

VIII. RESULTS OF S.T.D. OBSERVATION

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Little is known of the ocean environment in terms of the physics and chemistry particularly of the lower latitudes of Central Pacific. During the GH76-1 cruise, observations on the properties of ocean water were done, such as salinity and temperature, by means of a S.T.D. recorder to provide basic oceanographic data for a manganese nodule study.

The instrument used was a Plessey Environmental Systems Model 9060 Graphic Self-contained Salinity/Temperature/Depth Recorder for 6,000 m use. In practice, the instrument was hung a few meters from a separator attached to the main wire rope at position 30 m above a grab at the wire end. During sea surface to sea bottom rolling up and -down of the wire rope in grab sampling, salinity and temperature were continuously measured together with water depth, and were self-recorded.

Measurement had been scheduled for all the grab sampling stations. However, because of electric troubles we were forced to abandon the observation at nearly all the stations, and as the result, S.T.D. data are available for only two stations on the 174°W meridian (Sts. 403 and 406). From the measured values of depth, temperature and salinity, water density (δt), dynamic depth anomaly (ΔD) and thermosteric anomaly ($\Delta \sigma t$) were calculated.

The results are summarized in Table VIII-1.

In both the water columns, salinity varies slightly from 34.4 to 35.3 ‰ (largely 34.6–35.0‰), but the temperature has a wide variation from 26.8°–27.0°C at the surface to 1.5°C at a depth of 5,500 m, and clearly shows an exponential downward decrease. In the water mass above approximately 250 m depth, the temperature distribution was somewhat different at both station. At St. 403, 26.75°C in the 0–100 m column decreased to 25.45°C at 150 m, and suddenly to 19.20°C at 200 m and 10.50°C at 250 m, suggesting a thermocline between 100 m and 200 m. The thermocline is at a higher level at St. 406 where the temperature at 100 m decreased to 20.20°C (Fig. VIII-1).

Despite the difference in the uppermost water column, the temperature distribution below 250 m showed little variation at both stations. A temperature of 10.50°C at 250 m decreased with a nearly constant rate to about 4.5°C at 1,000 m, and below the depth the temperature gradually decreased to 1.40°C or so at 4,000–5,000 m. The deepest water mass below 5,000–5,500 m tends to have a slightly increased temperature.

The vertical temperature distribution suggests that a fluctuating water mass is underlain by a stable mass below a depth of about 250 m in the western part of the GH76-1 area.

The vertical distribution of water density and thermosteric anomalies were partly same and partly different at the two stations.

Water density of the column between 350 m and 1,000 m is almost common to both the stations. However, above 300 m and below 1,250 m is different; at 0 m and 100 m is

Table VIII-1(1) Results of S.T.D. observation at St. 403.

Station and observation numbers: St. 403, S1; the observation was accompanied by grab sampling G167.
 Position: 04°57.9'N, 173°56.3'W.
 Water depth: 5,660 m.
 Date and time: January 24, 1976, 08:32-11:09.
 Wind: 8 m (ESE). Swell: 2 m.

Depth m	Temp. °C	S ‰	σ_t g/cm ³	$\Delta\sigma_t$ 10 ⁻⁵ cm ³ /g	ΔD Dyn.m	Depth m	Temp. °C	S ‰	σ_t g/cm ³	$\Delta\sigma_t$ 10 ⁻⁵ cm ³ /g	ΔD Dyn.m
0	26.75	35.09	22.85	502	0.000	900	4.95	34.58	27.37	72	1.759
50	26.75	35.09	22.85	502	0.252	1,000	4.55	34.59	27.43	66	1.839
100	26.75	35.12	22.88	499	0.504	1,250	3.80	34.61	27.52	58	2.023
150	25.45	35.30	23.43	447	0.743	1,500	3.15	34.62	27.59	51	2.188
200	19.20	34.45	24.55	340	0.943	1,750	2.75	34.63	27.63	47	2.338
250	10.50	34.70	26.66	139	1.066	2,000	2.45	34.64	27.66	45	2.481
300	9.45	34.69	26.83	123	1.135	2,500	2.00	34.67	27.71	40	2.749
350	8.95	34.67	26.89	117	1.198	3,000	1.80	34.65	27.72	39	3.004
400	8.50	34.65	26.94	113	1.259	3,500	1.65	34.64	27.72	39	3.257
500	7.70	34.62	27.04	103	1.376	4,000	1.50	34.62	27.71	40	3.512
600	6.85	34.59	27.14	94	1.484	4,500	1.40	34.59	27.70	41	3.775
700	6.05	34.58	27.23	85	1.583	5,000	1.40	34.57	27.68	43	4.045
800	5.35	34.58	27.32	77	1.674	5,500	1.45	34.52	27.64	46	4.330

Table VIII-1(2) Results of S.T.D. observation at St. 406.

Station and observation numbers: St. 406, S4; the observation was accompanied by grab sampling G170 (failed)
 Position: 08°00.0'N, 174°02.1'W.
 Water depth: 5,980 m.
 Date and time: January 25, 1976, 16:16-19:20.
 Wind: 9 m (NE). Swell: 2.5 m.

Depth m	Temp. °C	S ‰	σ_t g/cm ³	$\Delta\sigma_t$ 10 ⁻⁵ cm ³ /g	ΔD Dyn.m	Depth m	Temp. °C	S ‰	σ_t g/cm ³	$\Delta\sigma_t$ 10 ⁻⁵ cm ³ /g	ΔD Dyn.m
0	27.00	34.52	22.34	551	0.000	900	5.10	34.61	27.37	72	1.507
50	26.90	34.53	22.39	546	0.275	1,000	4.70	34.62	27.43	66	1.587
100	20.20	34.55	23.88	404	0.514	1,250	3.75	34.63	27.54	56	1.766
150	13.40	34.90	26.24	179	0.662	1,500	3.05	34.65	27.63	47	1.920
200	11.20	34.56	26.43	161	0.749	1,750	2.60	34.68	27.68	43	2.058
250	10.50	34.73	26.68	137	0.826	2,000	2.35	34.69	27.71	40	2.187
300	9.85	34.75	26.81	125	0.894	2,500	2.00	34.69	27.73	38	2.435
350	9.20	34.73	26.89	117	0.958	3,000	1.80	34.68	27.74	37	2.678
400	8.70	34.68	26.93	114	1.019	3,500	1.65	34.67	27.75	36	2.916
500	7.80	34.65	27.04	103	1.125	4,000	1.55	34.66	27.75	36	3.154
600	6.90	34.61	27.14	94	1.232	4,500	1.40	34.65	27.75	36	3.394
700	6.25	34.60	27.23	85	1.330	5,000	1.45	34.62	27.72	39	3.647
800	5.60	34.60	27.31	78	1.421	5,500	1.50	34.58	27.68	43	3.925

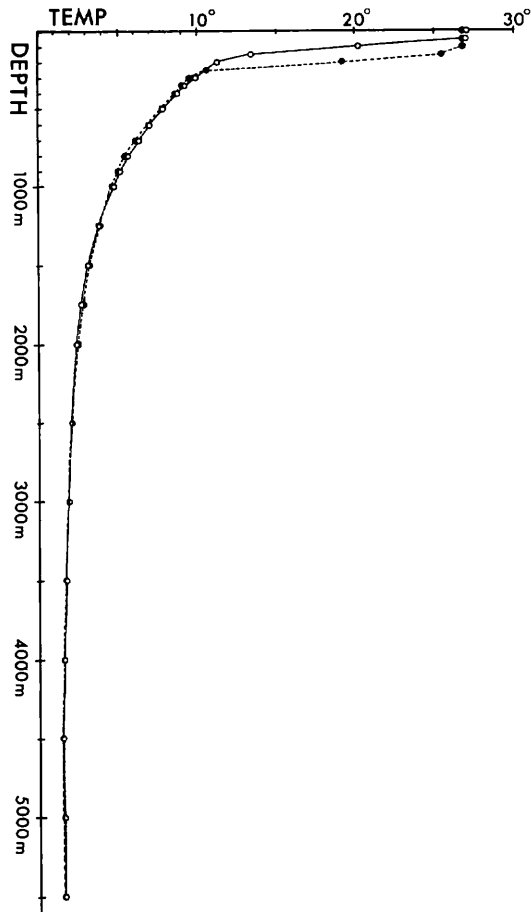


Fig. VIII-1 Vertical distribution of water temperature. Solid circle with solid line, St. 403; open circle with dotted line, St. 406.

larger in St. 403 and between 150 m and 250 m is smaller in St. 403, while that below 1,250 m is larger at St. 406. This is accompanied by a reverse tendency of the thermosteric anomaly.

The results suggest that the oceanic water can be vertically classified into several masses. The details of water movement which might be expected remain to be solved through more abundant areal S.T.D. observations in the future.