Nutrient Data from the Cruise of the Whiting

FRC 05-06

29-31 May 1979

by

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INTRODUCTION

Between 29 and 31 May 1979, water samples were collected for nutrient analyses on the NOAA Ship Whiting south of Martha's Vineyard across the continental shelf in the vicinity of the current meter moorings of the Nantucket Shoals Flux Experiment. Figure 1 shows station locations and the locations of current meter moorings along a line connecting stations 1 through 7. Samples for nutrient analyses were collected at stations 1 through 12, throughout the water column, to a depth of 200 m. Measurements of the concentrations of orthophosphorus (PO_4), reactive dissolved silicon (Si), nitrite (NO_2), nitrate (NO_3), and ammonium nitrogen (NH_4) were made. Ammonium nitrogen analyses were limited to samples from stations 2 through 6. Determinations of temperature and salinity were made by the Fisheries Oceanography Investigation (NMFS, Woods Hole) at these same stations and depths.

METHODS OF ANALYSES

Shortly after collection, seawater samples for nutrient analyses were pressure-filtered through precombusted glass fiber filters (Whatman GF/F, effective retention 0.7 μm) and the filtrate collected directly in acid-cleaned 30 ml polyallomer tubes, or acid-cleaned serum bottles in the case of the samples for ammonium nitrogen analyses. Ammonium samples were preserved with phenol-alcohol and frozen (Degobbis, 1973). All other samples were also immediately frozen and subsequently transported to the NMFS Laboratory at Sandy Hook, New Jersey for analyses.

Measurements of orthophosphorus, reactive dissolved silicon, nitrite, and nitrate were made on thawed samples with a Technicon industrial auto-analyzer. Nitrite and nitrate were measured using the methods of Wood et al. (1964) as modified by Stainton (1974). The inorganic phosphorus analysis utilized procedures after those of Murphy and Riley (1962). The reactive dissolved silicon procedure was based on that of Mullin and Riley (1965). The ammonium nitrogen analysis follow that of Solorzano (1969) as modified by Liddicoat et al. (1975).

RESULTS

Station locations, depths, and times of occupation are listed in Table I. Table II lists station numbers, depths, sample identification numbers, and concentrations of nutrients in micro-moles of N, P, and Si per liter (μM/L). DIN equals total dissolved inorganic nitrogen (ammonium + nitrite + nitrate).

Profiles of nutrient concentrations along the two transects on which nutrient samples were taken are shown in Figures 2-10. Figures 2-6 represent sections along the line of current meter moorings and Figures 7-10 sections along one of the two parallel transects through stations for which we have nutrient data.

Concentrations of NO_3, Si, and PO_4 in surface waters generally decreased seaward (Table II), and below 35 m progressively increased seaward with depth on both transects (Figures 3, 5, 6, 8, 9, 10). This pattern was interrupted along the current meter mooring transect by a nutrient-impoverished region throughout the depth of the water column at station 5 with the exception of

an area of elevated values at the 10-15 m level (Figures 3, 5, 6). The highest values of NO_3 (22.6 µM/L), Si (5.6 µM/L), and PO_4 (0.83 µM/L) measured on this transect occurred in the deepest water sampled (200 m) at station 2. The highest value of NO_3 measured (24.3 µM/L) occurred in the deepest water sampled on the second transect (110 m at station 12). The highest silicate value measured along this line (6.6 µM/L) also occurred at this station and depth. Values of PO_4 measured on this section were similarly observed to be highest (0.58-0.68 µM/L) in the deeper water at station 12 (Table II). The general pattern observed for NO_3, Si, and PO_4 along both sections was one in which the highest concentrations occurred in the deeper waters at the seaward ends of transects.

NH_4 values were also generally highest in the deepest waters (Figure 4). Distributions of NH_4 and NO_2 did not, however, closely follow the pattern of the other measured nutrients. While NO_2 concentrations were impoverished at station 5, they were not highest in the deepest waters as was the case for nitrate, phosphate, and silicate. The maximum value of NO_2 measured (0.49 µM/L) occurred at 40 m at station 3. The maximum NO_2 concentration (0.39 µM/L) observed on the second transect (stations 8-14) occurred at 70 m at station 12, roughly corresponding to the location of the NO_2 maximum on the first cross shelf section (stations 1-7), indicating the possible presence of a core of NO_2 rich water crossing through both sections (Figures 2, 7). The measured NH_4 maximum of 9.57 µM/L occurred at 30 m at station 2. Elevated NH_4 values (4.62 and 6.45 µM/L) in the surface water at stations 3 and 4 may have been an artifact or the result of biological activity, but the lack of supporting chlorophyll or productivity data make evaluation of their significance difficult.

REFERENCES

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1974. Simple, efficient, reduction column for use in the automated determination of nitrate in water. Anal. Chem. 46: 1616.

Wood, F. D., F. A. J. Armstrong, and F. A. Richards.

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TABLE I

Whiting Cruise FRC 05-06, 29-31 May 1979. Stations at which samples for nutrient analyses were taken.

Station Number	Latitude North	Longitude West	Station Depth (m)	Date 79/5/30 Hour
1	39°46.0'	70°26.2'	1828	0255
2	39°56.5'	70°23.5'	687	0520
3	40°07.0'	70°19.5'	116	0740
4	40°17.0'	70°17.6'	90	0911
5	40°25.4'	70°14.2'	72	1036
6	40°35.1'	70°10.8'	57	1245
7	40°45.9'	70°07.5'	39	1401
8	40°45.8'	69°54.0'	36	1520
9	40°35.1'	69°57.8'	55	1655
10	40°25.9'	70°00.5'	70	1822
11	40°16.5'	70°03.2'	84	1955
12	40°07.4'	70°06.2'	120	2139

TABLE II

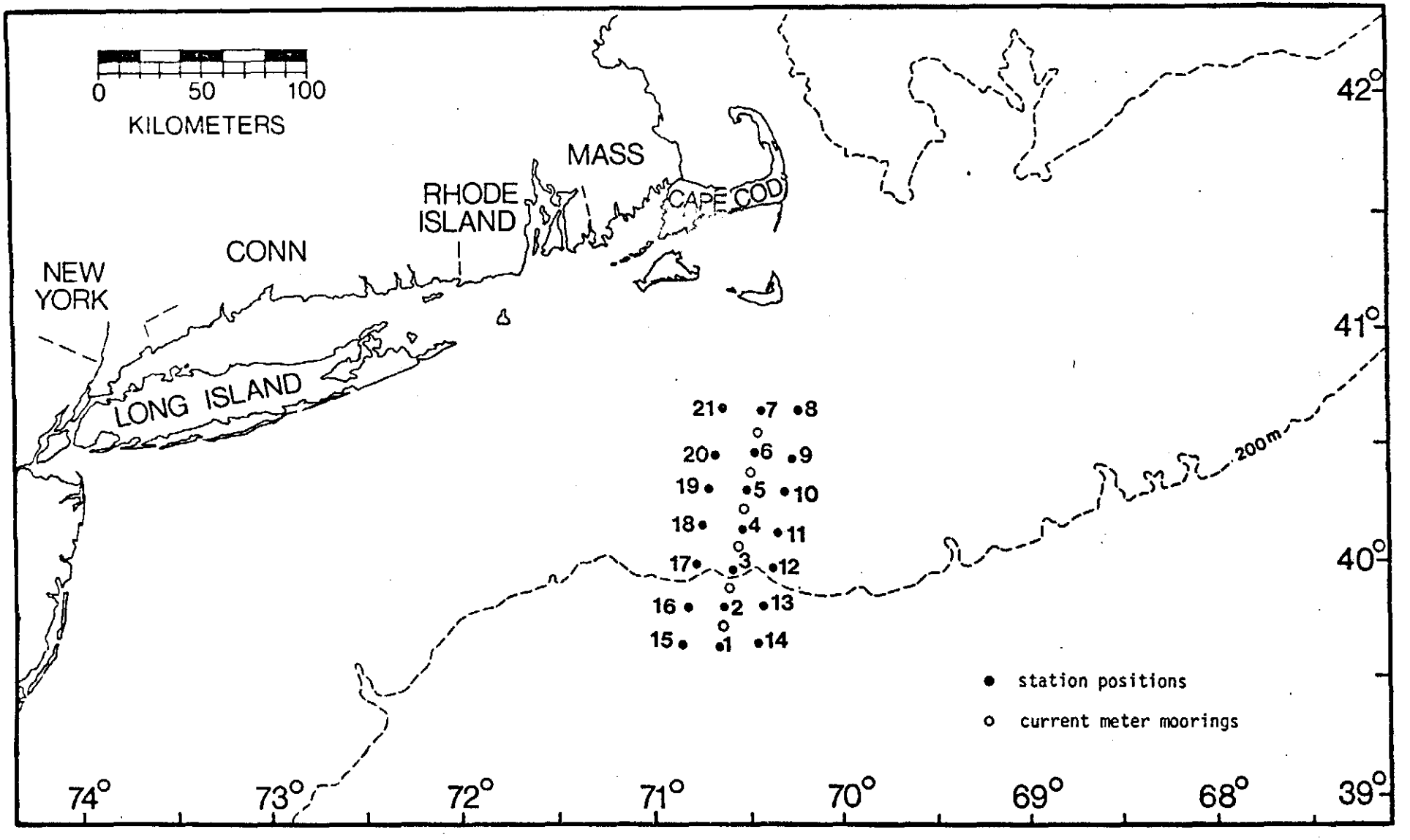
WHITING FRC 05-06 MAY 1979

NUTRIENTS
CONCENTRATION IN uM/L

STATION	DEPTH	SAMPLE	PO4	SI	NO2	NO3-	NH4	NO2+NO3	DIN
1	1	600	0.071	0.24	0.000	0.00		0.00	
1	10	601	0.071	0.70	0.000	0.00		0.00	
1	20	602	0.053	0.20	0.000	0.00		0.00	
1	30	603	0.088	0.00	0.000	0.00		0.00	
1	40	604	0.293	0.54	0.201	2.39		2.59	
1	60	605	0.417	1.67	0.422	8.32		8.74	
1	80	606	0.302	0.90	0.045	6.14		6.18	
1	100	607	0.444	2.08	0.045	11.54		11.59	
1	125	608	0.568	2.67	0.050	14.79		14.84	
1	200	609	0.817	5.43	0.050	22.25		22.30	
2	1	610	0.080	0.00	0.000	0.00	1.71	0.00	1.71
2	10	611	0.080	0.36	0.000	0.00	3.98	0.00	3.98
2	20	612	0.133	0.74	0.125	0.21	6.27	0.34	6.62
2	30	613	0.444	2.10	0.150	10.11	9.57	10.26	19.84
2	40	614	0.444	1.90	0.080	10.28	9.11	10.36	19.48
2	60	615	0.488	1.96	0.075	11.38	8.54	11.45	20.00
2	80	616	0.426	1.96	0.065	11.61		11.68	
2	100	617	0.462	2.08	0.055	12.73	7.06	12.78	19.85
2	125	618	0.453	2.26	0.055	12.12		12.18	
2	200	619	0.826	5.63	0.050	22.60		22.65	
3	1	620	0.382	0.00	0.000	0.00	4.62	0.00	4.62
3	10	621	0.026	0.00	0.000	0.13	1.48	0.13	1.61
3	20	622	0.071	0.00	0.040	0.06	3.63	0.10	3.73
3	30	623	0.533	0.92	0.382	2.20	4.44	2.59	7.03
3	40	624	0.302	1.01	0.487	4.19	2.06	4.68	6.74
3	50	625	0.400	1.31	0.201	7.55	2.33	7.75	10.09
3	60	626	0.426	1.92	0.075	8.87	2.53	8.95	11.48
3	70	627	0.400	1.51	0.050	9.19	2.68	9.24	11.92
3	80	628	0.400	1.53	0.050	9.19		9.24	
3	110	629	0.586	4.59	0.080	14.17		14.25	
4	1	630	0.088	0.00	0.000	0.00	6.45	0.00	6.45
4	10	631	0.053	0.00	0.000	0.00	3.89	0.00	3.89
4	20	632	0.053	0.00	0.000	0.00	3.18	0.00	3.18
4	25	633	0.133	0.15	0.000	0.00	3.15	0.00	3.15
4	30	634	0.204	0.47	0.025	0.18	2.81	0.20	3.02
4	35	635	0.444	1.26	0.125	3.41	4.39	3.54	7.93
4	40	636	0.462	1.99	0.135	3.70	3.98	3.83	7.82
4	50	637	0.497	1.92	0.150	4.16		4.32	
4	60	638	0.533	2.24	0.201	4.79		4.99	
4	90	639	0.551	3.96	0.352	7.51		7.86	
5	1	670	0.088	0.00	0.000	0.00	0.83	0.00	0.83
5	5	671	0.088	0.00	0.000	0.00	1.23	0.00	1.23
5	10	672	0.382	2.05	0.095	2.75	1.28	2.85	4.13
5	15	673	0.453	1.92	0.100	2.75	1.21	2.85	4.06
5	20	674	0.160	0.13	0.000	0.00	1.20	0.00	1.20
5	25	675	0.222	0.38	0.000	0.00	0.46	0.00	0.46
5	30	676	0.000	M	M	M	0.98		
5	35	677	0.000	0.00	0.000	0.00		0.00	
5	40	678	0.000	0.00	0.000	0.00		0.00	
5	70	679	0.000	0.00	0.000	0.20		0.20	
6	1	680	0.152	0.00	0.000	0.00	1.07	0.00	1.07
6	10	681	0.171	0.48	0.000	0.00	1.11	0.00	1.11
6	20	682	0.448	2.37	0.076	2.06	2.03	2.14	4.18
6	30	683	0.487	2.24	0.081	2.59	3.58	2.67	6.25
6	40	684	0.496	2.26	0.076	2.72	2.74	2.80	5.55
6	55	685	0.506	2.96	0.076	3.13	3.14	3.21	6.35
7	1	686	0.286	0.55	0.000	0.00		0.00	
7	10	687	0.152	0.00	0.000	0.00		0.00	
7	20	688	0.286	1.25	0.051	0.89		0.94	
7	30	689	0.334	2.02	0.061	1.06		1.12	
7	40	690	0.315	1.22	0.076	1.14		1.22	
8	1	691	0.248	0.55	0.066	1.08		1.14	
8	5	692	0.324	0.87	0.081	1.14		1.22	
8	10	693	0.382	1.04	0.076	1.35		1.42	
8	20	694	0.382	1.11	0.087	1.36		1.45	
8	30	695	0.248	0.69	0.046	1.10		1.14	
9	1	696	0.143	0.52	0.040	1.03		1.07	
9	10	697	0.257	1.71	0.097	2.29		2.39	
9	20	698	0.257	1.39	0.092	2.20		2.29	
9	30	699	0.236	0.74	0.091	2.02		2.11	
9	40	700	0.256	1.07	0.070	2.41		2.48	
9	50	701	0.493	2.37	0.121	3.19		3.32	
10	1	702	0.059	0.26	0.000	0.00		0.00	
10	10	703	0.059	0.16	0.000	0.00		0.00	
10	20	704	0.236	0.74	0.065	1.72		1.79	
10	30	705	0.345	1.98	0.101	3.66		3.76	
10	40	706	0.394	2.15	0.121	4.05		4.18	
10	50	707	0.394	2.47	0.111	4.02		4.13	
10	60	708	0.444	5.54	0.131	4.29		4.42	
11	1	709	0.148	2.83	0.000	0.00		0.00	
11	10	710	0.049	0.16	0.000	0.00		0.00	
11	20	711	0.444	2.37	0.121	4.13		4.25	
11	30	712	0.463	2.90	0.131	5.10		5.23	
11	50	713	0.444	3.03	0.177	5.50		5.68	
11	60	714	0.503	3.06	0.156	6.13		6.29	
11	70	715	0.562	3.74	0.182	7.63		7.82	
11	80	716	0.651	5.37	0.359	13.16		13.53	
12	1	721	0.000	0.42	0.000	0.00		0.00	
12	10	722	0.000	0.00	0.000	0.00		0.00	
12	20	723	0.059	0.09	0.000	0.00		0.00	
12	30	724	0.197	0.81	0.060	0.92		0.98	
12	50	717	0.631	3.58	0.344	11.11		11.46	
12	70	718	0.681	3.74	0.389	16.53		16.92	
12	80	719	0.582	3.61	0.080	19.30		19.38	
12	110	720	0.671	4.58	0.207	24.26		24.47	

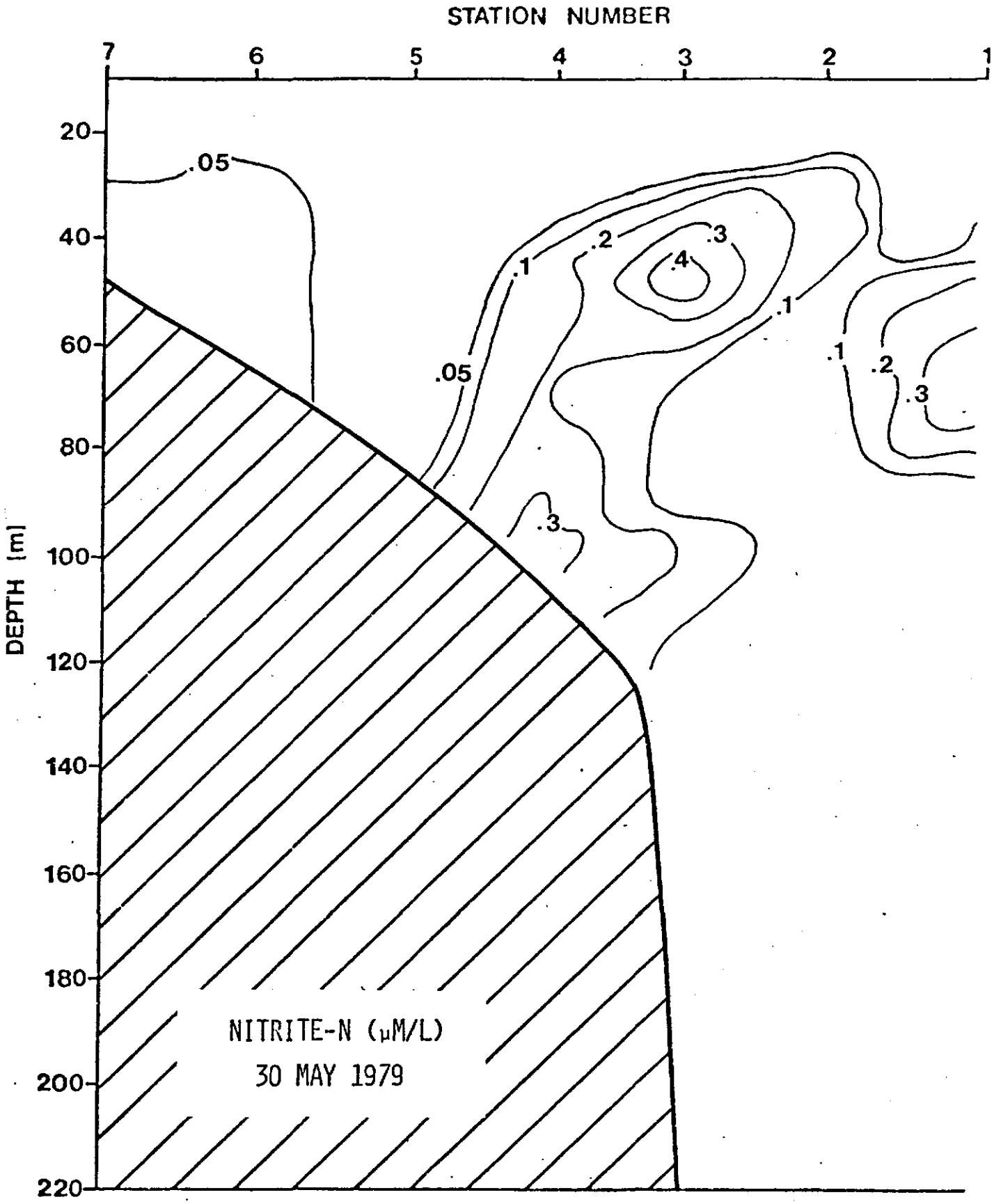
DONE

M=missing analysis



Positions of oceanographic stations occupied on cruise FRC 05-06, by the NOAA Ship Whiting, 29-31 May 1979.

FIGURE 1.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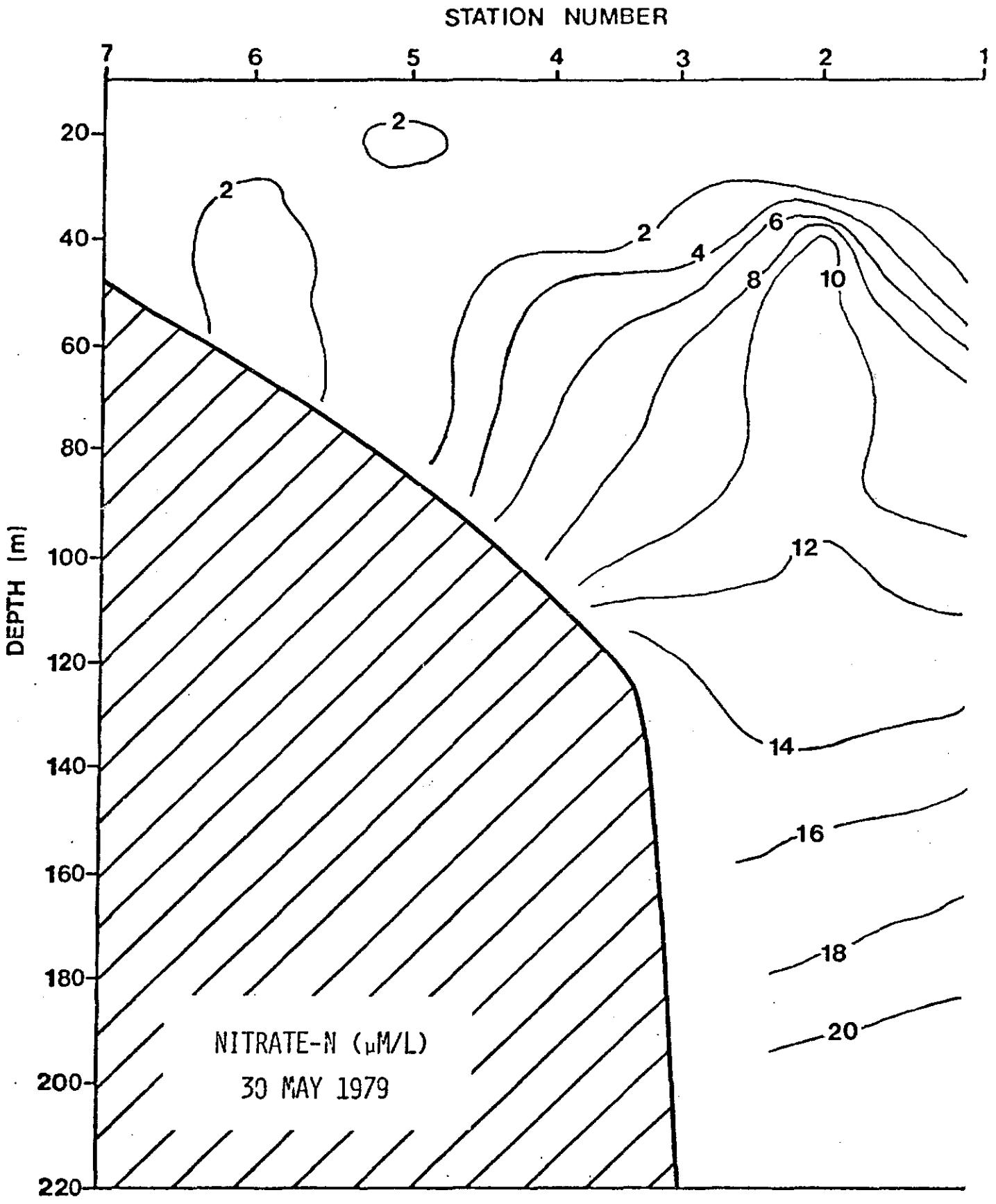
NITRITE-N (µM/L)
30 MAY 1979

FIGURE 2.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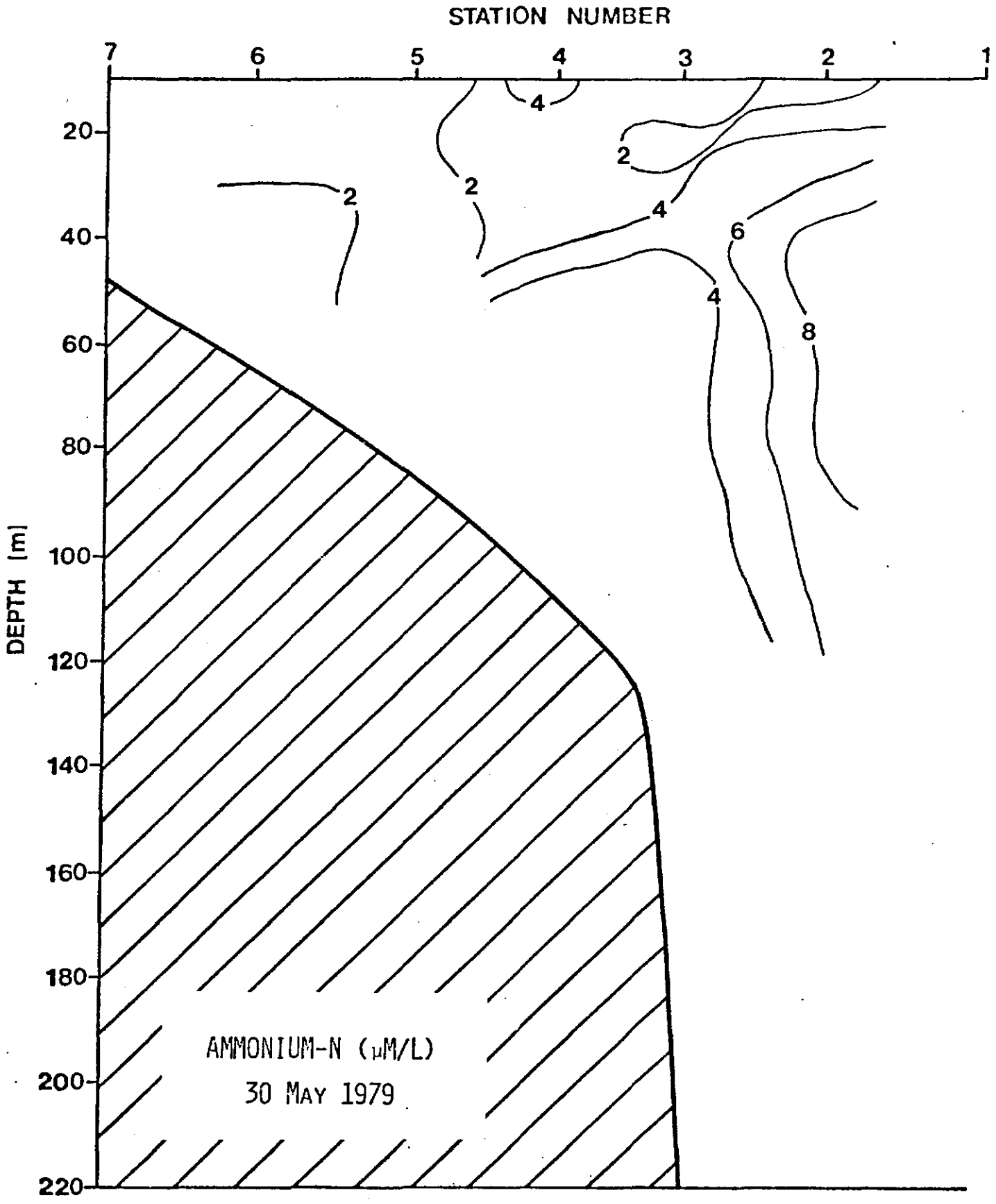
20
NITRATE-N (µM/L)
30 MAY 1979

FIGURE 3.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DEPTH (m)
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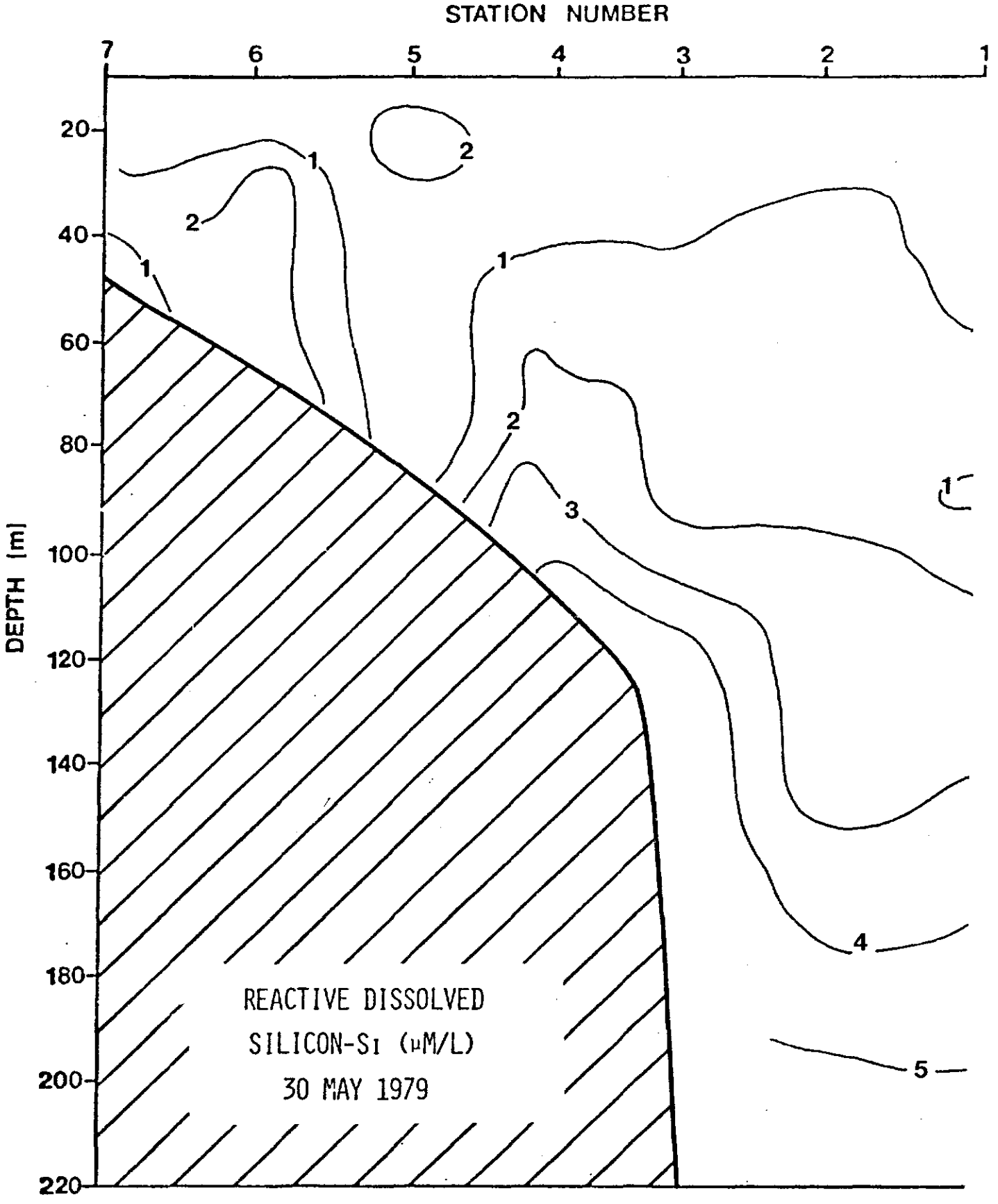
AMMONIUM-N (µM/L)
30 MAY 1979

FIGURE 4.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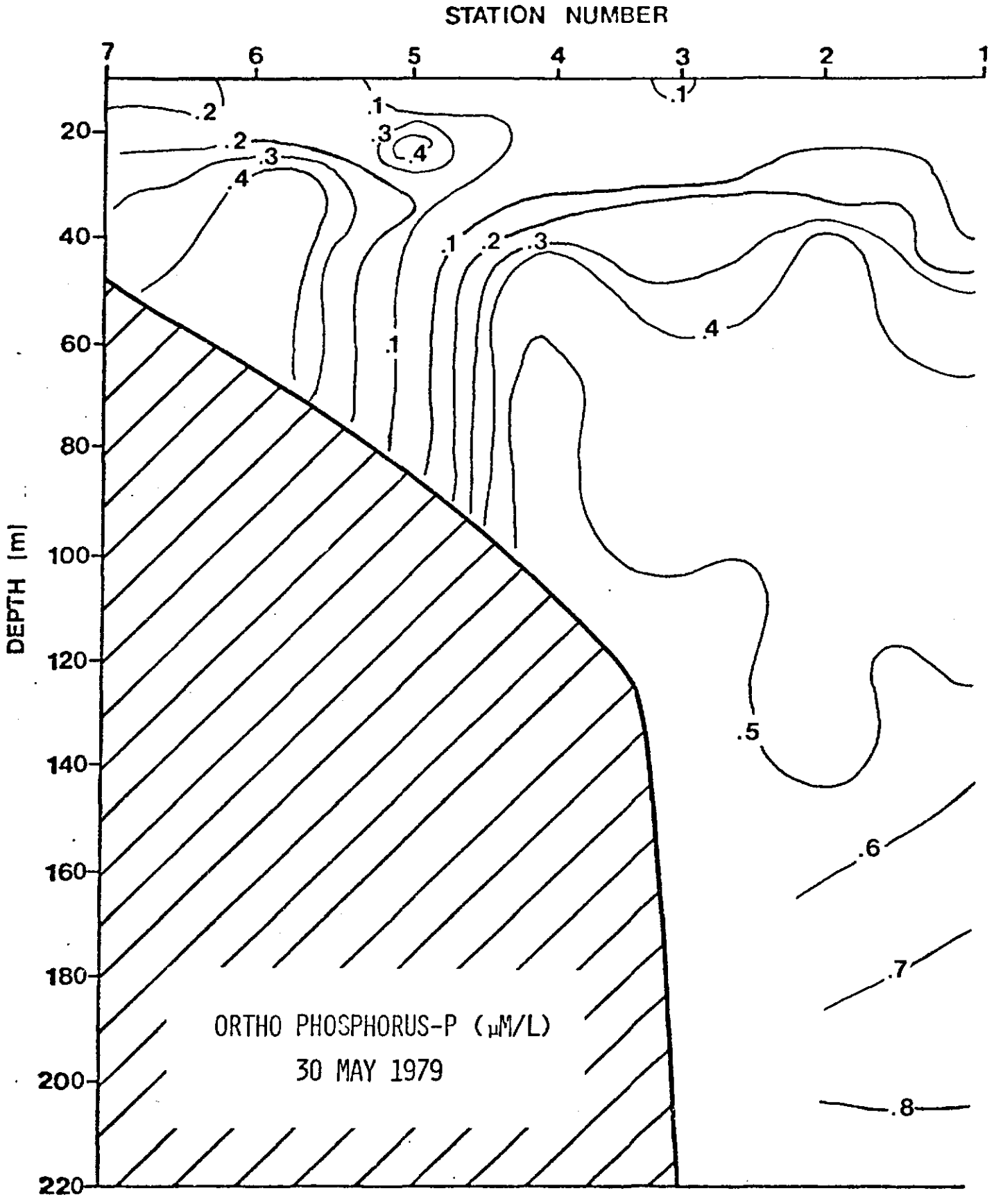
REACTIVE DISSOLVED
SILICON-Si (µM/L)
30 MAY 1979

FIGURE 5.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DEPTH (m)
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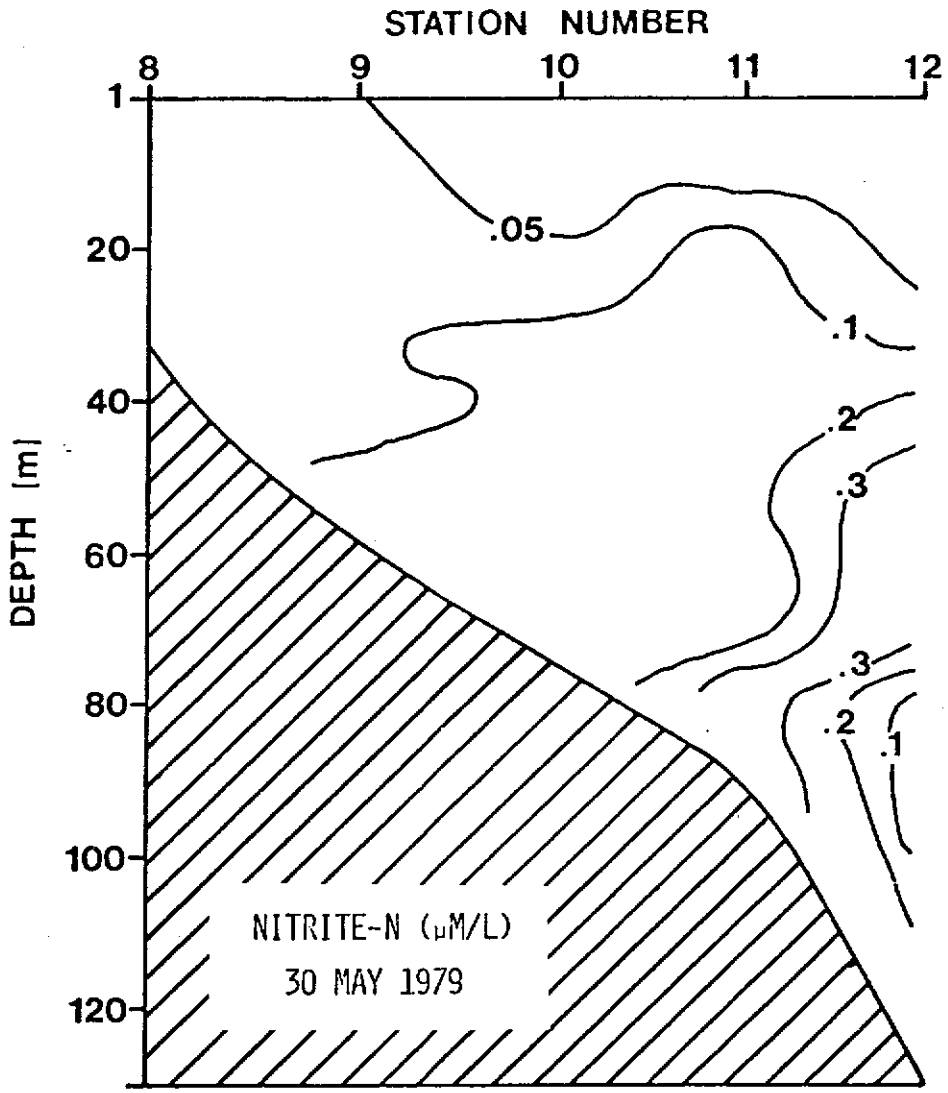
ORTHO PHOSPHORUS-P (µM/L)
30 MAY 1979

FIGURE 6.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DEPTH (m)
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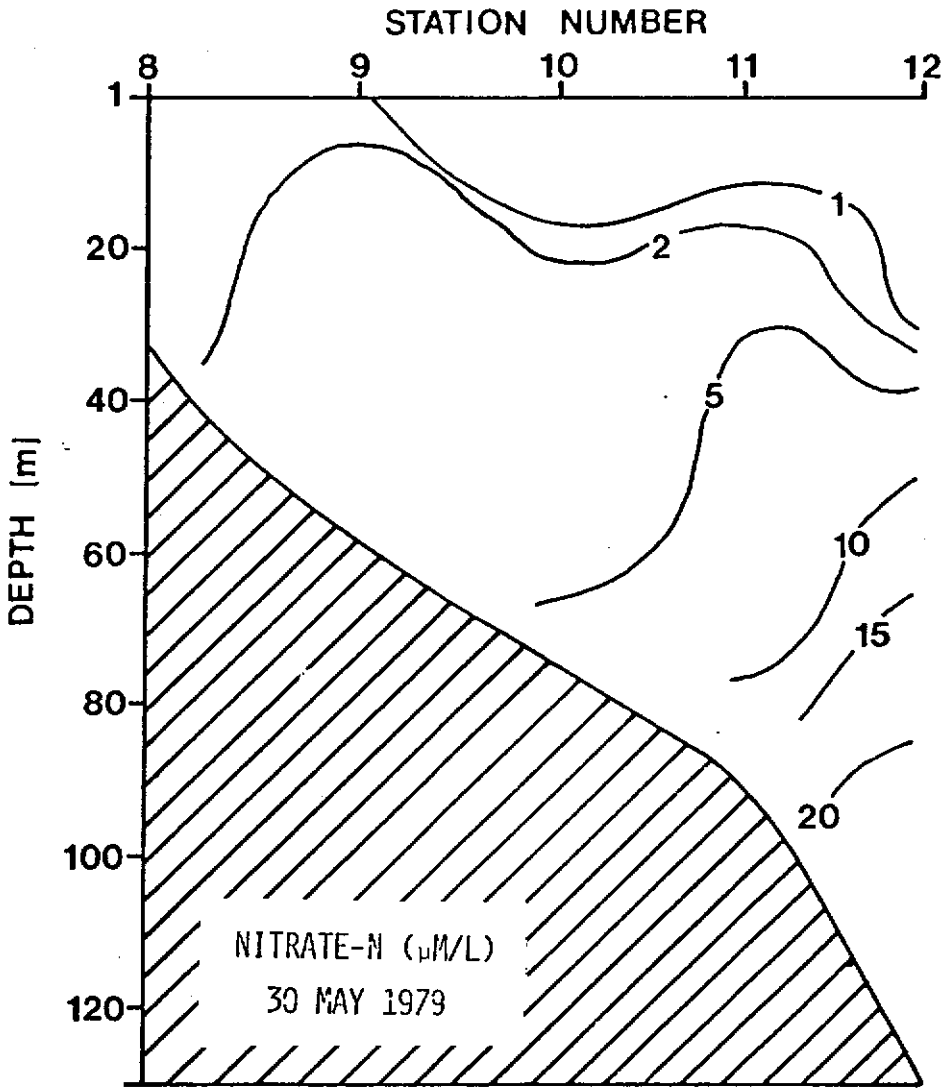
NITRITE-N (µM/L)
30 MAY 1979

FIGURE 7.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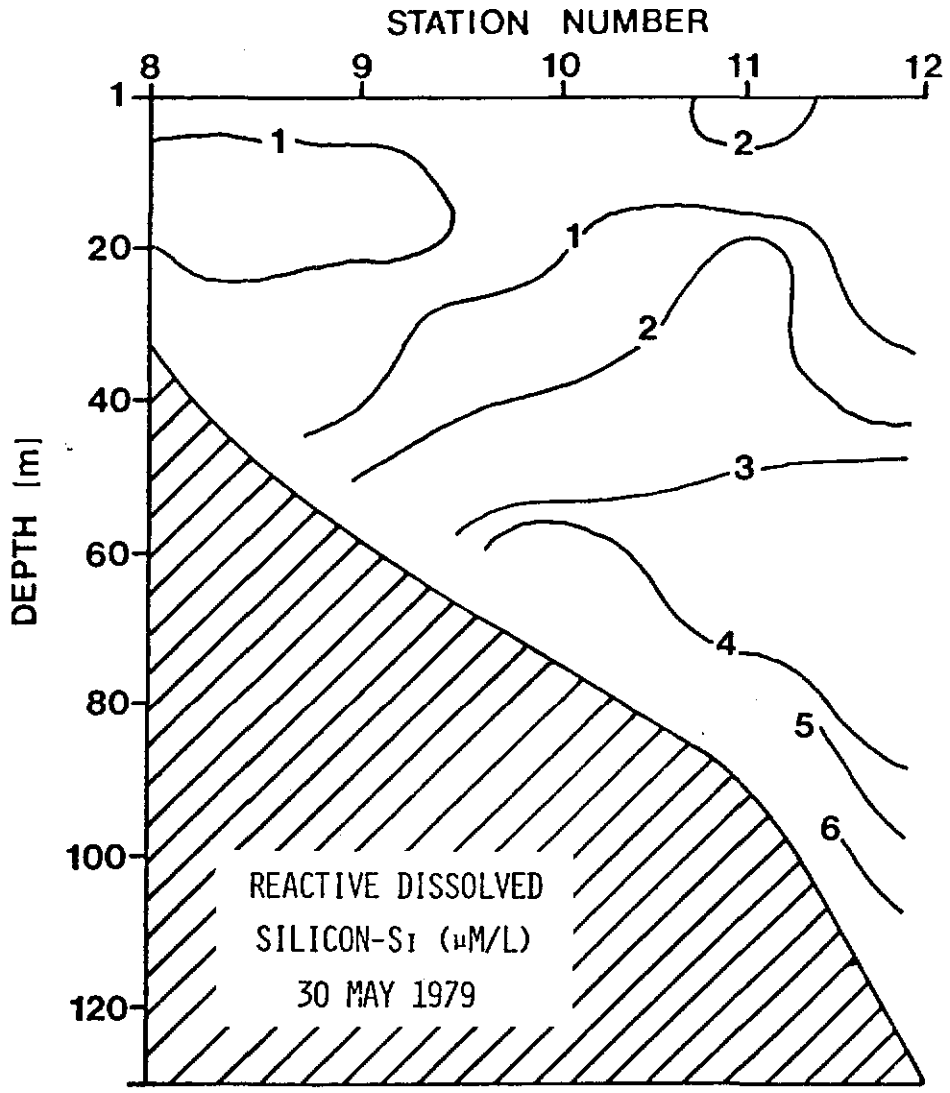
NITRATE-N (µM/L)
30 MAY 1979

FIGURE 8.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DEPTH (m)
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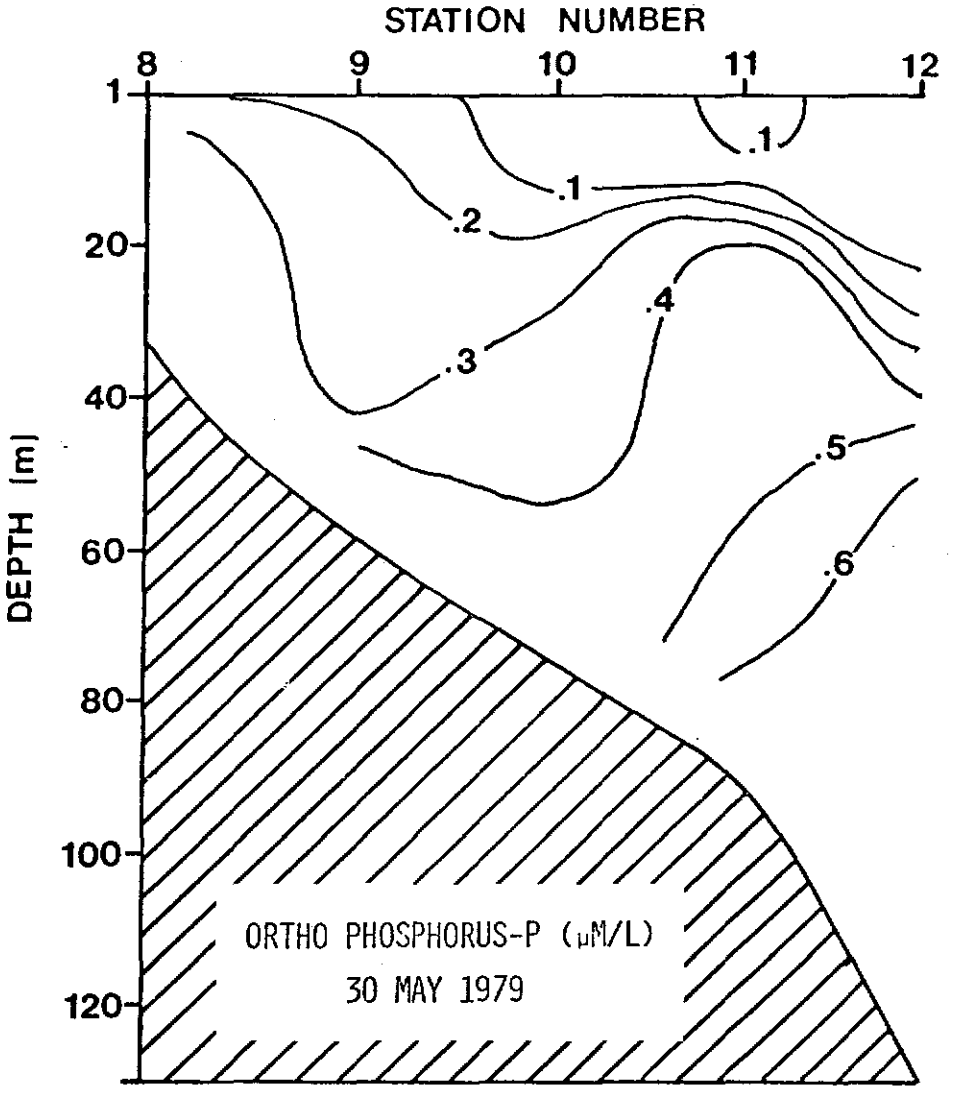
6
REACTIVE DISSOLVED
SILICON-Si (µM/L)
30 MAY 1979

FIGURE 9.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10
11
12
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20
40
60
80
100
120
DEPTH (m)
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.1
.2
.3
.4
.5
.6
ORTHO PHOSPHORUS-P (µM/L)
30 MAY 1979

FIGURE 10.