinity (ppt) March 1989
G30K31
G15L00
G00L30
G00M00
G00M30
G15N00
G15N30
G00P00
G00P27
F56Q00
F55Q30
G00R00
F57R26
G00S00
F55S30
MIN=38.66 MAX= 39.12 CI= 0.04
35.KM
PO4 - P (µg-at/l) March, 1989
West
East
Depth (m)
0.18
0.20
0.22
0.25
0.30
0.35

Figure 3



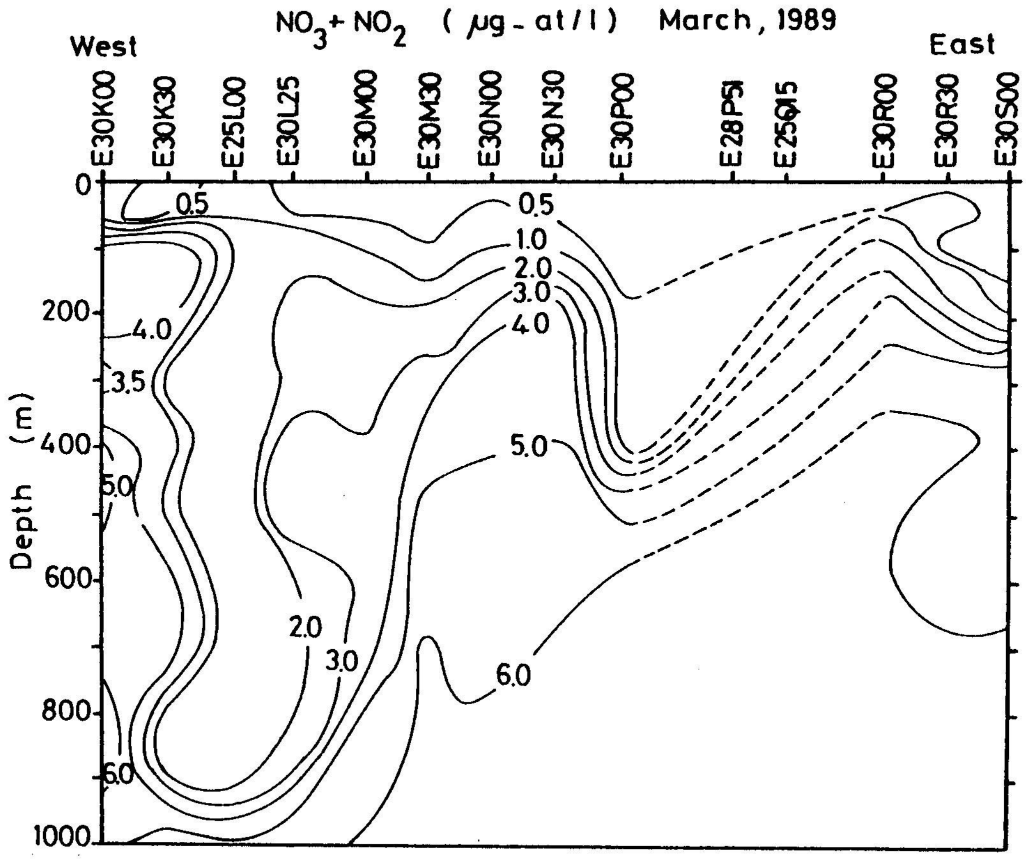


Figure 3 cont'd

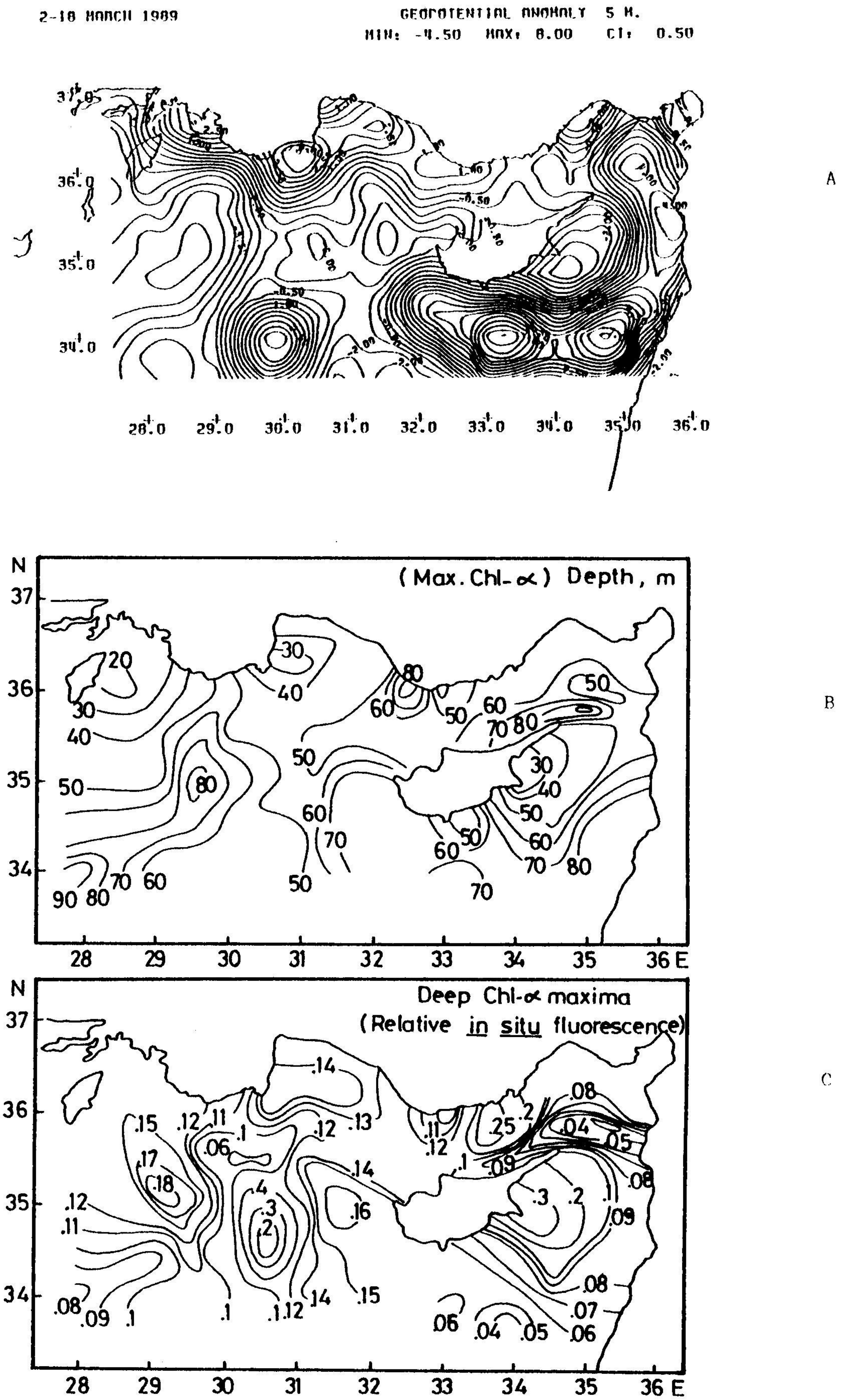

2-18 MARCH 1989
GEOPOTENTIAL ANOMALY 5 M.
MIN: -4.50 MAX: 8.00 CI: 0.50
36.0
35.0
34.0
28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0
A
(Max. Chl-α) Depth, m
N
37
36
35
34
28 29 30 31 32 33 34 35 36 E
B
Deep Chl-α maxima
(Relative in situ fluorescence)
N
37
36
35
34
28 29 30 31 32 33 34 35 36 E
C

Figure 4

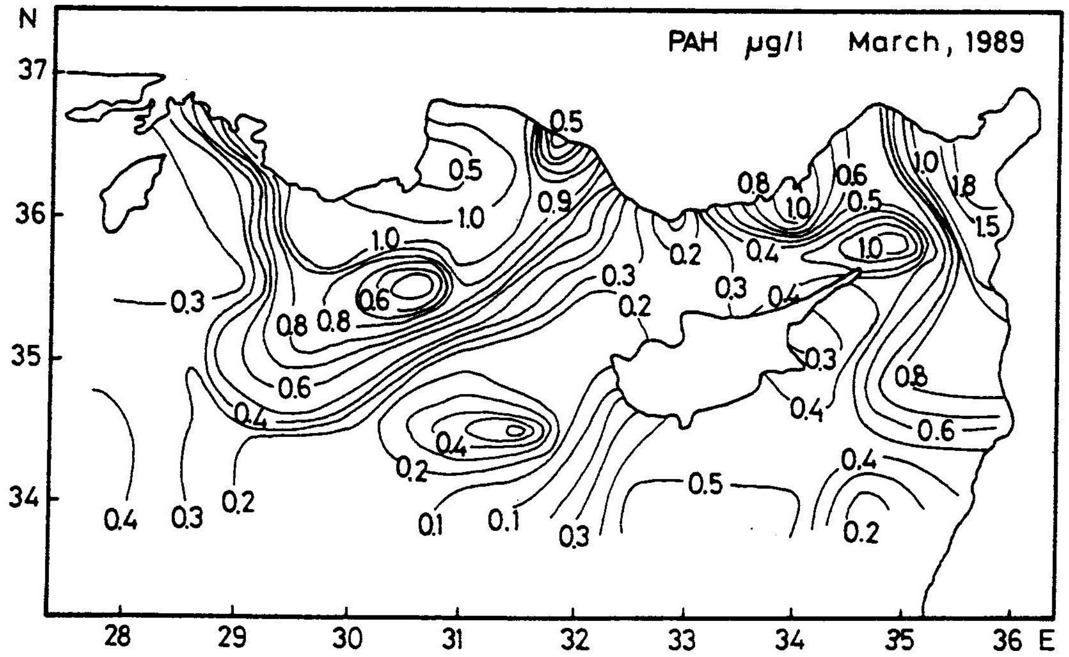


Figure 5