XVI. STD OBSERVATION IN GH77-1 CRUISE

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Introduction

Sea-water environment is one of the important basic data in considering the history of geologic development, genesis and exploitation of manganese nodule deposits. For this reason, a preliminary observation by STD graphic recorder was carried out in this cruise as the preparation for the future full-scaled studies. Some results of them are reported here.

Instrumentation and observation method

The instrument used was the Model 9060 Graphic Self-contained Salinity/Temperature/ Depth Recorder of the Plessey Environmental Systems, U.S.A. This can automatically and continuously record the salinity, temperature and water depth on a graph, during its down and up travel in the water.

In practice, the instrument was hung with a deviced attachment at the wire rope about 20 m above a larger type Okean grab sampler at the end, and the measurement was done simultaneously with the bottom sampling, without any difficulties (Fig. XVI-1).



Fig. XVI-1 Model 9060 Graphic STD Recorder hung on the wire rope.

Stations

25 main sampling stations in the present survey area (7°-11°N, 175°-179°W) were arranged at each crossing of main latitude and longitude lines spaced with 1° span. Among them STD measurements were made at five stations (St. 706-St. 710) along the longitude 178°W.

Results

An example of the obtained record is shown in Fig. XVI-2. As seen in the figure, though there are sometimes unstabilities in record as the abrupt step like changes on the lines, these were read by making correction. The reading was done in every 50 m interval at the depth from surface to 400 m, in every 100 m interval at 400-1,000 m, in every 250 m interval at 1,000-2,000 m and in every 500 m interval below than 2,000 m.

From the reading data of water depth, temperature and salinity, ΔD and density in situ to estimate the current direction and velocity as the essential purpose of the present study were calculated, following the manual of STD observation by the Hydrographic Department (Table XVI-1).

Characteristic point is that the values of water depth by the STD record are always smaller than that by PDR record, being 0.7–2.0% more in the range of 5,000–6,000 m depth.

From the above calculated data, distribution patterns of temperature (Fig. XVI-3), salinity (Fig. XVI-4) and current direction of water (Fig. XVI-5) were depicted on the profile along the 178°W longitudinal line. Among them the current direction was tentatively estimated as gross current direction of water mass by deducing from differences in the relative values of the density in situ between the upper and lower depth parts defined each as the same depth at two observational stations. The characteristic points of the three profiles are summarized as follows:

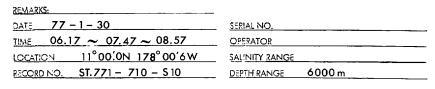
Temperature distribution

Temperature of this area is about 26 °C at the surface, which decreases abruptly around 100 m depth down to 15 °C at around 200 m depth (thermocline), and becomes about 8 °C at the depth of 400-500 m. Below the depth of 1,500 m, the temperature grades down with very slight changes, from about 3 °C to 1.4-1.5 °C at the depth of 5,000 m. But it again rises very slightly further below 5,000 m. Differing from the general tendency, the temperature along the vertical column of St. 708 shows slightly higher values than those of other stations.

Salinity distribution

Salinity of the survey area ranges from 33.76% to 34.45%. There are recognized two layers higher than 34%, both at the depths of 50–200 m and 200–350 m. The former corresponds to the lower half part of the thermocline in the northern area and upper half part of it in the southern area. The latter layer of higher salinity exists only in the southern area (St. 706 and St. 707), and thins out northward. Between these two layers, except around St. 707, a water mass of lower salinity of the level of 33.8% (with thickness of about 100 m) is intercalated, forming a sort of halocline zone.

Below the depth of 1,000 m, there is recognized a relatively higher salinity part at St. 708 (2,000-3,000 m), and relatively lower salinity parts at St. 707 (1,000-2,000 m), St. 710 (2,000-3,000 m), and Sts. 709 and 707 (4,500-5,500 m). The higher salinity part



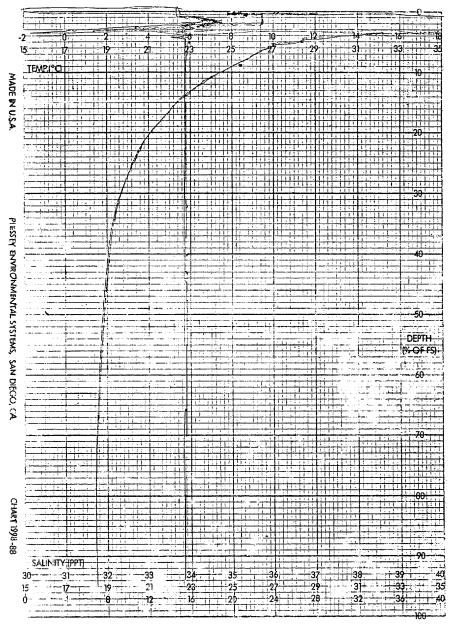


Fig. XVI-2 A graph record of STD observation.

Table XVI-1 Reading and calculated values from STD record.

	St.	St. GH-771-706-S6 06°59.2′N 178°0 1977 028 18.13 ~ WIND NE-9 m	706~S6 1 178°00.1 W 18.13~20.50 E-9 m SWEI	GH-771-706-S6 06°59.2'N 178°00.1 WD 5,225 m (by PDR) 1977 028 18.13~20.50 WIND NE-9 m SWELL about 3 m	'R)			St. GH-771-707-S7 08°00.0'N 178°0 1977 029 03.06~ WIND E-8 m S'	GH-771-707-S7 98°00.0°N 178°01.1 W 1977 029 03.06~05.48 WIND E-8 m SWELI	GH-771-707-S7 08°00.0°N 178°01.1 WD 5,590 m (by PDR) 1977 029 03.06~05.48 WIND E-8 m SWELL about 3 m	DR)
Depth	Temp	S	ôt	ΔSt	Qγ	Depth	Temp	S	δt	ΔSt	ďΡ
Œ	(၃ (၃)	(%)	(g/cm ³)	$(10^{-5} \text{ cm}^3/\text{g})$	(Dyn.m.)	(m)	(30)	(%)	(g/cm ³)	(10 ⁻⁵ cm³/g)	(Dyn.m.)
0	27.95	33.88	21.55	625	0.000	0	25.25	34.04	22.53	533	0.000
20	27.95	33.88	21.55	625	0.313	50	27.95	34.09	21.71	611	0.286
100	25.10	34,45	22.89	498	0.595	100	27.00	34.23	22.17	292	0.582
150	15.75	33.80	24.90	307	0.798	150	16.00	33.99	24.94	303	0.801
200	12.55	33.94	25.68	232	0.935	200	13.50	34.01	25.54	246	0.940
250	10.75	34.03	26.08	194	1.044	250	11.20	34.00	25.98	204	1.055
300	10.00	33.98	26.17	186	1.142	300	10.35	34.00	26.13	190	1.156
350	09.6	33.97	26.22	181	1.237	350	9.70	34.00	26.29	180	1.251
400	8.95	33.95	26.32	172	1.328	400	9.25	33.98	26.39	174	1.342
200	8.35	33.92	26.39	165	1.504	200	8.65	33.94	26.50	165	1.519
009	7.45	33.88	26.49	155	1.672	009	7.70	33.90	26.62	154	1.687
700	6.35	33.87	26.63	142	1.829	700	6.55	33.88	26.68	143	1.844
800	5.85	33.86	26.69	136	1.977	800	6.05	33.86	26.72	137	1.993
900	5.35	33.85	26.74	132	2.121	900	5.35	33.82	26.75	134	2.138
1000	4.85	33.85	26.79	127	2.260	1000	4.85	33.79	26.83	131	2.279
1250	3.85	33.85	26.91	911	2.588	1250	3.95	33.77	26.91	123	2.620
1500	3.20	33.84	26.97	110	2.895	1500	3.25	33.78	26.96	116	2.942
1750	2.70	33.84	27.00	107	3.190	1750	2.75	33.79	26.99	111	3.248
2000	2.35	33.84	27.03	10	3.476	2000	2.40	33.80	27.06	108	3.543
2500	2.00	33.83	27.05	102	4.033	2500	5.00	33.84	27.07	101	3.824
3000	1.80	33.82	27.06	101	4.585	3000	1.85	33.84	27.07	100	4.095
3500	1.65	33.81	27.07	100	5.125	3500	1.70	33.83	27.07	100	4.632
4000	1.45	33.80	27.07	100	5.657	4000	1.55	33.81	27.07	100	5.167
4200	1.40	33.80	27.08	66	6.187	4500	1.40	33.80	27.07	100	5.704
2000	1.40	33.80	27.08	66	6.717	2000	1.40	33.76	27.04	103	6.249
2260	1.40	33.80	27.08	66	6.993	5500	1.45	33.76	27.03	104	908'9
						2660	1.50	33.78	27.04	103	6.975

Table XVI-1 (Continued)

AD 0.000 0.311 0.614 0.845 0.998 1.136 1.253 1.356 1.453 1.453 1.4640 1.819 1.819 1.989 2.151 2.303 2.447 2.789 3.110 3.416 3.711 4.803 5.325	ASt (10 ⁻⁵ cm ³ /g) 621 621 623 331 297 245 245 245 210 191 184 174 165 165 147		Temp (°C) 27.25 27.25 20.10 13.70 11.70 9.60 9.00 8.25 7.45	S (%) 33.86 33.86 33.86 33.96 33.96 33.96 33.96 33.96 33.96	ot (g/cm³) 21.78 21.83 24.23 25.37 25.78	ASt (10 ⁻⁵ cm ³ /g) 604 600 370 262 223 201 189 182	4D (Dyn.m.) 0.000 0.301 0.544 0.704 0.827 0.935 1.035 1.130
(TC) (Mo.) (EyCom ²) (10 - cm ² /g) (LOyn, m.) (IO 27.65 33.83 21.61 621 0.000 27.65 33.83 21.61 621 0.000 26.95 34.00 21.98 585 0.614 11 26.95 34.00 21.98 585 0.614 16 19.00 34.40 24.64 331 0.845 15 16.70 34.10 25.00 297 0.998 26 11.30 33.95 25.59 210 1.356 25 11.30 33.99 26.12 191 1.453 44 9.40 33.99 26.19 184 1.453 44 9.15 33.99 26.19 174 1.640 56 8.35 33.99 26.19 174 1.640 56 8.35 33.83 26.49 155 1.819 74 4.15 33.83 26.49 12	(10 - cm'/g) 621 621 885 331 297 245 245 210 191 184 174 165 155	2	27.25 27.05 20.10 13.70 11.70 10.85 10.10 9.60 9.00 8.25	(%) 33.86 34.35 34.35 33.86 33.96 33.96 33.96 33.96	21.78 21.83 24.23 25.78 25.78	(10 ⁻⁵ cm ³ /g) 604 600 370 262 223 201 189 182	(Dyn.m.) 0.000 0.301 0.544 0.704 0.827 0.935 1.035 1.130
27.65 33.83 21.61 621 0.000 27.65 33.83 21.61 621 0.311 56.95 26.95 34.00 21.98 585 0.614 10 19.00 34.40 24.64 331 0.845 15 16.70 34.10 25.00 297 0.998 26 12.80 33.84 25.55 245 1.136 25 10.40 33.95 25.59 210 1.253 36 10.40 33.99 26.12 191 1.356 36 9.90 33.99 26.19 184 1.453 46 9.15 33.96 26.29 174 1.640 56 8.35 33.88 26.49 155 1.819 66 6.55 33.88 26.49 155 1.989 76 6.55 33.83 26.49 155 1.989 76 6.55 33.83 26.49 122 2.789 122 2.15 33.83 26.94 122	621 621 585 331 245 245 210 191 184 174 165 155		27.25 27.05 20.10 13.70 11.70 10.85 10.10 9.60 9.00	33.86 33.86 33.85 33.85 33.96 33.96 33.96	21.78 21.83 24.23 25.37 26.01	604 370 262 223 201 189 172	0.000 0.301 0.544 0.704 0.827 0.935 1.035 1.130
27.65 33.83 21.61 621 0.311 26.95 34.00 21.98 585 0.614 1 19.00 34.40 24.64 331 0.845 1 16.70 34.10 25.00 297 0.998 2 11.80 33.95 25.59 245 1.136 2 11.30 33.95 25.59 210 1.253 3 10.40 33.99 26.12 191 1.356 3 9.90 33.99 26.19 184 1.453 4 9.15 33.96 26.29 174 1.640 5 8.35 33.92 26.39 165 1.819 6 7.40 33.88 26.49 155 1.989 7 6.55 33.83 26.68 137 2.151 8 5.15 33.83 26.68 137 2.303 9 5.15 33.83 26.94 110 3.416 17 2.55 33.83 27.00 107 3.711	621 585 331 297 245 210 191 184 165 165 147		27.05 20.10 13.70 11.70 10.85 10.10 9.60 9.00	33.86 34.35 33.83 33.96 33.96 33.96 33.96	21.83 24.23 25.37 25.78 26.01	600 370 262 223 201 189 172	0.301 0.544 0.704 0.827 0.935 1.035 1.130
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7.40 33.88 26.49 155 1.989 6.55 33.84 26.58 147 2.151 5.75 33.83 26.68 137 2.303 5.15 33.83 26.74 132 2.447 4.15 33.81 26.84 122 2.789 3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 1 2.10 33.87 27.00 107 3.711 2 1.95 33.90 27.12 96 4.803 3 1.80 33.90 27.13 95 5.325 3 1.80 33.90 27.13 95 5.325 3	155 147 137			33.91	26.51	154	1.561
6.55 33.84 26.58 147 2.151 5.75 33.83 26.68 137 2.303 5.15 33.83 26.74 132 2.447 4.15 33.81 26.84 122 2.789 3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.803 1.80 33.90 27.13 95 5.325 1.80 33.90 27.13 95 5.325	147		6.35	33.90	26.67	138	1.716
5.75 33.83 26.68 137 2.303 5.15 33.83 26.74 132 2.447 4.15 33.81 26.84 122 2.789 3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.803 1.80 33.90 27.13 95 5.325 1.80 33.90 27.13 95 5.325	137		5.80	33.90	26.73	133	1.861
5.15 33.83 26.74 132 2.447 4.15 33.81 26.84 122 2.789 3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.803 1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325			5.15	33.89	26.80	126	2.000
4.15 33.81 26.84 122 2.789 3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.271 1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325	132		4.65	33.88	26.86	120	2.132
3.70 33.85 26.93 114 3.110 2.95 33.82 26.97 110 3.416 2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.271 1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325	122		3.80	33.88	26.94	113	2.447
2.95 33.82 26.97 110 3.416 1 2.55 33.83 27.00 107 3.711 2.10 2.10 33.87 27.08 99 4.271 1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325	114	_	3.15	33.88	27.00	107	2.747
2.55 33.83 27.00 107 3.711 2.10 33.87 27.08 99 4.271 1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325	110		2.70	33.87	27.03	104	3.034
2.10 33.87 27.08 99 4.271	107	_	2,35	33.87	27.06	101	3.312
1.95 33.90 27.12 96 4.803 1.80 33.90 27.13 95 5.325 1	66	_	2.05	33.87	27.08	66	3.854
1.80 33.90 27.13 95 5.325	96	.,	1.85	33.87	27.10	86	4.386
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	95	-	1.70	33.87	27.11	26	4.911
1.60 33.90 27.13 95 5.845	95		1.55	33.84	27.10	86	5.436
1.55 33.89 27.14 94 6.360	94		1.45	33.82	27.08	66	5.966
33.88 27.13 95 6.872	95	_	1.45	33.81	27.07	100	6.501
1,55 33.84 27.09 98 7.402	86		1.50	33.82	27.00	107	7.063
27.05 102	102		1.55	33.82	26.99	108	7.556

Table XVI-1 (Continued)

20.2 WD 5,550 m (by PDR) ~20.54 5 m SWELL 2 m δt ΔSI (cm³) (10-\$ cm³/g) (cm³) (cm²) (cm²) (cm²/g) (cm²) (cm²) (cm²/g) (cm²) (cm²/g) (cm²) (cm²/g) (cm²		St. G	St. GH771-710-S10	-S10		
1977 030 18.21 ~ 20.54 WIND ENE-5 m SWELL 2 m (°C) (%) $(g(cm^3)$ $(10^{-5} cm^3/g)$ 26.45 33.83 22.00 583 26.45 33.83 22.00 583 26.45 33.83 22.01 582 21.70 34.35 24.96 301 17.30 34.35 24.96 301 16.50 34.03 24.89 307 16.50 34.03 24.89 307 16.50 33.92 26.08 194 9.00 33.99 26.19 184 9.00 33.99 26.19 184 9.00 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.78 165 5.20 33.88 26.78 109 4.80 33.89 26.83 103 2.75 33.86 27.05 100 1.85 33.84 27.07 100 1.65 33.89 27.11 <t< td=""><td></td><td></td><td>10°59.4′N</td><td>178°00.2 W.</td><td>D 5,550 m (by PD</td><td>R)</td></t<>			10°59.4′N	178°00.2 W.	D 5,550 m (by PD	R)
h Temp S ht A5t (°C) (%a) (g/cm³) (10 ⁻⁵ cm³/g) 26.45 33.83 22.00 583 26.45 33.86 22.01 582 21.70 34.35 22.00 582 21.70 34.35 22.00 582 11.30 34.35 24.96 301 11.50 33.68 25.47 252 11.60 33.68 25.47 252 11.60 33.89 26.19 184 9.50 33.90 26.19 184 9.50 33.89 26.38 166 7.20 33.88 26.64 141 5.90 33.87 26.98 109 2.75 33.88 26.70 135 2.35 33.87 26.98 109 2.75 33.86 27.02 105 2.05 33.87 26.98 100 1.85 33.84 27.07 100 1.85 33.85 27.11 97 1.45 33.83 27.10 98 1.45 33.83 27.07 100 1.50 33.83 27.10 98 1.45 33.83 27.07 100 1.50 33.83 27.07 100			1977 030 WIND EI	18.21 ~ 20.54 NE-5 m SWF	ELL 2 m	
(°C) (%) (g/cm³) (10-5 cm³/g) 26.45 33.83 22.00 26.45 33.83 22.00 26.45 33.86 22.01 21.70 34.35 23.80 11.30 34.35 24.96 10.50 34.03 24.89 30.1 12.60 33.68 25.47 25.2 10.30 33.92 26.08 10.30 33.92 26.08 10.30 33.89 26.38 114 5.90 33.88 26.70 12.8 4.80 33.88 26.70 12.8 4.80 33.87 26.93 114 3.20 33.87 26.93 114 3.20 33.87 26.93 116 2.15 33.86 27.02 2.15 33.87 26.93 117 1.85 33.84 27.07 1.65 33.89 27.11 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.85 33.83 27.10 1.86 33.83 27.10 1.87 33.83 27.10 1.88 33.83 27.10 1.89 33.83 27.10	Depth	Temp	S	δt	ΔSt	QΓ
26.45 33.83 22.00 583 26.45 33.86 22.01 582 21.70 34.35 23.80 411 17.30 34.35 24.96 301 16.50 34.03 24.89 307 12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.50 33.90 26.19 184 9.00 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.70 135 5.25 33.88 26.70 135 5.25 33.88 26.73 114 3.80 33.87 26.98 109 2.75 33.84 27.05 100 1.65 33.89 27.11 95 1.55 33.83 27.11 97 1.45 33.83 27.10 98 1.48	(m)	ට _ං)	(%)	(g/cm ₃)	$(10^{-5} \text{ cm}^3/\text{g})$	(Dyn.m.)
26.45 33.86 22.01 582 21.70 34.35 23.80 411 17.30 34.35 24.96 301 16.50 34.03 24.89 307 12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.00 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.28 175 6.35 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.70 135 6.35 33.88 26.73 128 4.80 33.88 26.73 114 5.90 33.88 26.43 114 5.25 33.88 26.64 141 5.25 33.88 26.64 141 5.00 33.88 26.70 102 5.25 33.88 26.73 102 5.25 33.84 27.05 100 1.65	0	26.45	33.83	22.00	583	0.000
21.70 34.35 23.80 411 17.30 34.35 24.96 301 16.50 34.03 24.89 301 12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.00 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.23 166 7.20 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.70 138 4.80 33.88 26.64 141 5.25 33.88 26.73 128 4.80 33.88 26.64 141 5.25 33.88 26.64 141 3.80 33.88 26.93 114 3.80 33.84 27.05 102 2.75 33.84 27.05 100 1.65 33.84 27.07 100 1.45 33.83 27.11 95 1.48	20	26.45	33.86	22.01	582	0.291
17.30 34.35 24.96 301 16.50 34.03 24.89 307 12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.00 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.38 166 7.20 33.88 26.64 141 5.90 33.88 26.64 141 5.25 33.88 26.70 135 6.35 33.88 26.73 128 4.80 33.87 26.93 114 3.20 33.87 26.93 114 3.20 33.84 27.05 102 2.75 33.84 27.05 100 1.85 33.84 27.07 100 1.65 33.89 27.11 95 1.50 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.80	100	21.70	34.35	23.80	411	0.540
16.50 34,03 24.89 307 12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.00 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.38 166 7.20 33.88 26.64 141 5.90 33.88 26.70 135 5.25 33.88 26.73 128 4.80 33.88 26.73 128 4.80 33.89 26.93 114 3.20 33.87 26.93 114 3.20 33.87 26.93 102 2.75 33.84 27.05 102 2.05 33.84 27.05 100 1.85 33.84 27.07 100 1.65 33.89 27.11 95 1.45 33.83 27.10 98 1.45 33.83 27.07 100 1.50 33.83 27.07 98 1.40	150	17.30	34.35	24.96	301	0.720
12.60 33.68 25.47 252 10.30 33.92 26.08 194 9.50 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.38 166 7.20 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.70 135 4.80 33.88 26.73 128 4.80 33.87 26.93 114 3.20 33.87 26.93 114 3.20 33.87 26.93 100 2.75 33.84 27.05 100 1.85 33.84 27.05 100 1.65 33.89 27.11 95 1.50 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.07 98 1.50 33.83 27.07 98 1.50 <t< td=""><td>200</td><td>16.50</td><td>34.03</td><td>24.89</td><td>307</td><td>0.875</td></t<>	200	16.50	34.03	24.89	307	0.875
10.30 33.92 26.08 194 9.50 33.90 26.19 184 9.00 33.90 26.28 175 8.30 33.89 26.32 166 7.20 33.88 26.64 141 5.90 33.88 26.64 141 5.90 33.88 26.70 135 4.80 33.88 26.73 128 4.80 33.87 26.93 114 3.20 33.87 26.93 114 2.75 33.86 27.02 105 2.75 33.84 27.05 101 1.85 33.84 27.07 100 1.65 33.89 27.11 95 1.51 33.83 27.10 98 1.45 33.83 27.07 100 1.48 33.83 27.07 100 1.50 33.83 27.07 98 1.50 33.83 27.09 98	250	12.60	33.68	25.47	252	1.018
9.5033.9026.191849.0033.9026.281758.3033.8926.321667.2033.8826.641415.9033.8826.641415.9033.8826.701355.2533.8826.731284.8033.8726.931143.2033.8726.931142.7533.8627.021052.7533.8427.051011.8533.8427.071001.6533.8927.13951.4533.8327.10981.4833.8327.071001.5033.8327.071001.5033.8327.07981.5033.8327.0798	300	10.30	33.92	26.08	194	1.132
9.0033.9026.281758.3033.8926.381667.2033.8826.641415.9033.8826.641415.2533.8826.701354.8033.8826.831284.8033.8726.931143.2033.8726.931142.7533.8627.021052.7533.8427.051011.8533.8427.071001.6533.8927.11971.4533.8327.10981.4833.8327.071001.5033.8327.07981.5033.8327.07981.5033.8327.0798	350	9.50	33.90	26.19	184	1.229
8.30 33.89 26.38 166 7.20 33.88 26.64 141 5.90 33.88 26.70 135 5.25 33.88 26.70 135 4.80 33.88 26.78 128 4.80 33.89 26.83 123 3.20 33.87 26.93 114 2.75 33.87 26.98 109 2.75 33.86 27.02 105 2.35 33.84 27.05 101 1.85 33.84 27.07 100 1.65 33.89 27.11 97 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.07 98 1.50 33.83 27.07 98	400	00.6	33.90	26.28	175	1.322
7.20 33.88 26.52 153 6.35 33.88 26.44 141 5.90 33.88 26.70 135 5.25 33.88 26.78 128 4.80 33.88 26.83 123 3.80 33.87 26.93 114 3.20 33.87 26.98 109 2.75 33.86 27.02 105 2.35 33.84 27.05 101 1.85 33.84 27.07 100 1.65 33.89 27.11 97 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.07 98 1.50 33.83 27.07 98	200	8.30	33.89	26.38	166	1.500
6.3533.8826.641415.9033.8826.701355.2533.8826.781284.8033.8926.831233.2033.8726.931142.7533.8726.981092.7533.8627.021052.3533.8427.051011.8533.8427.071001.6533.8927.11971.4533.8327.10981.4833.8327.071001.5033.8327.0798	009	7.20	33.88	26.52	153	1.668
5.9033.8826.701355.2533.8826.781284.8033.8726.931143.2033.8726.981092.7533.8627.021052.3533.8427.051011.8533.8427.071001.6533.8927.13951.4533.8327.10981.4833.8327.071001.5033.8327.0798	700	6.35	33.88	26.64	141	1.824
5.2533.8826.781284.8033.8826.831233.8033.8726.931142.7533.8627.021052.3533.8527.051022.0533.8427.061011.8533.8427.071001.6533.8927.13951.4533.8327.10981.4833.8327.071001.5033.8327.0798	800	5.90	33.88	26.70	135	1.971
4.8033.8826.831233.8033.8726.981143.2033.8726.981092.7533.8627.021052.0533.8427.051011.8533.8427.071001.6533.8927.13951.4533.8327.10981.4533.8327.071001.5033.8327.0798	006	5.25	33.88	26.78	128	2.112
3.8033.8726.931143.2033.8726.981092.7533.8627.021052.0533.8427.061011.8533.8427.071001.6533.8927.13951.4533.8327.10981.4533.8327.071001.5033.8327.0798	1000	4.80	33.88	26.83	123	2.247
3.20 33.87 26.98 109 2.75 33.86 27.02 105 2.35 33.84 27.05 102 2.05 33.84 27.07 100 1.65 33.89 27.13 95 1.45 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100	1250	3.80	33.87	26.93	114	2.568
2.7533.8627.021052.3533.8427.051012.0533.8427.061011.8533.8927.13951.5533.8527.11971.4533.8327.10981.4833.8327.071001.5033.8327.0998	1500	3.20	33.87	26.98	109	2.873
2.3533.8527.051022.0533.8427.061011.8533.8427.071001.6533.8927.13951.4533.8327.11971.4533.8327.10981.4833.8327.071001.5033.8327.0998	1750	2.75	33.86	27.02	105	3.164
2.0533.8427.061011.8533.8427.071001.6533.8927.13951.5533.8527.11971.4533.8327.10981.4833.8327.071001.5033.8327.0998	2000	2.35	33.85	27.05	102	3.445
1.85 33.84 27.07 100 1.65 33.89 27.13 95 1.55 33.85 27.11 97 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.09 98	2500	2.05	33.84	27.06	101	3.995
1.65 33.89 27.13 95 1.55 33.85 27.11 97 1.45 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.09 98	3000	1.85	33.84	27.07	100	4.537
1.55 33.85 27.11 97 1.45 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.09 98	3500	1.65	33.89	27.13	95	5.062
1.45 33.83 27.10 98 1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.09 98	4000	1.55	33.85	27.11	26	5.577
1.45 33.83 27.10 98 1.48 33.83 27.07 100 1.50 33.83 27.09 98	4500	1.45	33.83	27.10	86	6.009
1.48 33.83 27.07 100 1.50 33.83 27.09 98	2000	1.45	33.83	27.10	86	6.629
1.50 33.83 27.09 98	2500	1.48	33.83	27.07	100	7.174
	2660	1.50	33.83	27.09	86	7.335

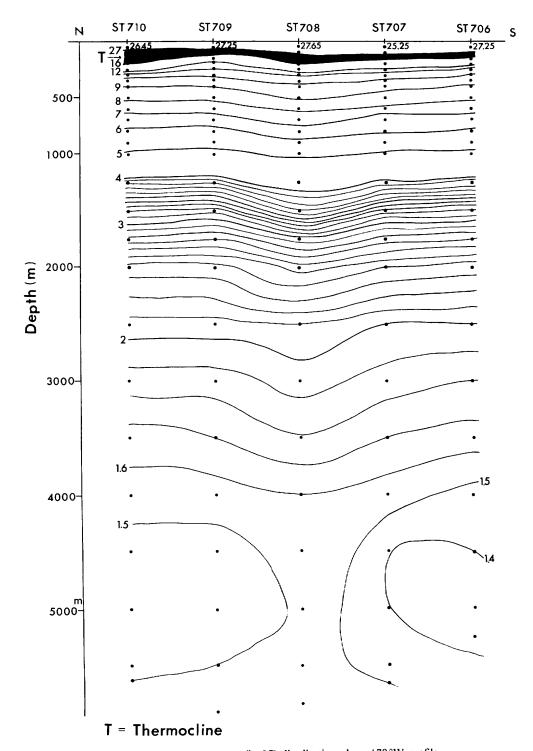


Fig. XVI-3 Temperature (in °C) distribution along 178°W profile.

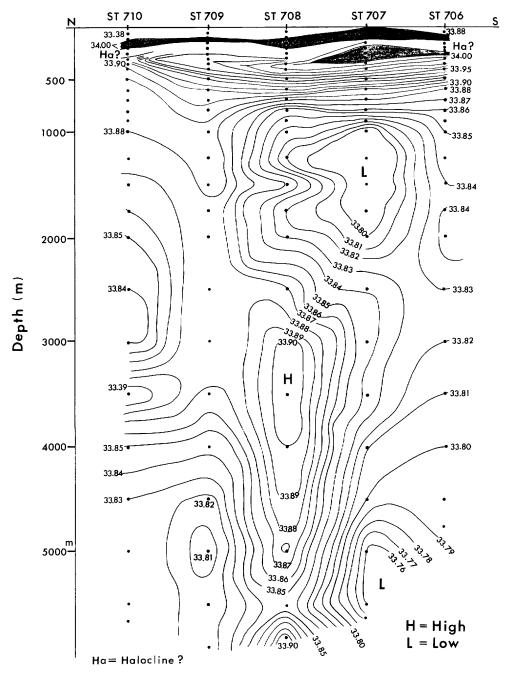


Fig. XVI-4 Salinity (in ‰) distribution along 178°W profile.

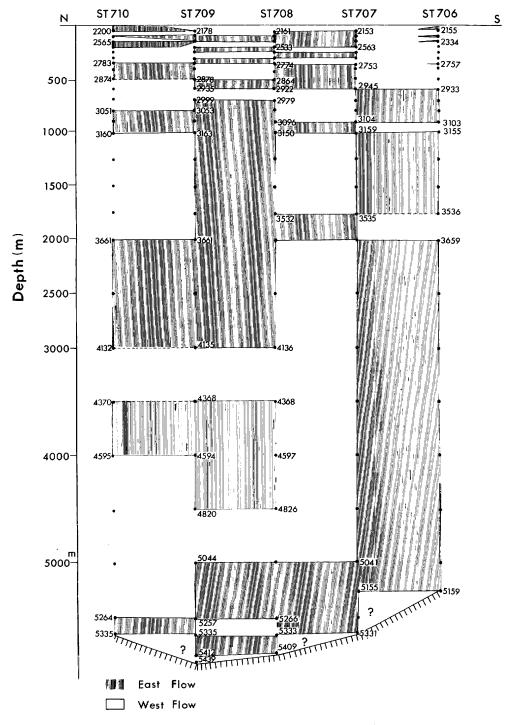


Fig. XVI-5 Tentatively estimated current direction of water along 178 °W profile.

at St. 708 corresponds to the higher temperature mass above mentioned.

Density in situ

The profile of the density in situ (Fig. XVI-4) shows that most surface currents flow westward, and most water in depth flows eastward, though there are some ones flowing westward, such as higher salinity part below the depth of 2,500 m at St. 708, lower salinity parts around the depth of 1,700 m at St. 702 and around 4,700 m at St. 709, and then water mass near 1,000-2,000 m depth at St. 710.

In conclusion, though we succeeded in trying to get the STD record data for understanding sea-water environment, these data are very limited in quality and quantity, and further investigation will be necessary for that purposes, on the basis of the present results including the increase in the number of stations in future survey.