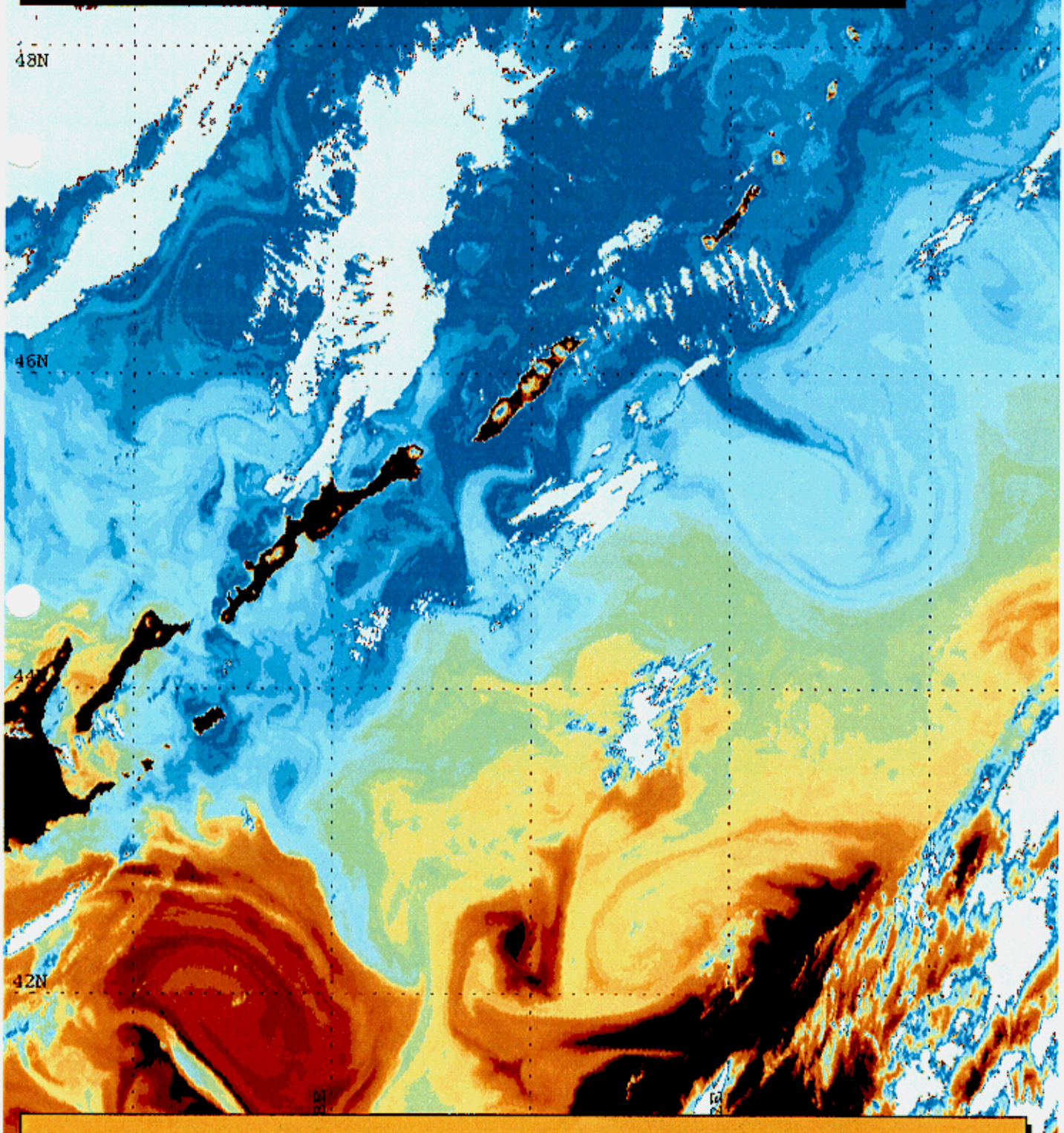


Preliminary Report of MR00-K03 Cruise



Japan Marine Science and Technology Center

Contents

1. Preface

2. Outline of MR00-K03

2.1 Cruise summary

2.2 Cruise Log and cruise track

2.3 List of participants

3. Observation

3.1 Meteorological observation

3.2 Temperature and salinity measurement and water sampling

3.3 Dissolved oxygen, nutrients, and salinity

3.3.1 Dissolved oxygen

3.3.2 Nutrient measurements of sea water sample

3.3.3 Salinity measurements

3.4 Carbonate chemistry

3.4.1 pH measurements

3.4.2 Total dissolved inorganic carbon

3.4.3 Total alkalinity

3.4.4 Carbon isotopes

3.5 Chlorophyll a concentration and absorption coefficient

3.6 Trace metal

3.7 Gas exchange

3.7.1 N₂, O₂ and Ar

3.7.2 O₂, N₂, Ar, Ne

3.8 Radionuclides

3.8.1 Radionuclides (²³⁴Th and Ra isotopes)

3.8.2 Time-series observation ²³⁴Th at Stn. KNOT

3.9 Primary production

3.10 Sediment trap

3.10.1 Sediment trap experiment

3.10.2 Sediment trap experiment

- 3.11 Drifting sediment trap experiment
- 3.12 Bio-optical measurement: MER (Multi-wavelength Environmental Radiometers)
- 3.13 Satellite observation
- 3.14 Plankton
- 3.15 Sediment
- 3.16 Atmospheric observation
 - 3.16.1 O₂/N₂ ratio and CO₂
 - 3.16.2 Aerosol and rain
 - 3.16.3 Aerosol
- 3.17 Underway observation
 - 3.17.1 pCO₂ in the atmosphere and sea surface
 - 3.17.2 Continuous pCO₂ measurement
 - 3.17.3 Salinity, temperature, DO and fluorescence
 - 3.17.4 Nutrients monitoring in sea water
- 3.18 XBT and XCTD
- 3.19 Shipboard ADCP
- 3.20 Geological / geophysical observation
 - 3.20.1 Sea surface gravity measurement
 - 3.20.2 Surface three component magnetometer
 - 3.20.3 Sea beam observation
- 3.21 Seismograph
- 3.22 Magnetometer

Appendix

1. CTD Bottle list

1. Preface

This volume includes the preliminary report of the MR00-K03 cruise carried out by R/V Mirai in the western North Pacific and Okhotsk Sea in 2000. An area off the Kuril Islands and the Okhotsk Sea have been recognized as a key area for the formation of the Intermediate Water, and thus for biogeochemical cycle of carbon in the northwestern North Pacific. Despite its importance, the area has never been surveyed by Japanese oceanographic research vessels for last tens of years due to the fact that the area is inside the Russian EEZ (Exclusive Economic Zone). After two years of preparation, we finally got permission to access to the Russian EEZ for the oceanographic research. On behalf of the scientists on board, I thank Russian authorities for allowing us to work inside the EEZ. During the process of application for the permission, many people in the Ministry of Foreign Affairs and Science and Technology Agency of Japan have helped us significantly. Without their help, the cruise would have never been realized.

The cruise has been completed as almost 100% of what we planned. I really appreciate captain Hashimoto, and crew members for their hard works on board the ship.

MR00-K03 Cruise Chief Scientist
Masashi Kusakabe
Japan Marine Science and Technology Center

2. Outline of MR00-K03

2.1 Cruise summary

M. Kusakabe

Japan Marine Science and Technology Center

The northern North Pacific, especially its western part, has been attracting attention of chemical oceanographers because of its importance in global biogeochemical cycles of carbon and its related materials, which have a great impact to the climate change of the earth. In addition, physical oceanographers have been interested in that region with respect to the formation of the North Pacific Intermediate Water. Despite its importance, there have been few systematic surveys to cover the temporal and spatial variation of biogeochemical processes in the area. Main goal of this cruise is to clarify the behavior of carbon and its related materials in the area.

Based on the above-mentioned goal, a cruise was planned to focus on the area along the Kuril Islands including southern part of the Okhotsk Sea, the Kruzenshterna Strait, Bussol Strait, Etorufu Strait, and the Oyashio Area, as well as the Stn. KNOT, Japan's time series observation station. Especially, emphasis was placed on clarification of water mass formation/mixing along the Kuril Islands and post-bloom biogeochemistry in the northwestern North Pacific.

R/V Mirai left Mutsu, Aomori Prefecture on May 9, 2000 for the cruise and was back to the city on June 10. During its 33 days of the cruise, we have occupied 30 stations for hydrocasts and/or CTD measurements, 4 stations for sediment core sampling, and more than 60 stations for XBT/XCTD casts. In order to study the structure of eddies occurred around the Kuril Islands, the locations for XBT/XCTD casts were determined based on satellite images of sea surface temperature. Biological observations (plankton sampling, bio-optic measurements) were done at the main hydrocast stations. Moored sediment traps were also recovered and redeployed. In the meantime, underway measurement of surface biogeochemical parameters as well as T and S were done while the ship was steaming. Measurement of the atmospheric components such as CO₂, O₂, and aerosol were continuously measured. Details of the observations are described in the following chapters.

2.2 Cruise Log and cruise track

S. Okumura (Global Ocean Development, Inc.)

Table 1. Cruise log

Date	Start Time (LST)	Station	Position (start)		Events
			Lat.	Long.	
2000/5/9	13:00		41-21.9 N	141-14.3 E	Departure from Sekinehama
5/10	8:48	TEST	41-54.6 N	147-50.0 E	Arrival at Station TEST
	8:57	TEST	41-54.6 N	147-50.0 E	Small CTD/Carousel Water Sampler (CWS) cast(1,000m)
	9:53	TEST	41-54.5 N	147-50.1 E	MER measurement
	10:12	TEST	41-54.6 N	147-50.2 E	Large CTD/CWS cast (1,000m)
	10:52	TEST	41-54.5 N	147-50.3 E	Surface water sampling
	11:30				Departure from Stn.TEST
5/11	9:30	KNOT-S	43-30.0 N	155-00.0 E	Arrival at Station KNOT-S1
	10:00	KNOT-S	43-30.0 N	155-00.1 E	Surface water sampling
	10:11	KNOT-S(X1)	43-30.0 N	155-00.1 E	XBT deployment
	10:15	KNOT-S	43-30.0 N	155-00.3 E	Small CTD/CWS cast (2,000m)
	11:24				Departure from Stn. KNOT-S1
	13:27	-	44-00.0 N	155-00-0 E	MER measurement
5/12	15:44	-	44-29.9 N	155-00.0 E	MER measurement
	16:00	-	44-29.9 N	155-00-0 E	Small CTD/CWS cast (2,000m)
	19:12	KNOT	44-00.0 N	155-00.0 E	Arrival at Station KNOT
	19:19	KNOT	44-00.0 N	154-59.8 E	Large CTD/CWS cast (300m)
	20:10	KNOT	43-59.9 N	154-59.9 E	Small CTD/CWS cast (1,000m)
	21:05	KNOT	44-00.0 N	154-59.8 E	Large CTD/CWS cast (800m)
	21:36	KNOT	43-59.9 N	154-59.8 E	Surface water sampling
	0:55	KNOT	44-00.0 N	154-59.9 E	Small CTD/CWS cast (200m)
	2:57	KNOT	44-00.1 N	154-59.8 E	<i>In situ</i> incubation system deployment
	7:55	KNOT	44-01.2 N	154-58.3 E	Drifting sediment trap deployment
	8:56	KNOT	44-00.9 N	154-59.1 E	Large CTD/CWS cast (500m)
	10:16	KNOT	44-01.3 N	154-56.1 E	Large CTD/CWS cast (250m)
	10:29	KNOT	44-01.5 N	154-56.1 E	Surface water sampling
	12:59	KNOT	44-01.8 N	154-54.5 E	Plankton net (0~500m)
	13:25	KNOT	44-02.1 N	154-54.2 E	Plankton net (0~150m)
	13:37	KNOT	44-02.2 N	154-54.0 E	Plankton net (0~200m)
	14:00	KNOT	44-02.6 N	154-53.6 E	Plankton net (100~1500m)
	15:03	KNOT	44-03.2 N	154-53.6 E	Plankton net (500~1000m)
	15:41	KNOT	44-03.5 N	154-53.2 E	Plankton net (250~500m)
	16:02	KNOT	44-03.6 N	154-53.0 E	Plankton net (50~250m)
	16:17	KNOT	44-03.7 N	154-52.9 E	Plankton net (0~50m)
5/13	1:57	KNOT	44-09.1 N	154-46.9 E	Plankton net (0~500m)
	2:20	KNOT	44-00.1 N	154-46.7 E	Plankton net (0~150m)
	2:31	KNOT	44-06.2 N	154-46.6 E	Plankton net (0~200m)
	3:02	KNOT	44-06.8 N	154-47.3 E	<i>In situ</i> incubation system recovery
	8:13	KNOT	44-42.3 N	155-38.3 E	Time series sediment trap(Hokkaido Univ.) recovery
5/14	7:40	KNOT	44-17.0 N	154-43.2 E	Drifting sediment trap recovery
	10:00	KNOT	44-58.6 N	155-02.5 E	Time series sediment trap(JAMSTEC) recovery
	12:30				Departure from Stn. KNOT-1
5/15	0:00	5	44-00.0 N	151-00.0 E	Arrival at Station 5
	0:20	5	44-00.1 N	150-59.7 E	Large CTD/CWS cast (1500m)
	2:07	5	43-59.7 N	151-00.1 E	Plankton net (0~500m)
	2:33	5	43-59.8 N	151-00.3 E	Plankton net (0~150m)
	3:45	5	44-00.0 N	150-59.9 E	Large CTD/CWS cast (6500m)
	7:42				Departure from Stn. 5
	9:30	X2	44-23.0 N	150-52.5 E	XBT deployment
	11:06	6	44-45.0 N	150-45.0 E	Arrival at Station 6
	11:12	6	44-44.9 N	150-45.0 E	Large CTD/CWS cast (300m)
	12:07	6	44-44.7 N	150-44.9 E	MER measurement
	12:19	6	44-44.6 N	150-45.0 E	Plankton net (0~500m)
	12:43	6	44-44.7 N	150-45.1 E	Plankton net (0~150m)
	12:52	6	44-44.7 N	150-45.1 E	Plankton net (0~ m)
	13:10	6	44-44.8 N	150-45.1 E	Small CTD/CWS (800m)
	14:00	6	44-44.9 N	150-45.1 E	Large CTD/CWS cast (1500m)
	15:22	X3-1	44-44.3 N	150-45.0 E	XBT deployment
	15:34	X3-2	44-44.44 N	150-44.8 E	XBT deployment
	15:45	6	44-44.7 N	150-45.0 E	Small CTD/CWS (5500m)
	18:50	6	44-45.6 N	150-45.5 E	Large CTD/CWS cast (5700m)
	20:32	6	44-45.2 N	150-45.2 E	Surface water sampling
	20:50	6	44-45.0 N	150-45.1 E	Surface water sampling
	22:33	6	44-44.8 N	150-45.5 E	Small CTD/CWS cast (200m)

5/16	22:54				Departure from Stn. 6
	0:14	X4	45-03.0 N	150-37.0 E	XBT deployment
	1:45	X5	45-20.9 N	150-28.7 E	XBT deployment
	4:12	7	45-40.0 N	150-20.0 E	Arrival at Station 7
	7:54	7	45-39.9 N	150-19.8 E	Plankton net (0~500m)
	8:22	7	45-39.8 N	150-19.7 E	Plankton net (0~150m)
	8:34	7	45-39.8 N	150-19.7 E	MER measurement
	8:53	7	45-39.7 N	150-19.7 E	Large CTD/CWS cast (700m)
	9:33	7	45-39.7 N	150-19.7 E	Surface water sampling
	10:00				Departure from Stn. 7
	12:17	X6	46-00.7 N	150-51.6 E	XBT deployment
	13:48	X7	46-21.7 N	150-46.8 E	XBT deployment
	14:58	X8	46-35.3 N	150-30.0 E	XBT deployment
	16:56	X9	47-03.9 N	150-39.9 E	XBT deployment
	18:06	7-2	47-20.0 N	150-40.0 E	Arrival at Station 7-2
	18:34	7-2	47-21.3 N	150-39.0 E	Small CTD/CWS cast (3328m)
	20:01	7-2	47-20.8 N	150-38.2 E	Surface water sampling
	20:40	7-2(X10)	47-21.0 N	150-38.7 E	XBT deployment
	20:42				Departure from Stn. 7-2
5/17	22:09	X11	47-22.2 N	150-10.3 E	XBT deployment
	23:37	X12	47-40.2 N	150-30.3 E	XBT deployment
	0:58	X13	47-59.9 N	150-29.8 E	XCTD deployment
	3:00	8	48-30.0 N	150-30.0 E	Arrival at Station 8
	7:58	8	48-29.8 N	150-30.0 E	Large CTD/CWS cast (300m)
	8:39	8	48-29.9 N	150-30.1 E	Plankton net (0~500m)
	9:04	8	48-29.9 N	150-30.2 E	Plankton net (0~150m)
	9:14	8	48-29.9 N	150-30.2 E	MER measurement
	9:32	8	48-29.8 N	150-30.2 E	Small CTD/CWS cast (150m)
	10:36	8	48-29.7 N	150-30.4 E	Large CTD/CWS cast (2314m)
	11:44	8	48-29.7 N	150-30.3 E	Surface water sampling
	12:35	8	48-29.7 N	150-30.3 E	Small CTD/CWS cast (100m)
	12:48				Departure from Stn. 8
	15:31	X14	47-59.5 N	151-09.3 E	XBT deployment
5/18	16:54	9	47-40.0 N	151-10.0 E	Arrival at Station 9
	16:54	9	47-39.8 N	151-09.8 E	Plankton net (0~500m)
	17:18	9	47-39.8 N	151-09.7 E	Plankton net (0~150m)
	17:31	9	47-39.8 N	151-09.6 E	Small CTD/CWS cast (3000m)
	19:15	9	47-39.9 N	151-09.5 E	Large CTD/CWS cast (3314m)
	20:39	9	47-40.3 N	151-09.5 E	Surface water sampling
	21:52	9	47-40.2 N	151-09.9 E	Small CTD/CWS cast (800m)
	22:30				Departure from Stn. 9
	0:12	X15	47-16.5 N	151-08.3 E	XCTD deployment
	2:31	X16	46-44.1 N	151-10.2 E	XCTD deployment
	3:35	X17	46-29.7 N	151-21.5 E	XCTD deployment
	4:52	X18	46-11.5 N	151-31.6 E	XBT deployment
	5:36	10	45-55.0 N	151-45.0 E	Arrival at Station 10
	14:02	10	45-52.6 N	151-33.1 E	Multiple core sampling
5/19	17:42	X19	45-18.1 N	151-29.9 E	XBT deployment
	20:05	X20	44-40.0 N	151-30.0 E	XBT deployment
	21:28	X21	44-50.2 N	151-52.2 E	XBT deployment
	22:33	X22	44-59.9 N	152-10.9 E	XBT deployment
	23:46	X23	45-10.9 N	152-31.9 E	XBT deployment
	0:18	X24	45-18.8 N	152-46.1 E	XCTD deployment
	2:08	X25	45-33.9 N	153-11.4 E	XBT deployment
	3:27	X26	45-46.7 N	153-33.8 E	XBT deployment
	5:06	X27	45-50.0 N	152-59.9 E	XBT deployment
	6:58	X28	45-53.1 N	152-20.0 E	XBT deployment
	8:42	10	45-54.9 N	151-44.9 E	Large CTD/CWS cast (900m)
	9:11	10	45-55.0 N	151-44.9 E	Surface water sampling
	9:48				Departure from Stn. 10
	12:00	11	45-33.0 N	152-12.0 E	Arrival at Station 11
	12:00	11	45-33.0 N	152-12.0 E	MER measurement
	12:14	11	45-33.2 N	152-12.0 E	Plankton net (0~500m)
	12:38	11	45-33.4 N	152-12.0 E	Plankton net (0~150m)
	12:49	11	45-33.4 N	152-12.0 E	Large CTD/CWS cast (300m)
	13:36	11	45-33.2 N	152-11.7 E	Small CTD/CWS cast (800m)
	14:18	11	45-33.3 N	152-11.7 E	Large CTD/CWS cast (1500m)
	16:00	11	45-32.9 N	150-11.8 E	Small CTD/CWS cast (5000m)

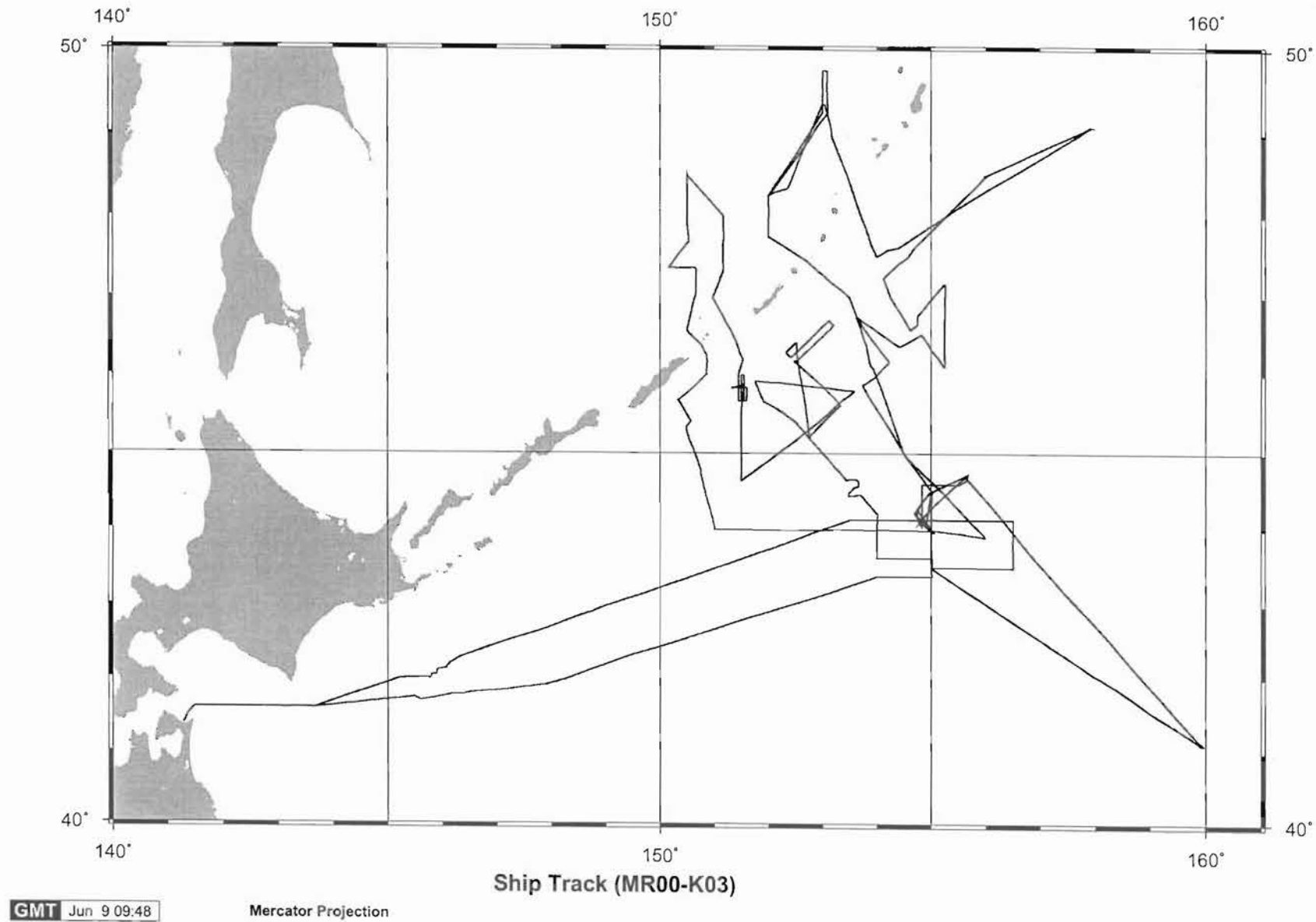
5/20	18:41	11	45-33.0 N	152-12.0 E	Large CTD/CWS cast (5378m)
	19:43	11	45-33.0 N	152-11.9 E	Surface water sampling
	22:06	11	45-32.9 N	152-12.0 E	Small CTD/CWS cast (200m)
	22:24				Departure from Stn. 11
	23:26	X29	45-25.0 N	152-27.9 E	XCTD deployment
	0:48	12	45-12.0 N	152-45.0 E	Arrival at Station 12
	7:52	12	45-12.0 N	152-45.0 E	Small CTD/CWS cast (6000m)
	11:24	12	45-12.0 N	152-44.9 E	Plankton net (0~500m)
	11:47	12	45-12.0 N	152-45.0 E	Plankton net (0~150m)
	12:06	12	45-11.9 N	152-45.0 E	Large CTD/CWS cast (6000m)
5/21	15:42				Departure from stn. 12
	17:09	X30	45-26.5 N	153-04.5 E	XBT deployment
	18:01	X31	45-35.7 N	153-18.1 E	XBT deployment
	21:23	X32	46-09.7 N	152-30.0 E	XBT deployment
	21:42				Piston core site survey start
	7:00	15	46-18.5	152-32.0	Arrival at piston core sampling point
	7:54	15	46-18.6 N	152-31.9 E	Multiple core sampling
	9:53	15	46-18.6 N	152-31.9 E	Piston core sampling
	13:18				Departure from Stn. 15
	17:30	12	45-12.0 N	152-45.0 E	Arrival at Station 12
5/22	17:35	12	45-11.9 N	152-44.9 E	Large CTD/CWS cast (300m)
	18:12				Departure from Stn. 12
	19:04	X33	45-02.5 N	152-57.2 E	XCTD deployment
	20:06	12-2			Arrival at Station 12-2
	20:07	12-2	44-51.9 N	153-10.7 E	Large CTD/CWS cast (5627m)
	23:36				Departure from Stn. 12-2
	0:49	X34	44-39.9 N	153-25.7 E	XCTD deployment
	9:36	13	44-12.9 N	154-00.3 E	Arrival at Station13
	9:40	13	44-12.9 N	154-00.1 E	Small CTD/CWS cast (800m)
	10:28	13	44-12.9 N	154-00.2 E	Large CTD/CWS cast (1500m)
5/23	11:15	13	44-12.9 N	154-00.2 E	Surface water sampling
	12:02	13	44-12.9 N	154-00.3 E	Plankton net (0~500m)
	12:24	13	44-13.0 N	154-00.3 E	Plankton net (0~150m)
	12:38	13	44-13.2 N	154-00.4 E	Small CTD/CWS cast (4500m)
	15:23	13	44-13.8 N	154-00.4 E	Large CTD/CWS cast (5024m)
	18:18				Departure from Stn. 13
	0:00	KNOT2-S	43-30.0 N	155-00.0 E	Arrival at Station KNOT-S
	1:30	KNOT2-S	43-30.0 N	154-59.9 E	Large CTD/CWS cast (1000m)
	3:44	KNOT2-S	43-29.9 N	155-00.1 E	Small CTD/CWS cast (50m)
	4:00				Departure from Stn. KNOT-S
5/24	6:00	KNOT2	44-00.0 N	155-00.0 E	Arrival at Station KNOT2
	6:00	KNOT2	43-59.7 N	154-59.9 E	Drifting sediment trap deployment
	6:54	KNOT2	44-00.0 N	154-59.9 E	Large CTD/CWS cast (5221m)
	10:11	KNOT2	44-00.1 N	155-00.0 E	Plankton net (0~500m)
	10:14	KNOT2	44-00.0 N	155-00.0 E	Surface watetr sampling
	10:33	KNOT2	44-00.1 N	155-00.0 E	Plankton net (0~150m)
	10:42	KNOT2	44-00.2 N	155-00.0 E	Plankton net (0~200m)
	10:56	KNOT2	44-00.1 N	155-00.0 E	Small CTD/CWS cast (600m)
	13:15	KNOT2	44-00.0 N	155-59.9 E	Large CTD/CWS cast (1210m)
	15:09	KNOT2	43-59.9 N	154-59.9 E	MER measurement
5/25	17:29	KNOT2	44-00.0 N	154-59.9 E	Large CTD/CWS cast (250m)
	17:44	KNOT2	44-00.0 N	154-59.9 E	Surface watetr sampling
	18:21	KNOT2	44-00.0 N	154-59.8 E	Small CTD/CWS cast (5000m)
	21:20	KNOT2	44-00.5 N	154-59.9 E	Large CTD/CWS cast (500m)
	0:01	KNOT2	44-00.2 N	154-59.7 E	Plankton net (0~500m)
	0:27	KNOT2	44-00.3 N	154-59.7 E	Plankton net (0~150m)
	0:37	KNOT2	44-00.5 N	154-59.7 E	Plankton net (0~200m)
	1:05	KNOT2	43-59.5 N	155-00.3 E	Small CTD/CWS cast (200m)
	2:53	KNOT2	43-59.2 N	155-00.8 E	<i>In situ</i> incubation system depoyment
	3:20	KNOT2	43-57.5 N	155-03.5 E	Time series sediment trap(JAMSTEC)
5/25	11:24	KNOT2	44-01.5 N	154-56.6 E	MER measurement
	3:12	KNOT2	44-08.2 N	154-50.7 E	<i>In situ</i> incubation system recovery
	4:05	KNOT2	44-13.1 N	154-42.2 E	Drifting sediment trap recovery
	5:00				Departure from Stn. KNOT2
	6:48	KNOT2-N	44-30.0 N	155-00.0 E	Arrival at Station KNOT2-N
	6:48	KNOT2-N	44-31.1 N	154-59.8 E	Large CTD/CWS cast (5000m)
	9:07	KNOT2-N	44-30.0 N	155-00.0 E	Surface water sampling
	10:21	KNOT2-N	44-30.0 N	155-00.1 E	Small CTD/CWS cast (1000m)
	13:35	KNOT2-N	44-43.9 N	155-39.9 E	Time series sediment trap deployment

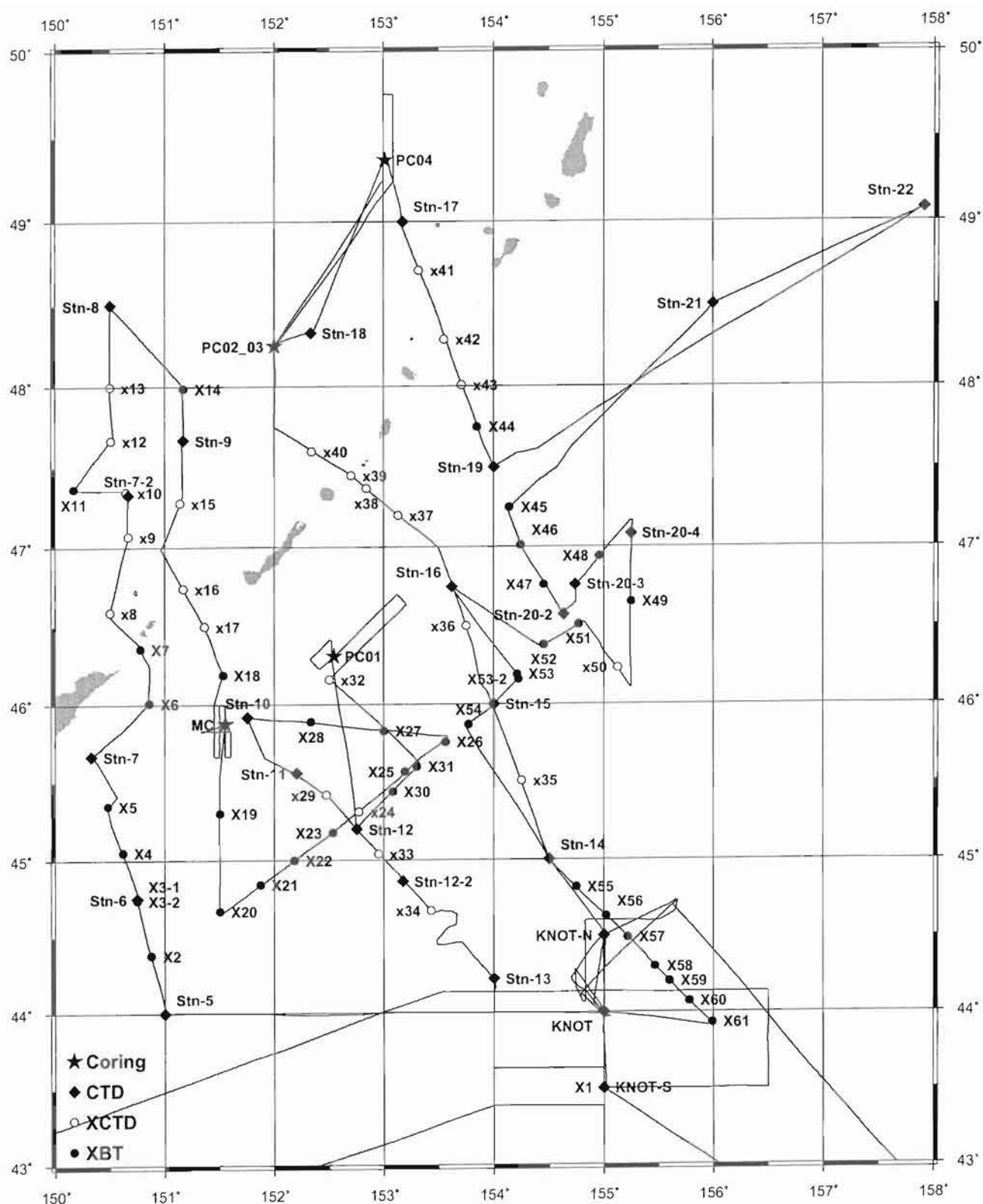
	15:48				Departure from Stn. KNOT2-N
5/26	11:36	23	41-00.0 N	160-00.0 E	Arrival at Station 23
5/27	6:00	23	41-07.0 N	159-59.7 E	OBS recovery
	12:34	23	41-07.0 N	159-55.9 E	OBS deployment (41-08.8N, 159-56.0E;
	15:50	23	41-06.5 N	159-58.0 E	MER measurement
	16:20	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:25	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:30	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:34	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:38	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:42	23	41-07.0 N	159-56.3 E	Plankton net calibration
	16:52	23	41-07.0 N	159-56.3 E	Small CTD/CWS cast (800m)
	17:32	23	41-07.0 N	159-56.4 E	Large CTD/CWS cast (5542m)
	20:13	23	41-07.0 N	159-56.3 E	Surface water sampling
	21:10	23	41-07.0 N	159-56.3 E	Small CTD/CWS cast (5000m)
	23:54				Departure from Stn. 23
5/29	0:43	X35	40-30.3 N	154-14.7 E	XCTD deployment
	4:44	X36	46-29.7 N	153-44.8 E	XCTD deployment
	7:57	X37	47-12.0 N	153-07.7 E	XCTD deployment
	9:02	X38	47-22.1 N	152-50.3 E	XCTD deployment
	9:35	X39	47-27.1 N	152-41.9 E	XCTD deployment
	10:46	X40	47-36.1 N	152-20.6 E	XCTD deployment
	13:00	18	48-40.0 N	153-25.0 E	Arrival at Station 18
5/30	7:51	18	48-15.0 N	151-59.9 E	Piston core site survey
	10:17	18	48-15.1 N	152-00.0 E	Multiple core sampling
	14:25	18	48-15.1 N	152-00.0 E	Piston core sampling
	18:36	18	48-20.0 N	152-20.1 E	Plankton net (0~500m)
	19:01	18	48-20.0 N	152-20.4 E	Plankton net (0~150m)
	19:19	18	48-20.0 N	152-20.0 E	Large CTD/CWS cast (3198m)
	21:03	18	48-19.8 N	152-19.9 E	Surface water sampling
	22:06				Departure from Stn. 18
5/31	2:48	17'	49-21.7 N	153-00.7 E	Arrival at Station 17'
	7:53	17'	49-21.9 N	153-00.8 E	Multiple core sampling
	9:35	17'	49-22.0 N	153-00.7 E	Piston core sampling
	12:00				Departure from Stn. 17'
	13:30	17	49-00.0 N	153-10.0 E	Arrival at Station 17
	13:33	17	48-59.9 N	153-10.0 E	MER measurement
	13:44	17	48-59.9 N	153-10.0 E	Plankton net (0~500m)
	14:06	17	48-59.9 N	153-10.1 E	Plankton net (0~150m)
	14:17	17	48-59.9 N	153-10.0 E	Large CTD/CWS cast (300m)
	15:13	17	49-00.0 N	153-09.9 E	Small CTD/CWS cast (800m)
	16:01	17	49-00.0 N	153-09.8 E	Large CTD/CWS cast (2809m)
	17:25	17	49-00.0 N	153-09.8 E	Surface water sampling
	18:20	17	49-00.0 N	153-09.9 E	Small CTD/CWS cast (2500m)
	20:00				Departure from Stn. 17
6/1	21:23	X41	48-42.8 N	153-19.3 E	XCTD deployment
	23:11	X42	48-17.6 N	153-33.8 E	XCTD deployment
	0:25	X43	48-00.3 N	153-42-7 E	XCTD deployment
	1:30	X44	47-45.2 N	153-51.1 E	XBT deployment
	2:42	19	47-30.0 N	154-00.0 E	Arrival at Station 19
	2:56	19	47-29.9 N	153-59.9 E	Plankton net (100~500m)
	3:20	19	47-29.7 N	153-59.4 E	Plankton net (0~150m)
	3:33	19	47-29.8 N	153-59.1 E	Large CTD/CWS cast (2060m)
	5:18				Departure from Stn. 19
	17:24	22	49-05.0 N	157-54.7 E	Arrival at Station 22
	17:29	22	49-05.0 N	157-54.8 E	MER measurement
	17:43	22	49-05.0 N	157-54.8 E	Plankton net (0~500m)
	18:07	22	49-04.8 N	157-54.8 E	Plankton net (0~200m)
	18:18	22	49-04.8 N	157-54.8 E	Plankton net (0~150m)
	18:31	22	49-04.7 N	157-54.7 E	Large CTD/CWS cast (300m)
	19:21	22	49-06.1 N	157-54.9 E	Small CTD/CWS cast (200m)
	19:42	22	49-04.9 N	157-55.0 E	Large CTD/CWS cast (1500m)
	20:26	22	49-04.8 N	157-54.6 E	Surface water sampling
	20:36	22	49-04.8 N	157-54.5 E	Surface water sampling
	21:18	22	49-04.8 N	157-54.4 E	Small CTD/CWS cast (800m)
	23:02	22	49-05.0 N	157-54.7 E	Large CTD/CWS cast (6487m)
6/2	3:11	22	49-05.0 N	157-55.0 E	Small CTD/CWS cast (5000m)
	6:00				Departure from Stn. 22
	11:18	21	48-30.0 N	156-00.0 E	Arrival at Station 21
	11:19	21	48-30.0 N	155-59.8 E	MER measurement
	11:29	21	48-30.0 N	155-59.7 E	Plankton net (0~500m)

6/3	11:50	21	48-30.0 N	155-59.6 E	Plankton net (0~200m)
	11:58	21	48-30.0 N	155-59.5 E	Plankton net (0~150m)
	12:10	21	48-30.1 N	155-59.7 E	Small CTD/CWS cast (800m)
	12:52	21	48-30.1 N	155-59.9 E	Large CTD/CWS cast (1500m)
	14:22	21	48-30.0 N	156-00.0 E	Small CTD/CWS cast (4500m)
	16:50	21	48-29.9 N	155-59.8 E	Large CTD/CWS cast (5023m)
	19:30	21	48-30.1 N	155-59.9 E	Surface water sampling
	19:59	21	48-30.2 N	155-59.9 E	Small CTD/CWS cast (200m)
	20:20				8 track for calibration of magnetometer
	20:54				Departure from Stn. 21
	3:25	X45	47-14.9 N	154-08.6 E	XBT deployment
	6:10	X46	47-00.8 N	154-14.3 E	XBT deployment
	7:26	X47	46-46.5 N	154-27.0 E	XBT deployment
	8:30	20-2	46-34.0 N	154-37.8 E	Arrival at Station 20-2
	8:32	20-2	46-34.0 N	154-37.7 E	Small CTD/CWS cast (2000m)
	8:43	20-2	46-34.1 N	154-37.5 E	Surface water sampling
	9:36	20-2			Departure from Stn. 20-2
6/4	10:53	-	46-45.4 N	154-44.5 E	Small CTD/CWS cast (6000m)
	10:57	-	46-45.4 N	154-44.5 E	Surface water sampling
	15:06	X48	46-56.3 N	154-57.8 E	XBT deployment
	16:18	20-3	47-09.8 N	155-14.8 E	Arrival at Station 20-3
	16:23	20-3	47-09.9 N	155-14.9 E	Small CTD/CWS cast (6000m)
	20:00				Departure from Stn. 20-3
	22:12	X49	46-38.8 N	155-14.7 E	XBT deployment
	2:04	X50	46-13.6 N	155-07.5 E	XBT deployment
	2:48	X51	46-30.3 N	154-46.3 E	XBT deployment
	3:48	X52	46-22.5 N	154-26.8 E	XBT deployment
	6:24	16	46-45.0 N	153-36.9 E	Arrival at Station 16
	6:27	16	46-45.0 N	153-37.1 E	Small CTD/CWS cast (3500m)
	8:30	16	46-44.9 N	153-36.9 E	Large CTD/CWS cast (3940m)
	10:30	16	46-44.9 N	153-36.9 E	Surface water sampling
	11:13	16	46-45.0 N	153-37.0 E	MER measurement
	11:24	16	46-45.0 N	153-36.9 E	Plankton net (0~500m)
	11:47	16	46-45.1 N	153-36.9 E	Plankton net (0~150m)
	12:01	16	46-45.1 N	153-36.8 E	Small CTD/CWS cast (800m)
	12:42				Departure from Stn. 16
6/5	15:58	X53	46-09.7 N	154-12.9 E	XBT deployment
	16:48	15	46-00.0 N	154-00.0 E	Arrival at Station 15
	16:53	15	46-00.0 N	153-59.9 E	MER measurement
	17:07	15	45-59.9 N	153-59.9 E	Plankton net (0~500m)
	17:30	15	46-00.1 N	153-59.8 E	Plankton net (0~150m)
	17:39	15	46-00.1 N	153-59.8 E	Plankton net (0~200m)
	17:50	15	46-00.1 N	153-59.8 E	Large CTD/CWS cast (300m)
	18:39	15	46-00.0 N	154-00.0 E	Small CTD/CWS cast (800m)
	19:23	15	46-00.0 N	154-00.0 E	Large CTD/CWS cast (1500m)
	19:35	15	46-00.0 N	154-00.0 E	Surface water sampling
	20:22	15	45-59.9 N	154-00.2 E	Surface water sampling
	20:53	15	45-59.9 N	154-00.1 E	Small CTD/CWS cast (200m)
	21:45	15	45-59.9 N	154-00.1 E	Small CTD/CWS cast (5000m)
	0:42	15	45-59.9 N	153-59.6 E	Large CTD/CWS cast (6500m)
	4:30				Departure from Stn. 15
6/6	5:25	X54	45-52.4 N	153-45.9 E	XBT deployment
	9:42	14	45-00.0 N	154-30.0 E	Arrival at Station 14
	10:08	14	44-59.9 N	154-29.8 E	Large CTD/CWS cast (5000m)
	13:30		N	E	Departure from Stn. 14
	14:32	X55	44-48.9 N	154-44.8 E	XBT deployment
	15:36	X56	44-37.7 N	155-01.4 E	XBT deployment
	16:23	X57	44-29.5 N	155-13.2 E	XBT deployment
	17:27	X58	44-18.0 N	155-28.2 E	XBT deployment
	17:59	X59	44-12.2 N	155-35.9 E	XBT deployment
	18:44	X60	44-04.1 N	155-46.7 E	XBT deployment
	19:40	X61	43-55.3 N	155-59.4 E	XBT deployment
	22:42	KNOT3	44-00.0 N	155-00.0 E	Arrival at Station KNOT3
	23:55	KNOT3	44-00.0 N	154-59.5 E	Plankton net (0~500m)
	23:56	KNOT3	44-00.0 N	154-59.5 E	Plankton net (0~150m)
	0:22	KNOT3	44-00.1 N	154-59.3 E	Plankton net (0~150m)
	0:32	KNOT3	44-00.2 N	154-59.1 E	Plankton net (0~200m)
	0:50	KNOT3	44-00.1 N	154-59.3 E	Small CTD/CWS cast (200m)
	1:17	KNOT3	44-00.0 N	154-59.6 E	Large CTD/CWS cast (250m)

6/7	2:23	KNOT3	44-00.0 N	155-00.1 E	<i>In situ</i> incubation system deployment
	2:46	KNOT3	44-00.5 N	155-00.9 E	Drifting sediment trap deployment
	7:59	KNOT3	43-59.7 N	155-00.1 E	Large CTD/CWS cast (1000m)
	8:46	KNOT3	43-59.7 N	155-00.1 E	Surface water sampling
	9:19	KNOT3	43-59.7 N	154-59.9 E	Plankton net (0~500m)
	9:42	KNOT3	43-59.7 N	154-59.7 E	Plankton net (0~150m)
	9:50	KNOT3	43-59.7 N	154-59.6 E	Plankton net (0~
	10:02	KNOT3	43-59.6 N	154-59.3 E	MER measurement
	10:21	KNOT3	43-59.5 N	154-59.6 E	Small CTD/CWS cast (260m)
	11:23	KNOT3	43-59.4 N	154-59.6 E	Large CTD/CWS cast (2000m)
	13:24	KNOT3	43-59.8 N	154-59.1 E	Small CTD/CWS cast (5000m)
	2:35	KNOT3	44-02.7 N	154-54.1 E	<i>In situ</i> incubation system recovery
	3:09	KNOT3	44-02.9 N	154-54.5 E	Drifting sediment trap recovery
	3:30				Departure from KNOT3
6/10	8:00		41-21.9 N	141-14.3 E	Arrival at Sekinehama

2.2-7





CTD, XBT, XCTD & Coring Sites

GMT Jun 8 17:56

Mercator Projection

2.3 List of participants

Name	Affiliation
Masashi KUSAKABE	Japan Marine Science & Technology Center (JAMSTEC)
Chizuru SAITO	JAMSTEC
Naomi HARADA	JAMSTEC
Yuichiro KUMAMOTO	JAMSTEC
Hazime KAWAKAMI	JAMSTEC
Andrey ANDREEV	JAMSTEC
Katsunori KIMOTO	JAMSTEC
Toshiya KANAMATSU	JAMSTEC
LOBANOV Vyacheslav	Pacific Oceanological Insitute (POI)
JABINE Igor	POI
Steven EMERSON	University of Washington Seattle, WA U.S.A.
Yukihiro NOJIRI	National Institute for Environmental Studies (NIES)
Hisashi NARITA	Hokkaido University
Noriko NAKAYAMA	Hokkaido University
Kousei SASAKA	Hokkaido University

Name	Affiliation
Keiri IMAI	Japan Science and Technology corporation (JST)
Jun NISHIOKA	Central Reseach Insitute of Electric Power Industry
Hajime SHIOBARA	University of Tokyo
Kazutake OHTA	University of Tokyo
Hiroaki TOH	Toyama University
Sawako HONMA	Toyama University
Sayuki KOYAMA	Toyama University
Tadanori GOTO	Aichi University
Kazuhiro HAYASHI	Marine Works Japan Ltd. (MWJ)
Toshikatsu SUGAWARA	MWJ
Hirokatsu UNO	MWJ
Fuyuki SHIBATA	MWJ
Shinichiro YOKOGAWA	MWJ

Name	Affiliation
Katsunori SAGISHIMA	MWJ
Hiroaki MURAKI	MWJ
Aya KATO	MWJ
Mikio KITADA	MWJ
Fujio KOBAYASHI	MWJ
Kenichiro SATO	MWJ
Kazue MATSUO	MWJ
Yutaka MATSUURA	MWJ
Tacko OHAMA	MWJ
Hiroshi MATSUNAGA	MWJ
Takayoshi SEIKE	MWJ
Toshio FURUTA	Global Ocean Development, Inc. (GODI)
Satoshi OKUMURA	GODI

3. Observation

3.1 Meteorological observation

Satoshi Okumura

(Global Ocean Development Inc.)

(1) Introduction

The surface meteorological parameters were observed as a basic dataset of the meteorology. These parameters brings us the information about temporal variation of the meteorological condition surrounding the ship.

Measured parameters are:

<i>Name</i>	<i>Sampling Interval</i>	<i>Acronyms in Table 3.1.2</i>
Wind direction	6 sec./10 min. averaged	WD
Wind speed	6 sec./10 min. averaged	WS
Weather	3 hourly	Weather
Pressure (adjusted to the sea surface level)		
	6 sec./10 min. averaged	P
Air temperature	6 sec./10 min. averaged	T
Dew-point temperature	6 sec./10 min. averaged	DPT
Relative humidity	6 sec./10 min. averaged	RH
Sea surface temperature	6 sec./10 min. averaged	SST
Rainfall amount	3 hourly (accumulated)	Rain
Significant wave height	3 hourly (20 min. averaged)	Wv. Ht.
Significant wave period	3 hourly (20 min. averaged)	Wv. Pd.

(2) Methods

The meteorological sensors onboard R/V Mirai are listed in Table 3.1.1. Surface meteorological data were collected and processed by KOAC-7800 weather data processor and some sensors assembled by Koshin Denki, Japan.

(3) Preliminary Results

Table 3.1.2 shows the part of the observation results for the permanent sensors.

Dew point temperature sometimes show higher value than atomospheric temperature (means humidity excess 100%). There might be some trouble with temperature sensors. As comparison with portable temperature and humidity sensors at same position, the data seems to have an error within $\pm 0.5^{\circ}\text{C}$.

(4) Data Archive

The dataset with 6 seconds, 10 minutes and 1hour interval are available in the 3.5" magnetic optical (MO) disk. The dataset will be submitted to the DMO (Data Management Office), JAMSTEC and will be under their control.

Table 3.1.1

Sensors	Type	Maker	Location (Altitude from surface)
Anemometer:	KE-500	Koshin Japan	Denki, Foremast (24m)
Thermometer:	FT	Koshin Japan	Denki, Compass Deck (19m)
Dew point meter:	DW-1	Koshin Japan	Denki, Compass Deck (19m)
Barometer:	F-451	Yokogawa, Japan	Weather observation room, Captain Deck (13m)
Rain gauge:	50202	Young, U.S.A.	Compass Deck (19m)
Optical Rain gauge:	ORG-115DR	SCTI, U.S.A.	Compass Deck (19m)
Radiometer:	MS-801 (short wave) MS-200 (long wave)	Eiko Seiki, Japan	Radar mast (28m)
Wave height meter:	MW-2	Tsurumi-seiki, Japan	Bow

Table 3.1.2 Summary of meteorological observation

		Time		Position		Weather	WD	WS	P	T	DPT	RH	SST	Rain	Wv.Ht.	Wv.Pd.
UTC	ship			Lat.	Long.		(deg)	(m/s)	(hPa)	(deg.C)	(deg.C)	(%)	(deg.C)	(mm/3h)	(m)	(sec)
9-May	4:00	9-May	13:00	41-21 N	41-14 E	-	110	3.2	1015.5	11.5	9.8	90	12.1	0.0	0.1	7
	6:00		15:00	41-36 N	41-40 E	bc	330	4.8	1015.3	10.2	9.4	95	10.1	0.0	0.8	5
	9:00		18:00	41-36 N	42-48 E	bc	220	1.9	1015.5	8.7	6.8	88	6.8	0.0	0.8	5
	12:00		21:00	41-36 N	43-51 E	f	20	4.6	1016.9	7.1	7.2	100	4.3	0.6	0.8	5
	15:00		0:00	41-41 N	44-53 E	f	30	3.1	1017.5	6.3	6.9	100	5.4	0.4	0.8	5
	18:00	10-May	3:00	41-44 N	45-53 E	f	60	3.4	1017.4	9.0	9.6	100	9.1	0.3	0.9	6
	21:00		6:00	41-49 N	46-53 E	f/r	120	4.5	1018.2	8.6	8.9	100	8.6	0.4	1.2	6
	0:00		9:00	41-54 N	47-50 E	o	100	4.0	1019.6	5.7	7.0	100	10.8	0.0	1.1	7
	3:00		12:00	41-55 N	47-57 E	o/f	120	6.3	1019.7	6.5	6.3	99	3.1	0.0	1.2	6
	6:00		15:00	42-10 N	48-55 E	o	90	3.8	1020.1	6.6	6.9	100	6.5	0.3	1.0	7
	9:00		18:00	42-25 N	49-55 E	f	110	3.0	1021.0	5.2	5.0	99	6.4	0.5	1.0	8
	12:00		21:00	42-38 N	50-54 E	f	30	0.9	1021.7	4.6	4.7	100	5.4	0.3	1.0	7
	15:00		0:00	42-52 N	51-53 E	f	50	1.8	1021.2	5.8	6.0	100	5.8	0.3	0.8	7
	18:00		3:00	43-07 N	52-55 E	f/r	100	4.9	1021.2	6.2	6.5	100	4.8	0.7	1.0	6
	21:00		6:00	43-22 N	53-56 E	f	150	6.8	1022.2	5.4	6.1	100	4.0	1.3	0.9	6
11-May	0:00		9:00	43-24 N	55-00 E	f/o	150	5.0	1022.9	4.8	5.2	100	3.7	0.0	0.8	6
	3:00		12:00	43-38 N	55-00 E	o	180	4.4	1022.4	5.1	4.7	98	3.8	0.0	0.9	13
	6:00		15:00	44-20 N	54-59 E	o	210	5.1	1022.2	4.9	4.6	98	4.4	0.0	1.0	13
	9:00		18:00	44-17 N	55-00 E	f	230	4.7	1022.1	4.4	4.5	100	4.3	2.4	1.0	9
	12:00		21:00	44-00 N	54-59 E	f	220	5.3	1022.3	4.7	5.0	100	3.9	0.2	0.9	8
	15:00	12-May	0:00	44-00 N	54-59 E	f	340	3.3	1022.7	3.9	4.3	100	3.6	0.0	0.9	8
	18:00		3:00	44-00 N	54-59 E	f	20	4.3	1023.1	3.3	3.4	100	4.1	0.0	0.9	8
	21:00		6:00	44-01 N	54-58 E	f	50	5.8	1023.9	2.8	3.1	100	4.0	0.0	1.0	9
	0:00		9:00	44-01 N	54-59 E	f	30	4.5	1024.3	2.2	3.1	100	4.1	0.0	1.2	8
	3:00		12:00	44-01 N	54-55 E	f	10	3.8	1024.1	2.1	2.4	100	4.1	0.0	1.4	10
12-May	6:00		15:00	44-03 N	54-53 E	f	10	3.3	1024.4	1.7	0.5	92	4.1	0.0	1.3	9
	9:00		18:00	44-04 N	54-53 E	f	60	2.6	1024.3	1.7	0.0	88	4.2	0.0	1.4	10
	12:00		21:00	44-06 N	54-50 E	o	30	3.5	1025.0	1.4	-0.7	86	4.1	0.0	1.2	10
	15:00		0:00	44-06 N	54-49 E	o	60	3.3	1024.5	1.7	-0.5	86	4.1	0.0	1.1	9
	18:00		3:00	44-06 N	54-47 E	o	60	4.1	1024.7	1.5	1.3	98	4.2	0.0	1.3	9
	21:00	13-May	6:00	44-34 N	55-26 E	o	140	1.6	1026.3	1.8	1.1	95	4.4	0.0	1.2	7
	0:00		9:00	44-41 N	55-39 E	o/f	60	2.3	1026.3	1.9	1.4	97	3.5	0.0	1.4	9
	3:00		12:00	44-36 N	55-10 E	o	90	2.9	1025.7	3.1	2.4	95	4.4	0.0	1.6	16
	6:00		15:00	44-05 N	54-49 E	f	120	6.0	1025.1	3.5	3.8	100	4.6	0.3	1.4	11
	9:00		18:00	44-11 N	54-45 E	f	110	5.4	1025.5	3.3	3.3	100	4.4	0.0	1.2	9
	12:00	14-May	21:00	44-12 N	54-45 E	bc	140	5.9	1026.3	5.0	5.1	100	4.3	0.0	1.1	9
	15:00		0:00	44-13 N	54-44 E	o	150	4.8	1025.8	5.8	5.0	95	4.5	0.0	1.2	10
	18:00		3:00	44-14 N	54-43 E	o	140	6.4	1025.5	5.8	4.6	92	4.4	0.0	1.4	10
	21:00		6:00	44-16 N	54-42 E	o	130	5.1	1026.5	6.0	4.3	89	4.3	0.0	1.8	11
	0:00		9:00	44-10 N	54-50 E	o	130	7.0	1026.1	5.5	4.8	95	4.5	0.0	1.5	8
14-May	3:00		12:00	43-59 N	55-01 E	o	130	5.0	1025.3	8.2	6.6	90	4.6	0.0	1.5	10
	6:00		15:00	44-00 N	54-11 E	c	150	7.0	1023.7	6.1	5.6	96	4.6	0.0	2.2	16
	9:00		18:00	44-00 N	53-08 E	bc	150	7.9	1022.4	5.9	5.8	99	4.7	0.0	2.0	15
	12:00		21:00	43-59 N	52-04 E	o	130	7.6	1021.0	5.8	6.1	100	4.4	0.0	2.1	16
	15:00		0:00	44-00 N	51-00 E	o	140	10.6	1017.9	6.3	6.8	100	4.2	2.3	2.5	13
	18:00	15-May	3:00	43-59 N	51-00 E	o	140	10.7	1016.6	6.2	6.7	100	3.2	0.0	2.1	8
	21:00		6:00	43-59 N	51-00 E	o	140	10.5	1016.7	6.1	6.5	100	4.3	0.0	2.1	8
	0:00		9:00	44-16 N	50-55 E	o	140	11.4	1015.8	5.5	5.7	100	3.3	0.0	2.9	19
	3:00		12:00	44-44 N	50-45 E	o	150	10.4	1014.4	5.8	5.8	100	3.7	0.0	1.9	8
	6:00		15:00	44-44 N	50-45 E	f	130	10.3	1012.4	5.4	5.8	100	3.8	0.1	1.8	8
15-May	9:00		18:00	44-45 N	50-45 E	f	140	9.9	1011.2	5.6	6.0	100	3.7	0.8	1.9	8
	12:00		21:00	44-44 N	50-45 E	r	150	10.5	1010.3	5.6	6.0	100	3.9	1.3	1.9	9
	15:00		0:00	45-00 N	50-38 E	o	150	11.3	1007.8	5.2	5.7	100	3.4	1.4	2.1	20
	18:00		3:00	45-28 N	50-30 E	f	140	12.5	1005.5	4.5	5.1	100	1.4	6.1	2.6	18
	21:00		6:00	45-41 N	50-20 E	f	160	9.6	1004.2	3.5	4.0	100	1.7	1.8	2.3	9
16-May	0:00		9:00	45-39 N	50-19 E	f	40	0.7	1003.9	3.1	4.6	100	1.3	0.0	1.6	7
	3:00		12:00	45-58 N	50-48 E	f	150	6.9	1002.4	3.1	3.7	100	2.4	7.2	2.1	10
	9:00		18:00	47-19 N	50-40 E	f	230	4.2	1001.4	1.7	2.1	100	1.6	0.0	2.5	19
	12:00		21:00	47-21 N	50-34 E	f	240	3.6	1001.7	1.2	1.3	100	1.5	0.3	1.7	10
	15:00		0:00	47-45 N	50-31 E	f	330	5.9	1001.2	1.2	1.4	100	1.3	2.5	1.6	13
	18:00		3:00	48-29 N	50-30 E	f	330	8.7	1001.0	0.9	1.2	100	1.4	1.4	2.0	14
	21:00		6:00	48-31 N	50-33 E	f	330	9.6	1001.8	0.6	0.8	100	1.3	1.3	1.5	6
17-May	0:00		9:00	48-29 N	50-30 E	f	320	9.8	1002.9	0.7	1.1	100	1.1	0.0	1.3	6
	3:00		12:00	48-29 N	50-30 E	f	320	10.2	1003.1	0.8	1.0	100	1.0	1.0	1.4	6
	6:00		15:00	48-05 N	51-03 E	o	310	9.8	1004.0	0.9	1.0	100	1.2	1.2	1.9	18
	9:00		18:00	47-39 N	51-09 E	o	320	10.1	1004.9	0.7	0.4	98	0.9	0.9	1.9	6
	12:00		21:00	47-40 N	51-09 E	o	310	10.4	1006.5	0.6	0.8	100	0.8	0.8	1.8	6
	15:00	18-May	0:00	47-18 N	51-09 E	o	300	12.2	1007.3	0.4	0.4	100	1.2	1.2	2.2	15
	18:00		3:00	46-37 N	51-15 E	d	300	10.4	1009.1	0.4	0.5	100	1.4	0.0	2.1	17
	21:00		6:00	45-55 N	51-27 E	o	320	12.3	1010.5	0.2	0.1	99	1.2	0.0	2.4	14
	0:00		9:00	45-56 N	51-29 E	o	320	12.6	1010.9	0.4	-0.1	97	1.4	1.7	1.8	6
	3:00		12:00	45-46 N	51-35 E	o	330	9.1	1011.6	1.0	0.7	98	2.5	1.0	1.6	5
18-May	6:00		15:00	45-52 N	51-33 E	o	340	8.6	1012.1	0.4	0.5	100	2.1	0.1	1.5	7

	Time			Position		Weather	WD (deg)	WS (m/s)	P (hPa)	T (deg.C)	DPT (deg.C)	RH (%)	SST (deg.C)	Rain (mm/3h)	Wv.Ht. (m)	Wv.Pd. (sec)
	UTC	ship		Lat.	Long.											
18-May	9:00	18-May	18:00	45-13 N	51-29 E	o	10	3.3	1013.4	1.5	0.6	94	3.3	0.0	1.6	18
	12:00		21:00	44-46 N	51-44 E	o	30	5.0	1013.7	2.2	1.4	95	3.9	0.0	1.1	8
	15:00	19-May	0:00	46-13 N	52-36 E	o	10	3.9	1013.2	1.5	1.3	98	2.8	0.8	1.1	6
	18:00		3:00	45-42 N	53-26 E	o	340	2.2	1013.1	2.0	2.2	100	2.4	0.1	1.2	6
	21:00		6:00	45-51 N	52-40 E	f	50	7.4	1014.8	2.1	2.7	100	1.8	1.7	1.5	15
19-May	0:00		9:00	45-54 N	51-45 E	f	40	7.2	1016.0	1.9	2.9	100	1.6	0.0	1.2	7
	3:00		12:00	45-32 N	52-12 E	f	60	9.6	1015.8	2.5	3.0	100	2.9	2.3	1.3	7
	6:00		15:00	45-33 N	52-11 E	f	70	9.6	1016.3	2.6	3.1	100	3.1	0.0	1.5	7
	9:00		18:00	45-33 N	52-12 E	f	70	7.7	1018.2	2.6	2.8	100	2.9	0.0	1.3	7
	12:00		21:00	45-32 N	52-11 E	f	60	6.6	1019.6	2.5	3.0	100	2.9	0.0	1.5	7
	15:00	20-May	0:00	45-18 N	52-36 E	o	70	7.4	1019.3	2.6	2.9	100	2.9	0.0	1.4	7
	18:00		3:00	45-11 N	52-43 E	o	70	5.5	1020.2	2.6	2.6	100	2.9	0.0	1.2	6
	21:00		6:00	45-12 N	52-39 E	o	70	6.3	1021.2	2.6	2.7	100	3.0	0.0	1.3	7
	20-May	0:00	9:00	45-12 N	52-45 E	o	70	6.4	1022.0	2.5	3.0	100	2.7	0.0	1.2	7
	3:00		12:00	45-11 N	52-45 E	o	70	6.2	1022.2	2.8	2.1	95	2.7	0.0	1.3	7
	6:00		15:00	45-11 N	52-45 E	o	90	6.3	1022.0	3.0	1.7	92	2.9	0.0	1.3	7
	9:00		18:00	45-35 N	53-17 E	o	80	5.0	1022.8	3.2	0.0	80	2.3	0.0	1.2	5
	12:00		21:00	46-06 N	52-35 E	c	140	4.4	1023.4	2.7	0.0	82	2.5	0.0	1.8	17
	15:00	21-May	0:00	46-29 N	52-59 E	bc	110	5.1	1022.8	2.5	0.6	87	2.8	0.0	1.0	6
	18:00		3:00	46-29 N	52-47 E	o	140	4.1	1022.3	2.7	1.6	93	2.9	0.0	1.1	12
21-May	21:00		6:00	46-23 N	52-27 E	o	110	3.4	1022.7	2.6	2.0	96	2.4	0.0	1.2	7
	0:00		9:00	46-18 N	52-32 E	f	140	4.8	1022.1	2.5	2.7	100	2.8	0.0	1.0	8
	3:00		12:00	46-18 N	52-32 E	f	140	5.9	1020.9	2.9	3.2	100	3.1	0.0	1.0	8
	6:00		15:00	45-51 N	52-37 E	f	120	6.7	1018.9	2.6	3.0	100	2.1	0.7	1.2	7
	9:00		18:00	45-11 N	52-45 E	f	110	6.1	1017.6	3.4	3.6	100	3.3	0.3	1.4	7
	12:00		21:00	44-51 N	53-10 E	f	110	5.0	1016.4	3.5	4.1	100	2.9	0.2	1.3	7
	15:00	22-May	0:00	44-47 N	53-17 E	f	110	5.3	1014.6	3.9	4.1	100	2.5	0.2	1.1	6
	18:00		3:00	44-28 N	53-29 E	f	100	3.7	1013.7	4.5	5.3	100	3.6	2.0	1.5	11
	21:00		6:00	44-27 N	53-39 E	f	100	4.4	1013.5	4.5	5.6	100	3.9	0.2	1.2	7
	22-May	0:00	9:00	44-19 N	53-52 E	f	120	6.5	1012.6	5.0	5.5	100	4.2	1.9	1.2	6
	3:00		12:00	44-12 N	54-00 E	f	100	6.2	1012.5	4.9	6.0	100	4.2	0.2	1.2	7
	6:00		15:00	44-13 N	54-00 E	f	110	4.1	1012.8	5.0	5.7	100	4.3	0.0	1.4	7
	9:00		18:00	44-13 N	54-00 E	f	360	4.0	1014.2	4.4	5.2	100	4.3	0.2	1.2	7
	12:00		21:00	43-38 N	54-07 E	f	10	4.9	1014.8	4.8	5.4	100	4.8	2.0	1.1	6
	15:00	23-May	0:00	43-30 N	54-59 E	f	100	5.1	1014.8	4.7	5.6	100	4.8	0.3	1.4	7
	18:00		3:00	43-29 N	55-00 E	f	80	5.6	1015.8	4.6	5.4	100	4.6	1.0	1.5	8
	21:00		6:00	43-59 N	54-59 E	f	220	0.6	1017.3	5.2	6.6	100	5.3	0.7	1.3	10
	23-May	0:00	9:00	44-00 N	55-00 E	f	120	2.0	1018.0	5.4	7.4	100	5.5	0.0	1.3	8
	3:00		12:00	43-59 N	55-00 E	f	130	3.3	1017.9	5.8	5.6	99	5.4	0.0	1.3	9
	6:00		15:00	43-59 N	55-00 E	o	90	4.5	1017.4	6.0	5.4	96	5.3	0.0	1.9	9
	9:00		18:00	44-00 N	54-59 E	o	110	6.0	118.1	6.0	4.8	92	6.0	0.0	2.1	9
	12:00		21:00	44-00 N	54-59 E	o	110	7.4	1018.6	5.5	5.0	96	6.2	0.0	1.9	10
	15:00	24-May	0:00	44-00 N	54-59 E	o	100	8.4	1018.0	5.3	5.2	99	5.5	2.8	2.0	9
	18:00		3:00	43-59 N	55-00 E	o	110	9.5	1017.8	5.6	5.4	99	5.8	0.1	1.9	9
	21:00		6:00	43-57 N	55-03 E	o	110	9.7	1018.6	5.6	5.8	100	5.8	0.3	1.7	9
24-May	0:00		9:00	44-01 N	54-56 E	o	120	9.2	1018.9	6.1	5.6	97	5.3	0.0	1.5	8
	3:00		12:00	44-01 N	54-56 E	o	110	9.7	1018.1	6.0	6.0	100	5.5	0.0	1.3	7
	6:00		15:00	44-01 N	54-54 E	o	120	8.3	1016.9	6.1	6.5	100	5.8	0.0	1.5	8
	9:00		18:00	44-04 N	54-53 E	o	110	9.5	1016.3	6.6	6.6	100	5.8	0.0	1.3	7
	12:00		21:00	44-05 N	54-51 E	o	110	9.7	1015.5	6.7	7.2	100	5.4	0.0	1.3	7
	15:00	25-May	0:00	44-06 N	54-52 E	o	110	12.5	1013.3	7.0	7.0	100	5.4	0.0	1.7	6
	18:00		3:00	44-07 N	54-50 E	r	110	14.9	1010.9	6.7	7.4	100	5.6	0.5	1.8	6
	21:00		6:00	44-23 N	54-51 E	r	110	15.5	1008.9	6.3	6.7	100	5.2	17.1	2.4	9
	25-May	0:00	9:00	44-30 N	55-00 E	r	150	7.5	1009.0	7.1	7.7	100	6.2	2.3	2.2	7
	3:00		12:00	44-35 N	55-15 E	f	180	10.4	1008.7	7.4	8.1	100	5.6	1.1	2.2	7
	6:00		15:00	44-42 N	55-37 E	o	200	10.9	1009.4	8.0	8.8	100	5.6	3.5	2.7	8
	9:00		18:00	44-18 N	56-06 E	o	190	13.4	1010.8	8.0	8.5	100	4.6	28.6	2.1	5
	12:00		21:00	43-45 N	56-44 E	c	180	10.7	1013.5	8.8	8.4	98	6.5	0.0	2.1	5
	15:00	26-ay	0:00	43-11 N	57-25 E	bc	160	9.1	1014.2	9.3	8.3	94	9.6	0.0	1.9	6
	18:00		3:00	42-38 N	58-07 E	o	120	5.9	1014.2	8.9	9.2	100	8.6	0.0	1.5	6
26-May	21:00		6:00	42-03 N	58-47 E	o	90	7.8	1014.8	8.9	8.8	99	8.3	0.0	1.7	5
	0:00		9:00	41-31 N	59-26 E	o	60	12.6	1012.4	10.5	9.8	95	11.4	0.0	2.4	8
	3:00		12:00	41-07 N	59-56 E	o	50	10.6	1011.0	10.3	10.2	100	11.8	0.1	3.8	9
	6:00		15:00	41-07 N	59-53 E	o	70	11.8	1010.8	10.4	9.8	96	11.8	0.0	3.6	9
	9:00		18:00	41-06 N	59-54 E	o	50	11.4	1012.4	9.6	1.0	100	11.8	3.0	3.4	10
	12:00		21:00	41-06 N	59-54 E	o	50	7.7	1013.9	9.5	9.7	100	11.8	0.0	2.9	9
	15:00	27-May	0:00	41-06 N	59-53 E	o	350	5.1	1014.0	8.9	9.2	100	11.7	0.2	2.9	10
	18:00		3:00	41-07 N	59-53 E	o	310	6.1	1015.1	8.6	9.2	100	11.4	0.0	3.5	10
	21:00		6:00	41-07 N	59-55 E	f	310	5.6	1016.1	8.5	9.1	100	11.7	0.0	2.7	9
	27-May	0:00	9:00	41-07 N	59-56 E	f	250	7.0	1016.5	9.9	10.8	100	11.8	0.0	2.9	9
	3:00		12:00	41-07 N	59-56 E	o	250	7.2	1015.8	11.7	11.8	100	11.9	0.0	2.6	9
	6:00		15:00	41-06 N	59-54 E	o	240	7.1	1015.8	12.0	11.6	98	11.3	0.0	2.1	10
	9:00		18:00	41-07 N	59-56 E	f	260	6.1	1016.8	11.5	11.9	100	11.6	0.0	1.6	9
	12:00		21:00	41-07 N	59-56 E	f	290	4.5	1017.8	10.4	11.1	100	11.5	0.0	1.6	9
	15:00	28-May	0:00	41-07 N	59-55 E	f	280	6.0	1017.9	10.2	10.8	100	11.0	0.0	1.9	9
	18:00		3:00	41-32 N	59-02 E	f	320	3.4	1019.0	7.4	7.9	100	11.5	0.1	2.2	18

	Time			Position		Weather	WD (deg)	WS (m/s)	P (hPa)	T (deg.C)	DPT (deg.C)	RH (%)	SST (deg.C)	Rain (mm/3h)	Wv.Ht. (m)	Wv.Pd. (sec)
	UTC	ship		Lat.	Long.											
27-May	21:00	28-May	6:00	41-59 N	58-08 E	f	230	2.8	1020.1	6.4	7.3	100	9.2	0.1	1.8	14
28-May	0:00		9:00	42-24 N	57-15 E	f	170	2.9	1019.3	8.0	8.9	100	10.0	0.0	1.9	17
	3:00		12:00	42-50 N	56-22 E	f	160	5.7	1017.8	9.1	10.1	100	10.2	0.0	2.0	18
	6:00		15:00	43-16 N	55-28 E	f	160	8.9	1015.5	11.0	11.8	100	10.3	0.0	1.8	17
	9:00		18:00	43-52 N	54-59 E	f	150	10.3	112.9	8.3	8.8	100	6.4	0.0	1.7	11
	12:00			44-39 N	54-52 E	f	150	12.2	1010.3	8.2	9.2	100	5.6	0.0	2.0	18
	15:00	29-May	0:00	45-20 N	54-19 E	f	150	12.0	1005.6	6.9	7.3	100	4.0	0.0	2.3	18
	18:00		3:00	46-03 N	53-56 E	f/r	140	15.0	998.9	6.8	7.2	100	4.1	4.3	2.0	19
	21:00		6:00	46-49 N	53-35 E	f/r	150	16.5	993.3	6.7	7.1	100	3.6	7.1	2.8	22
29-May																
	3:00		12:00	47-46 N	51-59 E	c	190	16.8	983.7	7.7	8.6	100	1.4	0.1	3.1	20
	6:00		15:00	48-22 N	52-07 E	o/f	200	11.7	983.1	3.3	3.5	100	1.7	0.1	2.6	12
	9:00		18:00	49-01 N	52-46 E	f	210	10.0	984.5	2.7	3.2	100	2.3	0.0	2.8	11
	12:00		21:00	49-37 N	52-59 E	o	200	9.7	985.8	2.2	2.5	100	1.9	0.0	3.0	13
	15:00	30-May	0:00	49-21 N	53-05 E	f	230	10.8	987.3	2.6	2.4	98	1.9	14.3	2.1	6
	18:00		3:00	48-45 N	52-34 E	o	200	11.2	987.3	3.5	3.1	98	1.9	0.5	2.6	8
	21:00		6:00	48-15 N	51-59 E	bc	210	8.5	989.5	3.5	3.3	99	1.5	0.0	2.8	8
30-May	0:00		9:00	48-14 N	51-59 E	bc	220	8.7	988.9	5.3	3.0	85	1.6	0.0	2.3	8
	3:00		12:00	48-14 N	51-59 E	bc	200	11.9	989.1	4.7	1.9	83	1.7	0.0	2.5	8
	6:00		15:00	48-15 N	52-00 E	o	210	10.4	989.1	3.9	1.7	86	1.7	0.1	2.4	8
	9:00		18:00	48-18 N	52-09 E	o	220	10.7	990.5	3.0	1.3	89	2.1	0.0	2.6	14
	12:00		21:00	48-19 N	52-19 E	o	230	10.2	990.6	2.3	1.8	97	1.7	0.0	2.0	7
	15:00	31-May	0:00	48-43 N	52-35 E	o	280	5.8	991.2	1.5	1.6	100	2.1	0.1	2.3	17
	18:00		3:00	49-21 N	53-00 E	o	310	8.0	994.4	1.8	2.0	100	2.1	0.3	2.5	11
	21:00		6:00	49-21 N	53-01 E	o	300	6.9	998.7	1.5	2.1	100	1.9	0.1	2.0	7
31-May	0:00		9:00	49-21 N	53-00 E	f	330	8.1	1002.6	1.4	1.8	100	1.9	0.7	2.5	8
	3:00		12:00	49-21 N	53-02 E	f	290	8.1	1006.4	2.2	2.0	99	1.9	0.0	2.1	8
	6:00		15:00	49-00 N	53-09 E	o	290	9.5	1009.0	2.2	1.6	96	2.0	0.0	2.0	7
	9:00		18:00	49-00 N	53-09 E	o	320	8.9	1011.4	2.0	1.5	97	1.9	0.0	1.7	7
	12:00		21:00	48-47 N	53-16 E	f	300	8.4	1014.2	1.0	1.1	100	1.5	0.0	1.9	11
	15:00	1-Jun	0:00	48-05 N	53-39 E	f	310	6.5	1016.0	1.2	1.5	100	1.8	0.0	1.7	9
	18:00		3:00	47-29 N	53-59 E	f	310	4.9	1017.4	1.6	2.1	100	2.3	0.0	1.7	7
	21:00		6:00	47-35 N	54-12 E	f	320	6.0	1018.5	0.7	1.3	100	2.4	0.3	1.8	16
1-Jun	0:00		9:00	47-57 N	55-09 E	f	300	5.4	1019.3	0.3	0.6	100	3.4	0.5	2.2	18
	3:00		12:00	48-21 N	56-07 E	f	300	6.5	1017.7	1.1	1.4	100	3.6	0.0	1.9	15
	6:00		15:00	48-45 N	57-08 E	f	300	4.5	1016.8	1.5	2.3	100	3.4	0.0	1.9	15
	9:00		18:00	49-04 N	57-54 E	bc	250	6.1	1016.6	3.0	2.1	94	3.0	0.0	1.4	6
	12:00		21:00	49-04 N	57-54 E	bc	240	3.6	1016.5	2.9	2.6	98	2.9	0.0	1.2	6
	15:00	2-Jun	0:00	49-05 N	57-54 E	bc	240	3.6	1015.8	2.8	2.2	96	2.9	0.0	1.3	6
	18:00		3:00	49-05 N	57-54 E	bc	290	2.1	1016.0	2.9	2.5	97	2.9	0.0	1.1	6
	21:00		6:00	49-04 N	57-53 E	f	190	4.5	1015.7	1.7	1.6	99	3.1	0.0	1.2	6
2-Jun	0:00		9:00	48-44 N	56-48 E	bc	140	1.1	1015.3	4.3	3.2	92	3.5	0.0	0.9	6
	3:00		12:00	48-30 N	55-59 E	bc	90	4.2	1014.6	4.8	3.5	91	5.0	0.0	0.9	7
	6:00		15:00	48-30 N	56-00 E	f	140	49.0	1014.3	1.9	1.7	99	3.9	0.0	0.9	7
	9:00		18:00	48-29 N	55-59 E	f	120	5.9	1013.8	1.5	1.2	98	4.1	0.0	1.0	7
	12:00		21:00	48-28 N	55-57 E	f	120	5.6	1013.9	1.1	1.5	100	4.0	0.6	0.8	9
	15:00	3-Jun	0:00	47-53 N	55-06 E	f	90	7.8	1011.5	1.3	1.8	100	3.8	0.1	1.0	10
	18:00		3:00	47-19 N	54-14 E	f	60	8.1	1009.6	1.9	2.5	100	3.3	0.0	1.2	8
	21:00		6:00	47-00 N	54-14 E	o	60	9.1	1008.6	2.5	2.6	100	3.7	0.2	1.2	5
3-Jun	0:00		9:00	46-34 N	54-37 E	o	40	9.8	1007.9	2.6	3.0	100	2.9	0.0	1.6	7
	3:00		12:00	46-45 N	54-44 E	o	20	10.2	1006.7	2.8	3.1	100	3.3	0.0	1.8	7
	6:00		15:00	45-55 N	54-56 E	o	20	10.1	1006.3	3.2	2.9	98	3.8	0.0	2.0	7
	9:00		18:00	47-10 N	55-14 E	o	30	10.4	1006.8	3.1	2.8	98	3.3	0.0	2.1	7
	12:00		21:00	46-56 N	55-15 E	o	20	9.8	1006.6	3.4	3.1	99	3.2	0.1	2.4	8
	15:00	4-Jun	0:00	46-12 N	55-15 E	r	360	10.0	1004.5	3.3	3.2	100	3.3	1.0	2.5	10
	18:00		3:00	46-28 N	54-43 E	r	360	10.2	1005.7	3.5	3.3	98	3.5	4.7	2.0	10
	21:00		6:00	46-41 N	54-43 E	r	10	11.4	1007.8	3.7	3.2	96	4.0	8.4	2.1	16
4-Jun	0:00		9:00	46-45 N	53-37 E	o	30	10.1	1009.3	4.4	2.7	90	4.3	0.0	1.6	6
	3:00		12:00	46-45 N	53-36 E	o	40	11.0	1008.8	4.2	2.9	91	4.4	0.0	1.6	6
	6:00		15:00	46-20 N	54-02 E	o	50	11.1	1007.1	4.1	2.5	89	3.7	0.0	1.8	9
	9:00		18:00	46-00 N	53-59 E	o	40	13.2	1005.7	3.9	2.6	91	3.8	0.0	2.0	7
	12:00		21:00	45-59 N	54-00 E	o	60	11.2	1005.6	3.9	2.1	88	3.7	0.0	1.9	6
	15:00	5-Jun	0:00	45-59 N	53-59 E	o	60	12.0	1004.4	3.5	2.2	91	3.7	0.0	2.2	6
	18:00		3:00	45-59 N	54-00 E	o	50	14.5	1002.8	3.0	1.9	93	3.7	0.0	2.3	6
	21:00		6:00	45-45 N	53-49 E	o	50	15.0	1003.0	3.0	2.2	95	4.0	0.0	2.7	9
5-Jun	0:00		9:00	45-08 N	54-23 E	o	40	13.4	1002.5	3.5	3.1	98	4.2	0.0	3.0	9
	3:00		12:00	44-59 N	54-29 E	o	20	12.8	1003.1	3.8	2.7	93	4.8	0.0	2.8	7
	6:00		15:00	44-43 N	54-52 E	o	30	13.1	1003.9	3.9	2.6	92	4.7	0.0	3.0	9
	9:00		18:00	44-11 N	55-36 E	o	20	12.3	1005.7	4.3	3.4	94	6.5	0.0	3.4	10
	12:00		21:00	43-57 N	55-34 E	o	20	10.6	1008.7	4.4	3.1	92	6.4	0.1	3.7	15
	15:00	6-Jun	0:00	44-00 N	54-59 E	o	10	4.2	1011.7	4.0	2.4	90	6.3	0.0	2.9	9
	18:00		3:00	44-00 N	55-01 E	o	10	5.0	1013.8	3.6	2.5	92	6.1	0.0	2.7	8
	21:00		6:00	43-59 N	54-59 E	o	100	1.6	1015.5	3.6	1.6	87	5.8	0.0	2.9	9
6-Jun	0:00		9:00	43-59 N	55-00 E	o	190	4.7	1016.2	4.4	2.0	85	5.9	0.0	2.8	9
	3:00		12:00	43-59 N	54-59 E	o	190	3.8	1015.4	5.9	4.0	88	6.4	0.0	2.2	9
	6:00		15:00	44-00 N	54-58 E	o	220	5.0	1015.6	7.0	4.9	87	6.4	0.0	2.1	9

Time				Position		Weather	WD	WS	P	T	DPT	RH	SST	Rain	Wv.Ht.	Wv.Pd.
UTC	ship			Lat.	Long.		(deg)	(m/s)	(hPa)	(deg.C)	(deg.C)	(%)	(deg.C)	(mm/3h)	(m)	(sec)
6-Jun	9:00	6-Jun	18:00	44-01 N	54-56 E	o	180	4.9	1016.0	7.2	5.5	89	6.2	0.0	2.3	9
	12:00		21:00	44-01 N	54-55 E	o	180	8.3	1014.7	7.9	6.5	91	6.1	0.0	2.0	9
	15:00	7-Jun	0:00	44-01 N	54-54 E	r	190	9.1	1013.9	7.4	7.7	100	5.9	0.1	1.9	9
	18:00		3:00	44-02 N	54-54 E	o	170	8.6	1011.6	7.9	7.8	99	6.3	0.1	1.9	9
	21:00		6:00	44-22 N	54-59 E	f	170	10.0	1010.7	7.8	8.5	100	6.8	3.3	2.0	12
	7-Jun		0:00	9:00	43-37 N	55-00 E	f	160	10.4	1009.4	9.4	10.2	100	7.1	0.0	1.9
	3:00		12:00	43-29 N	55-54 E	o	170	12.7	1009.7	11.1	10.6	96	10.9	0.0	2.1	7
	6:00		15:00	43-52 N	56-29 E	o	170	11.6	1009.5	10.5	10.3	99	7.3	0.0	2.8	17
	9:00		18:00	44-08 N	55-49 E	f	170	10.6	1007.1	8.6	9.3	100	6.7	0.0	2.3	12
	12:00		21:00	44-08 N	54-48 E	f	180	14.0	1004.0	8.9	9.7	100	6.7	13.2	2.1	12
	15:00	8-Jun	0:00	44-08 N	53-47 E	f	220	9.5	1002.1	7.8	8.6	100	6.0	19.3	2.3	14
	18:00		3:00	43-57 N	52-49 E	f	260	7.6	1003.7	5.8	6.7	100	6.1	1.0	2.3	12
	21:00		6:00	43-42 N	51-53 E	bc	290	10.9	1006.5	5.7	4.7	93	7.5	0.0	1.7	9
	8-Jun		0:00	9:00	43-28 N	50-59 E	o	300	8.8	1009.6	5.7	3.8	88	6.6	0.0	1.7
	3:00		12:00	43-14 N	50-04 E	bc	270	7.8	1011.8	5.7	4.1	89	6.5	0.0	1.8	11
	6:00		15:00	43-00 N	49-06 E	o	230	2.4	1012.9	6.1	4.3	88	6.8	0.0	1.4	9
	9:00		18:00	42-46 N	48-13 E	o	140	6.8	1011.6	6.5	5.7	95	6.6	0.0	1.6	11
	12:00		21:00	42-33 N	47-21 E	o	120	10.5	1009.0	10.3	10.2	100	11.1	0.3	2.0	12
	15:00	9-Jun	0:00	42-19 N	46-27 E	f	30	3.0	1006.0	10.8	11.6	100	11.6	0.0	1.5	14
	18:00		3:00	42-00 N	45-42 E	f	30	2.3	1003.6	11.4	12.5	100	10.8	0.1	1.4	12
	21:00		6:00	41-52 N	44-45 E	f	40	8.7	1003.0	12.2	13.6	100	15.3	0.0	1.4	14
	9-Jun		0:00	9:00	41-38 N	43-51 E	f	10	11.1	1003.3	9.0	10.0	100	10.0	0.3	2.0
	3:00		12:00	41-32 N	42-55 E	o	60	13.3	1001.4	9.1	10.4	100	11.7	0.3	1.9	19
	6:00		15:00	41-35 N	41-53 E	r	140	5.6	1001.7	10.6	11.4	100	11.7	0.3	1.9	24
	9:00		18:00	41-28 N	41-17 E	o	280	3.0	1002.9	12.7	13.0	100	12.2	0.0	0.8	6
	12:00		21:00	41-27 N	41-17 E	o	210	7.0	1004.2	14.0	13.2	95	14.3	0.0	0.8	6
	15:00	10-Jun	0:00	41-27 N	41-18 E	bc	270	7.6	1005.8	13.3	11.5	89	16.3	0.0	0.8	4
	18:00		3:00	41-27 N	41-18 E	c	290	11.0	1007.8	12.5	10.4	87	17.7	0.0	0.7	4
	21:00		6:00	41-27 N	41-16 E	c	270	6.1	1009.8	12.3	9.7	84	18.5	0.0	0.8	4

3-2. Temperature and salinity measurement and water sampling: CTD/CWS

Hirokatsu UNO¹⁾, Fujio KOBAYASHI¹⁾, Hiroshi MATSUNAGA¹⁾, Yuichiro KUMAMOTO²⁾ and Chizuru SAITO²⁾

1) Marine Works Japan Ltd.

2) Japan Marine Science and Technology Center

(1). Introduction

As a basic property of the water mass in the study area, temperature and salinity were measured with CTD (SBE911plus; Sea-Bird Electronics, Inc.) and seawater sampling was conducted with Carousel Water Sampler (CWS: SBE32; Sea-Bird Electronics, Inc.) in order to obtain the samples for chemical analysis. In this section, we describe as for the CTD/CWS observations in MR00-K03 cruise from 9 May 2000 to 10 June 2000 on R/V MIRAI.

(2). Measured Items

Temperature and Salinity were measured from sea surface to 6,500 m in maximum (Large system) or 6,000 m (Small system). Seawater was sampled with CTD/ CWS at 28 stations. The 87 water-sampling casts in total were for the chemical analysis of general water properties, carbon, trace metals, radioisotope, etc.

(3). Observation Methods

(a). CTD/CWS systems

Two CTD/CWS water sampling system were used through this cruise. One was the CTD (SBE911plus; Sea-Bird Electronics, Inc.) with the 30-liters 24-positions Carousel Water Sampler (SBE32; Sea-Bird Electronics, Inc.), called Large-CTD/CWS. Another one was the CTD and CWS like Large CTD/CWS, but with 12-liters 12-positions water sampler, called Small-CTD/CWS. 12 bottles of 12-liters Niskin were Niskin-X External Spring Water Samplers (General Oceanics, Inc.) which especially modified and cleaned for the trace metal analysis. The sensors attached on each CTD were temperature sensor, conductivity sensor, pressure sensor and altimeter. Specifications of the sensors were listed below:

CTD/CWS type	Sensor	Serial No.
Large-CTD/CWS	Temperature	31359
	Conductivity	41206
	Pressure	42423
	Altimeter	206 (Benthos 2110-1)
	Fluorometer*	132S (SeaTech Inc.) *Only shallow cast
Small-CTD/CWS	Temperature	31525
	Conductivity	41088
	Pressure	751190
	Altimeter	396 (Datasonics PSA-900D)

(b). Operation during Observation

Large-CTD/CWS was deployed and recovered with the A-frame in the stern of R/V MIRAI, and Small-CTD/CWS was with another small frame installed on starboard side, called the Gallows. The CTD raw data was acquired on real time by using a SEASAVE utility of software SEASOFT (Ver. 4.232) provided by Sea-Bird Electronics, Inc. and stored on the hard disk of a personal computer set in After Wheel-house. Water sampling was made during up cast by sending a fire command from the computer. Detail information during a cast such as date/time, station/cast/file names, location at the start/bottom/end of observation, water sampling layers and events were recorded in CTD cast log sheets. These were summarized in CTD Cast Table or CTD Bottle List shown in Appendix.

After a cast, the Large-CTD/CWS was lifted down from upper deck to the Water Drawing Room on 2nd deck and seawater was drawn from the bottles.

(c). CTD data processing

The CTD raw data was processed by using SEASOFT (Ver. 4.232) on another computer. Procedure of the data processing and used utilities of SEASOFT were as following:

DATCNV: Converts the binary raw data to output on physical units. Output items are depth, pressure, temperature, potential temperature, salinity,

density (sigma-t), oxygen, conductivity, and descent rate. Simultaneously, this utility selects the CTD data when bottles closed to output on another file: *.BTL.

SECTION: Select a range of data based on either scan number or pressure. Write out selected rows of converted data to a new file.

WILDEDIT: Marks wild points by setting their values to the bad value specified in the input .CNV header. The first pass of WILDEDIT is used to obtain an accurate estimate of the true standard deviation of the data. The second pass is used to mark the values good or bad.

SPLIT: Splits the data made by DATCNV into up and down cast data.

BINAVG: Calculates the averaged data in every 1 m.

ROSSUM: Edits the data of sampled water to output a summary file. These data were shown in tables in Appendix CTD Bottle List.

SEAPLOT: Display the vertical profiles of averaged temperature, salinity, sigma-t, and oxygen data on CRT and print out.

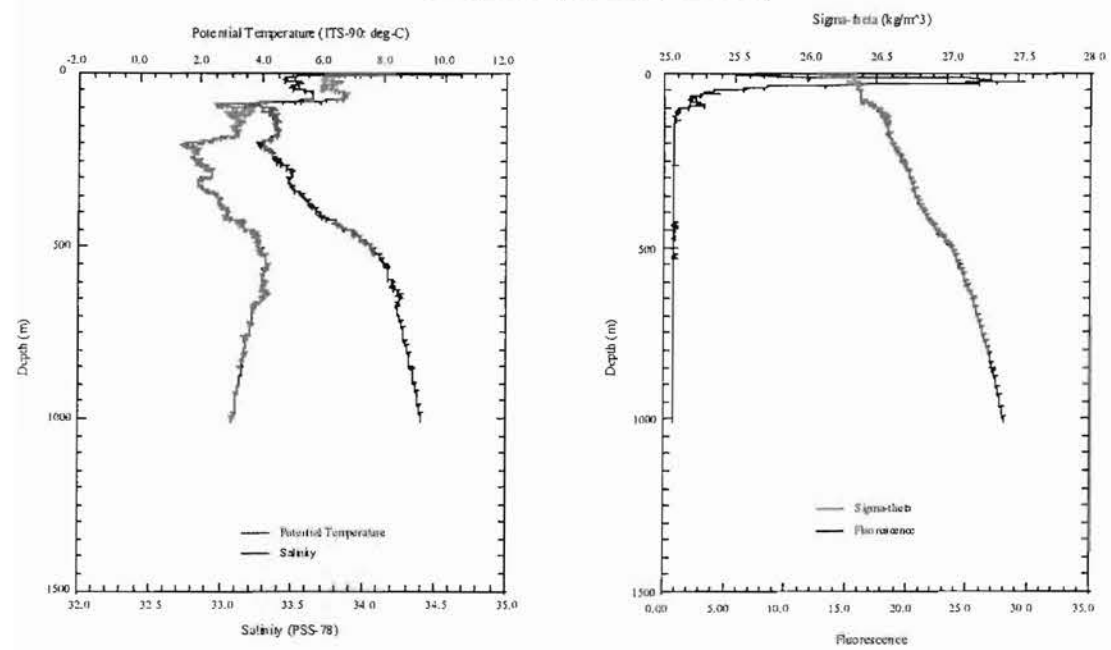
Profiles obtained during deep casts at every station are shown in Figs. 3.2..

(4). Management of the CTD data

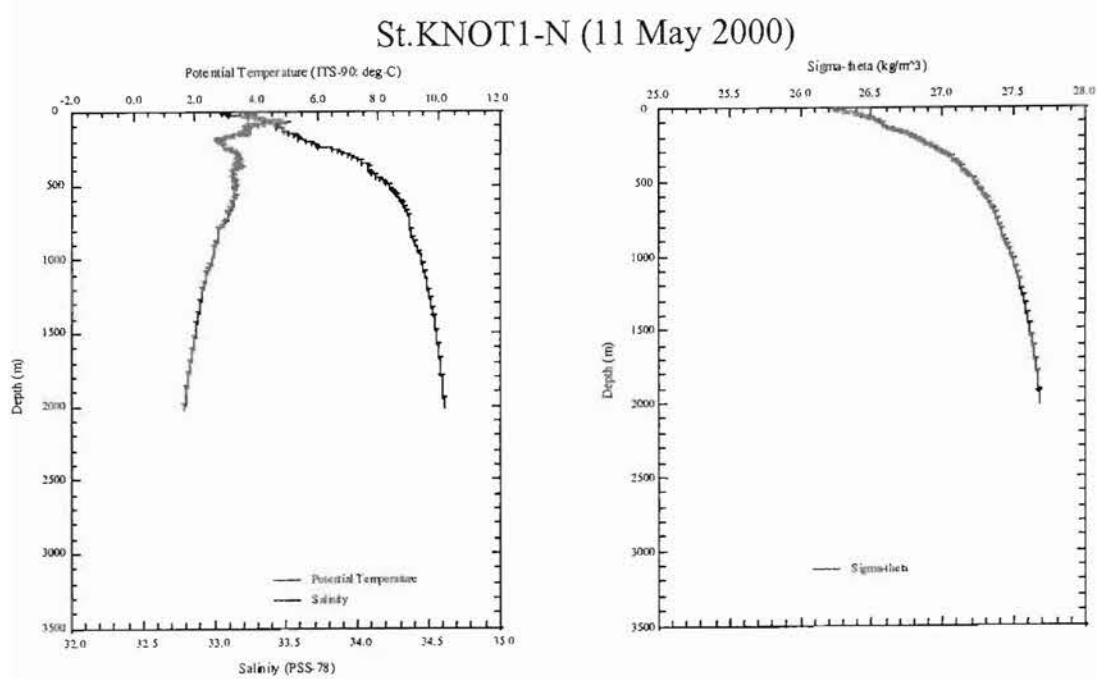
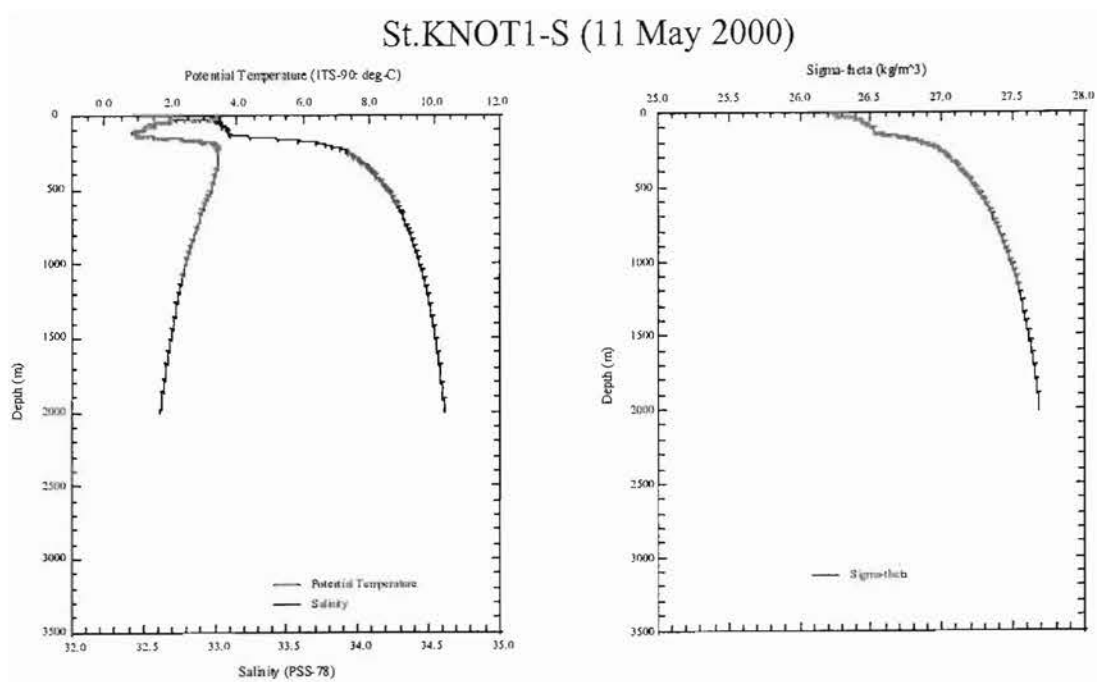
A file name of each cast consists of station name, CTD/CWS type, and cast number, e.g., 001L01. After SPLIT utility was used, up/down identification was added. As a result of above on-board processing, 9 files were made for 1 cast, such as .DAT, .CON, .HDR, .BL, .ROS, .BTL, d*.CNV, u*.CNV *.CNV files.

All of raw and processed CTD data files were copied into 3.5 inches magnetic optical disks (MO disks).

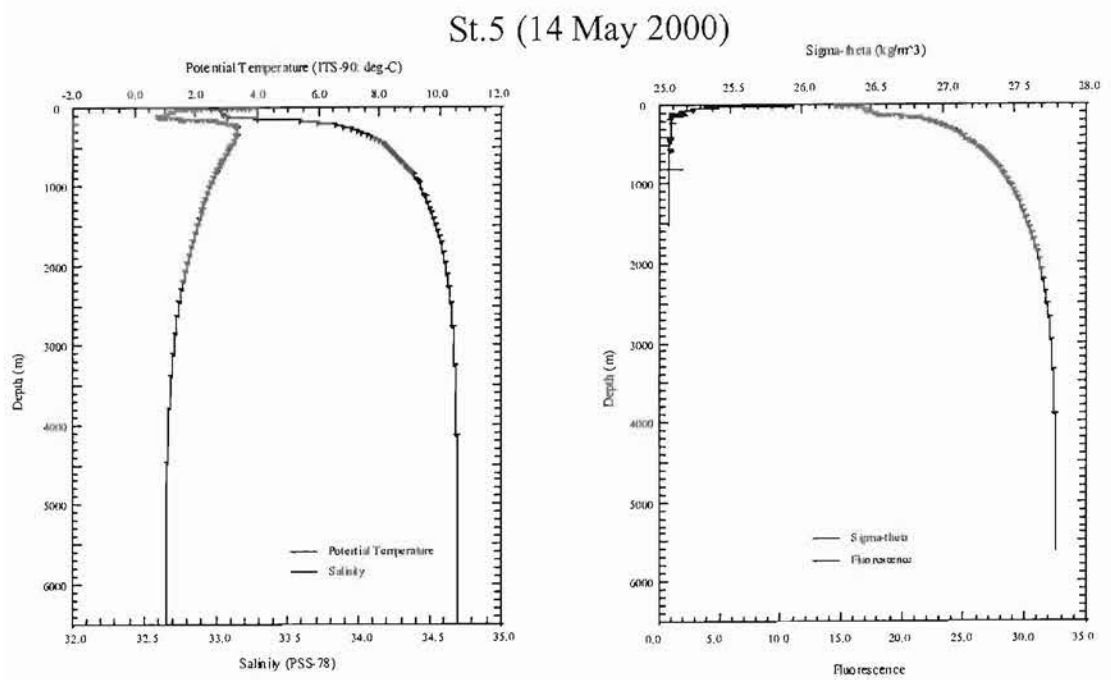
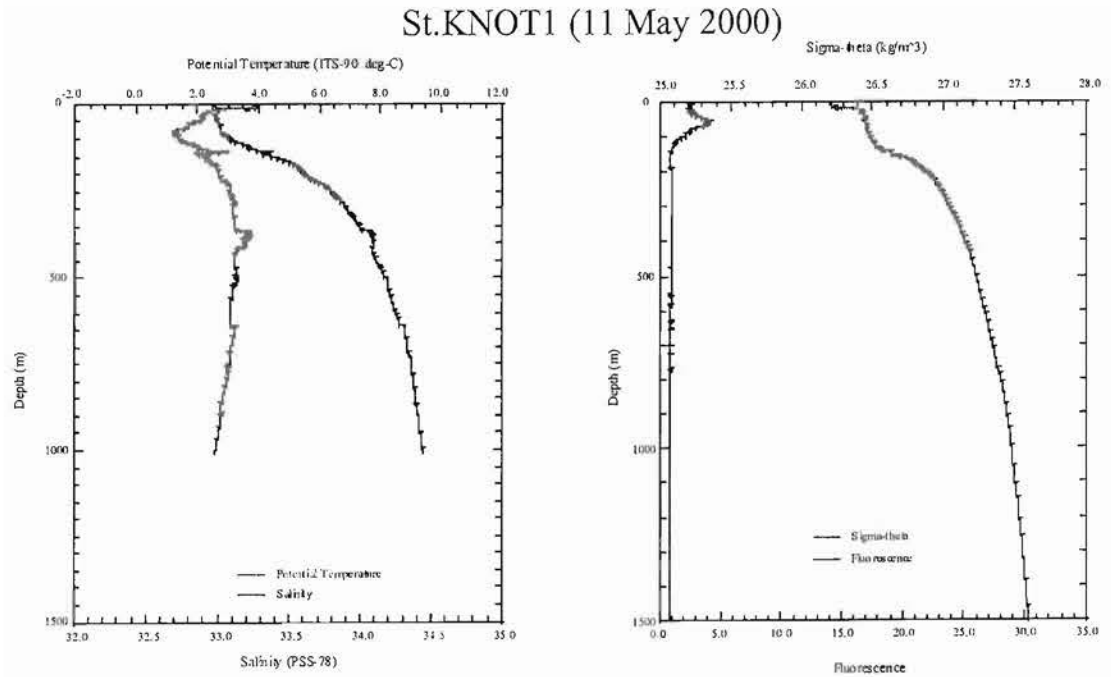
St.TEST (09 May 2000)



F i g 3 . 2 . 1

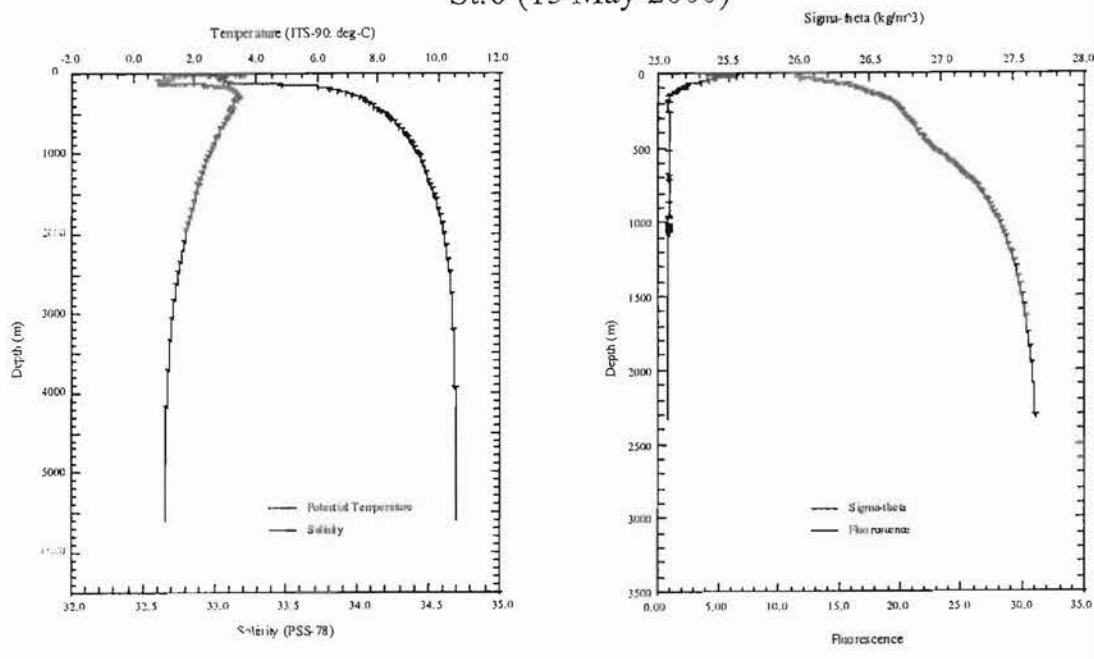


F i g 3 . 2 . 2

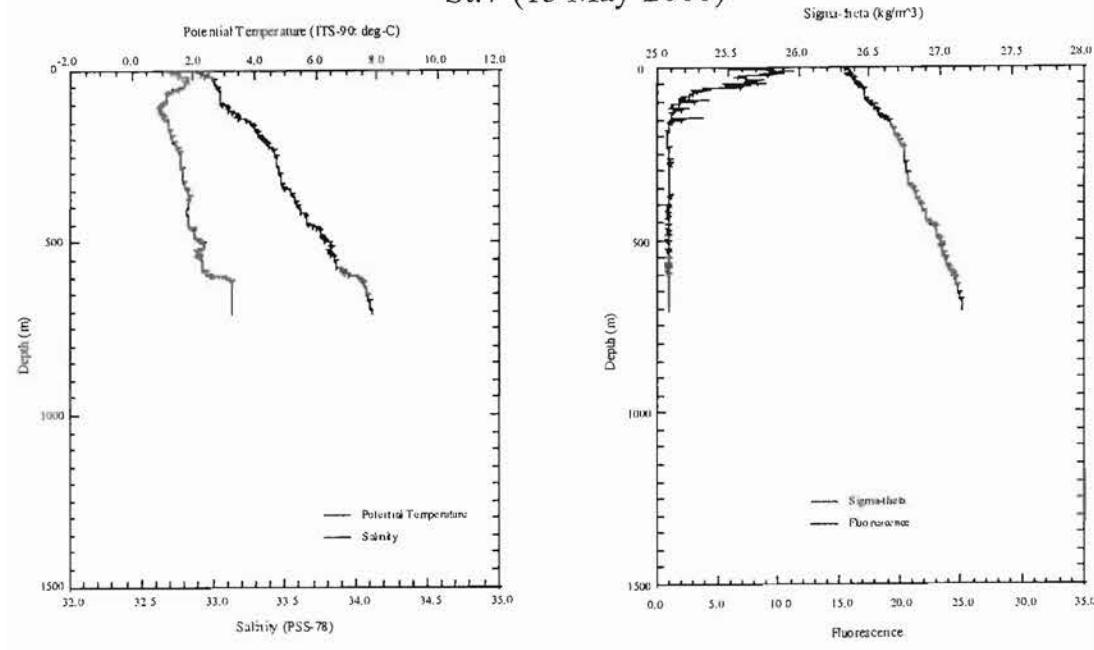


F i g 3 . 2 . 3

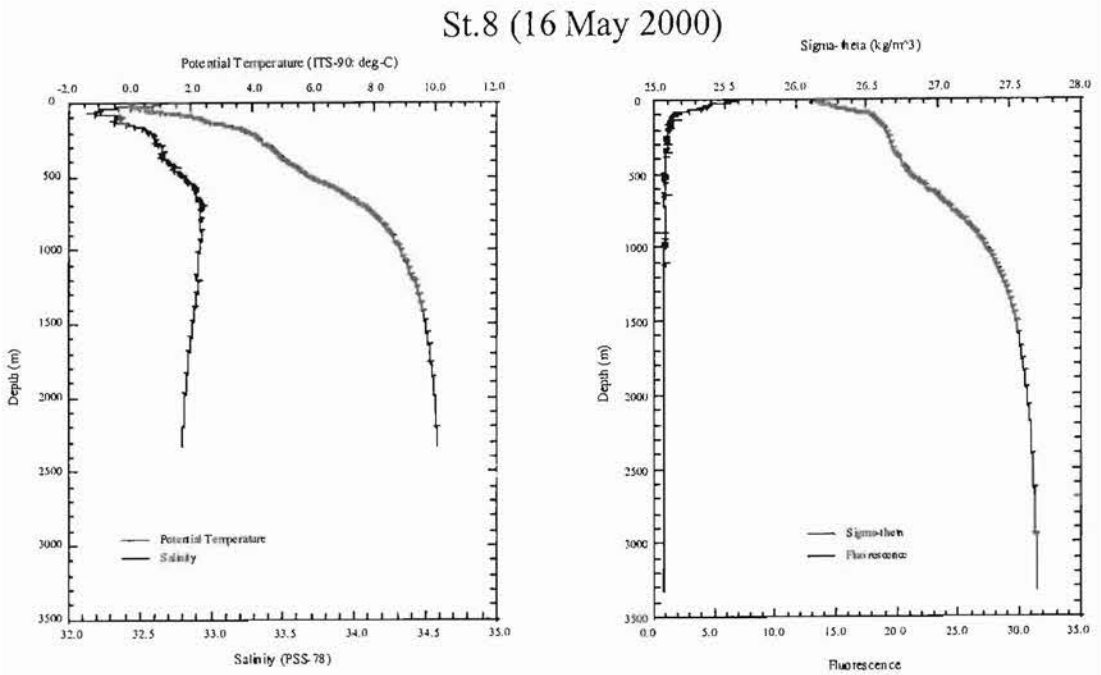
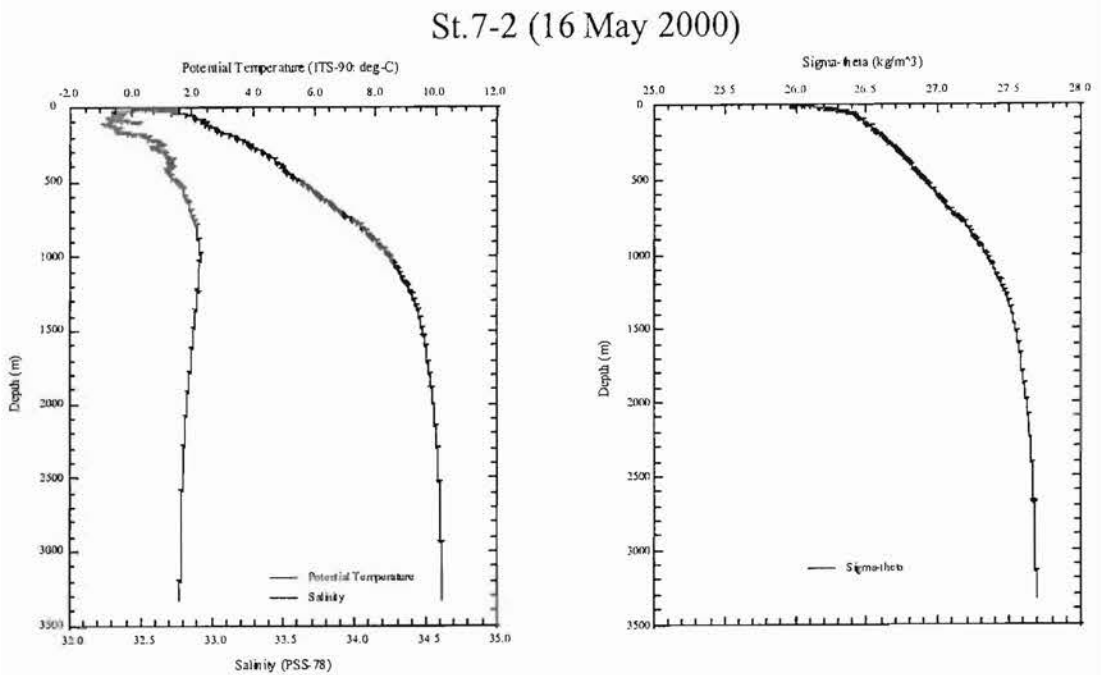
St.6 (15 May 2000)



St.7 (15 May 2000)

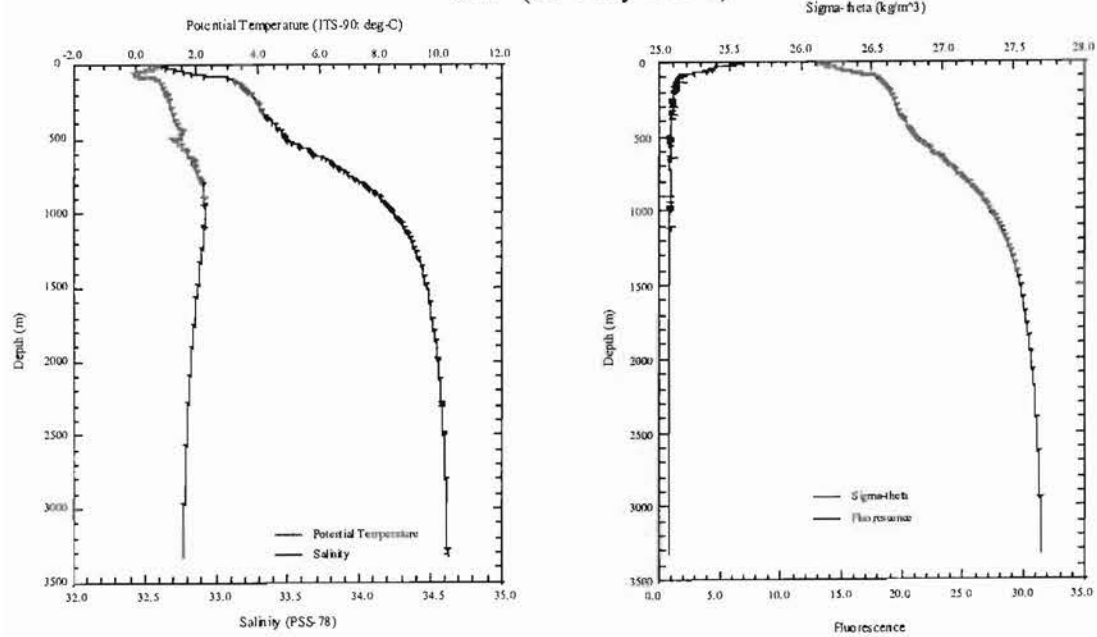


F i g 3 . 2 . 4

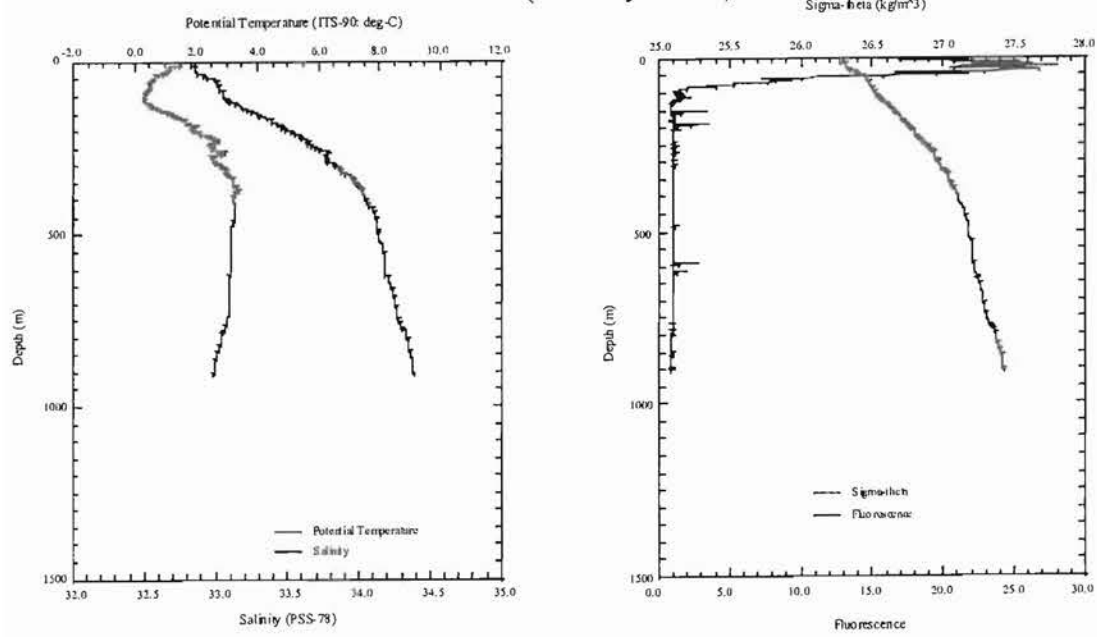


F i g 3 . 2 . 5

St.9 (17 May 2000)

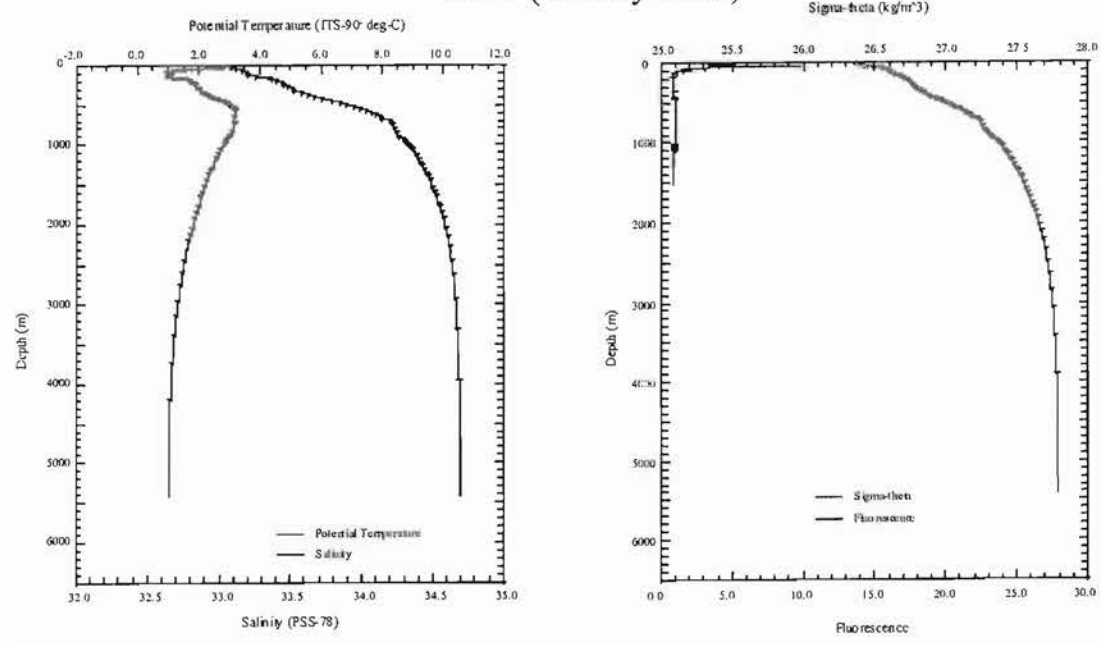


St.10 (18 May 2000)

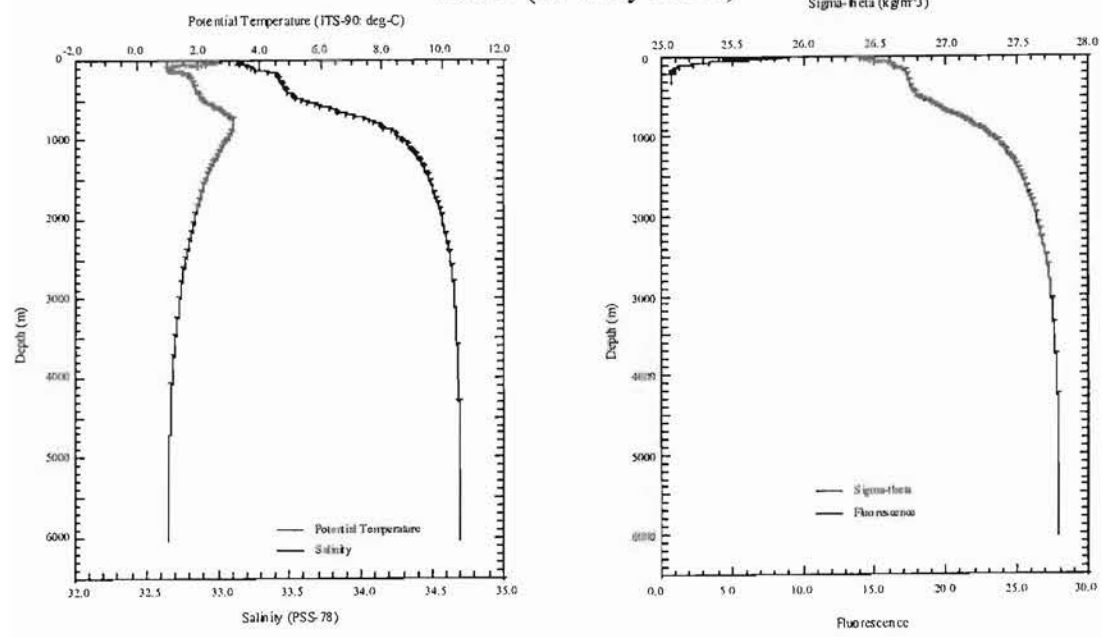


F i g 3 . 2 . 6

St.11 (19 May 2000)

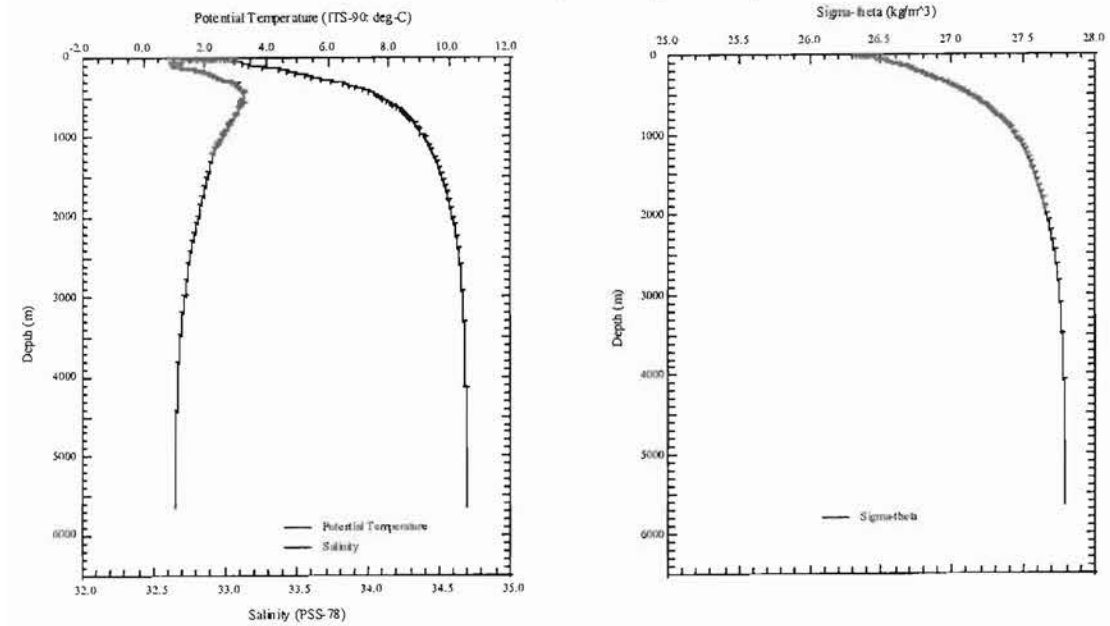


St.12 (20 May 2000)



F i g 3 . 2 . 7

St.12-2 (21 May 2000)



St.13 (22 May 2000)

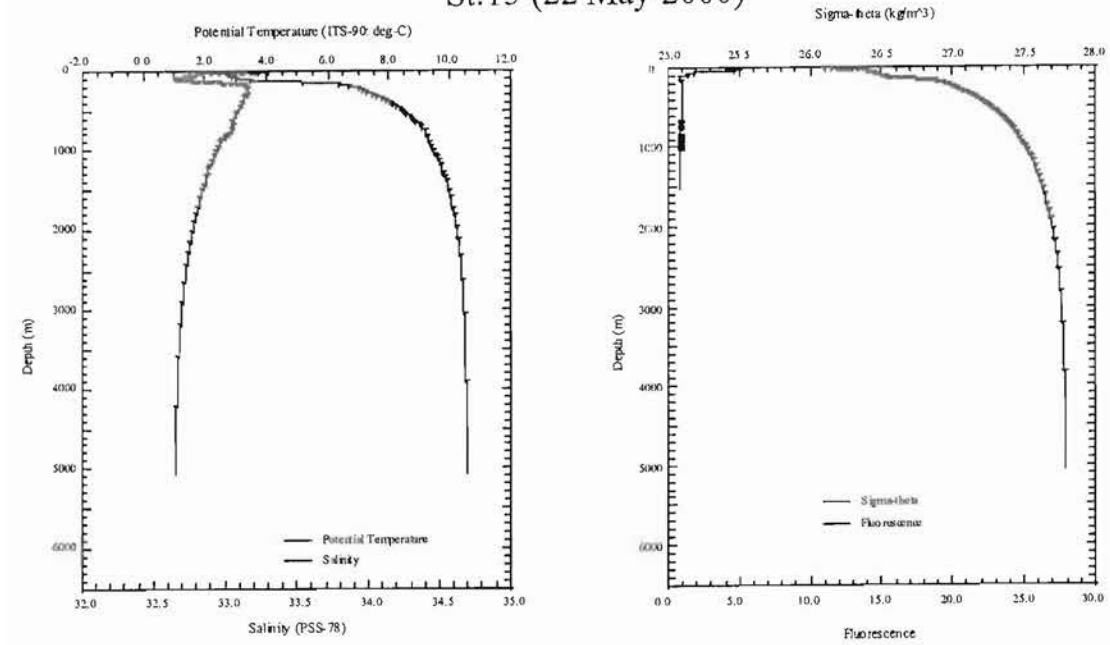
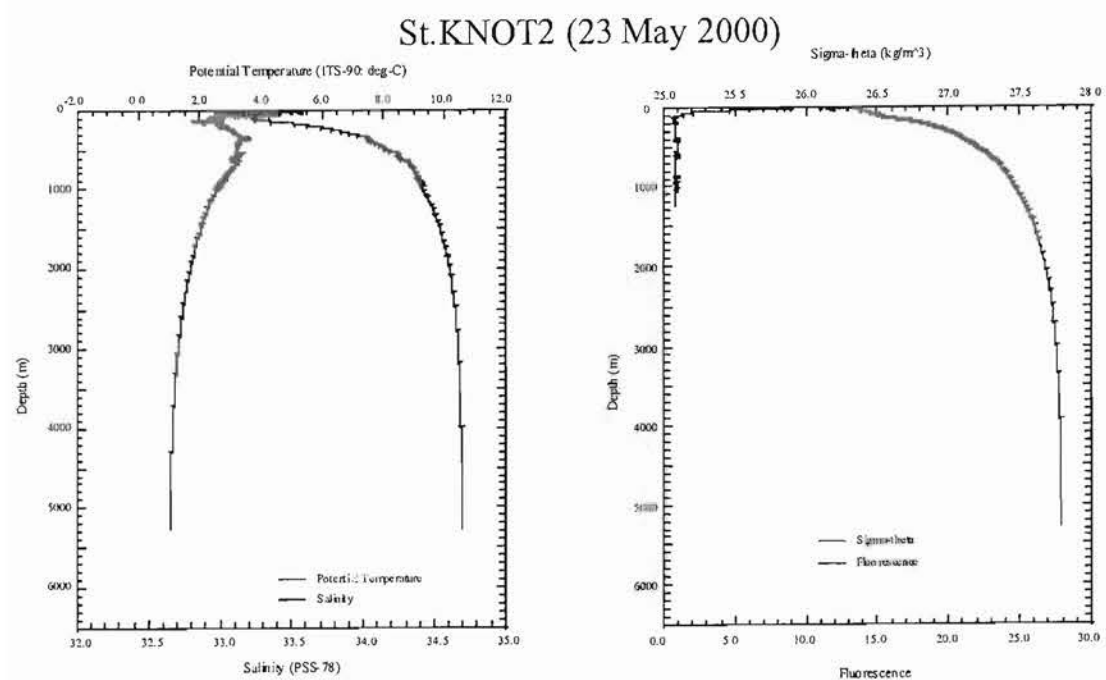
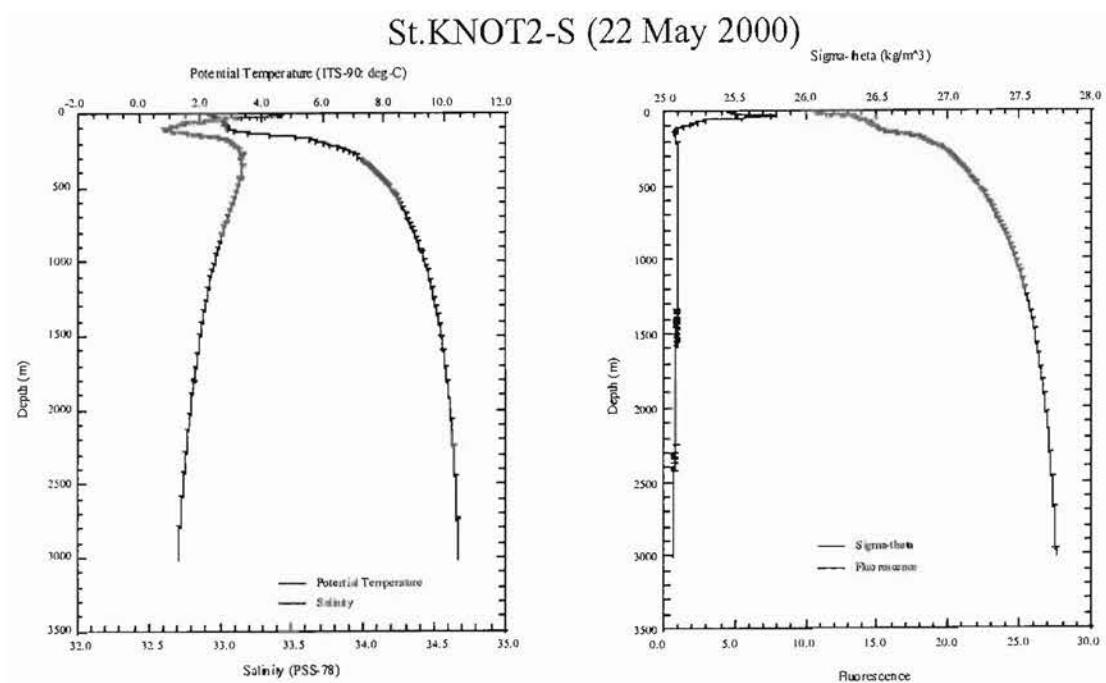


Fig 3. 2. 8



F i g 3 . 2 . 9

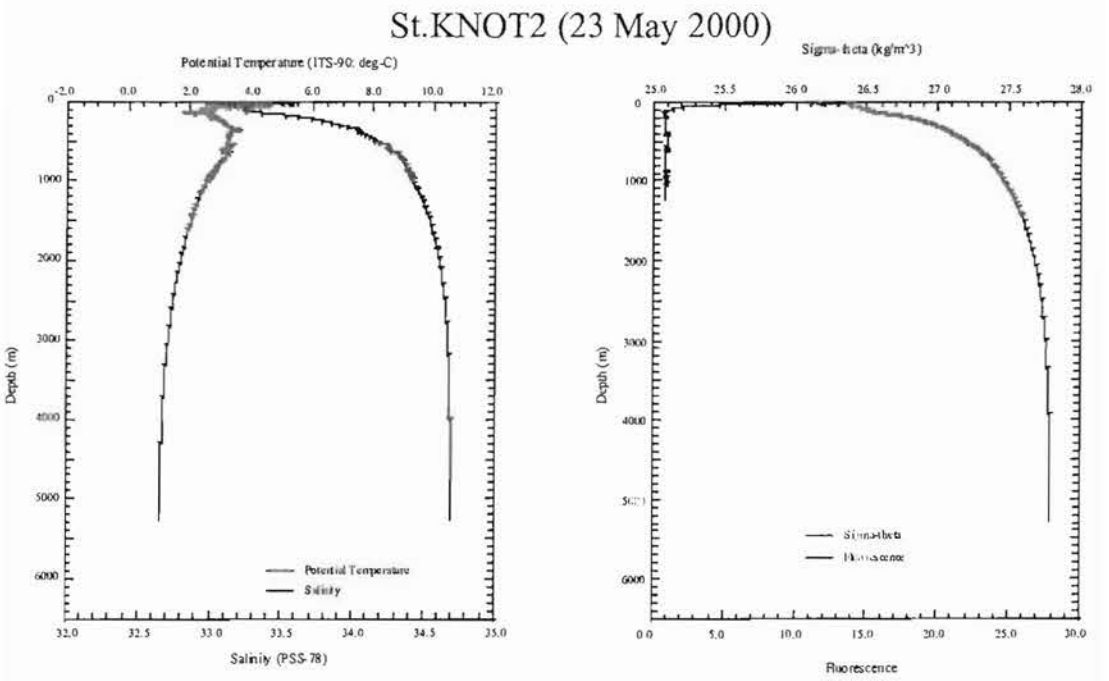
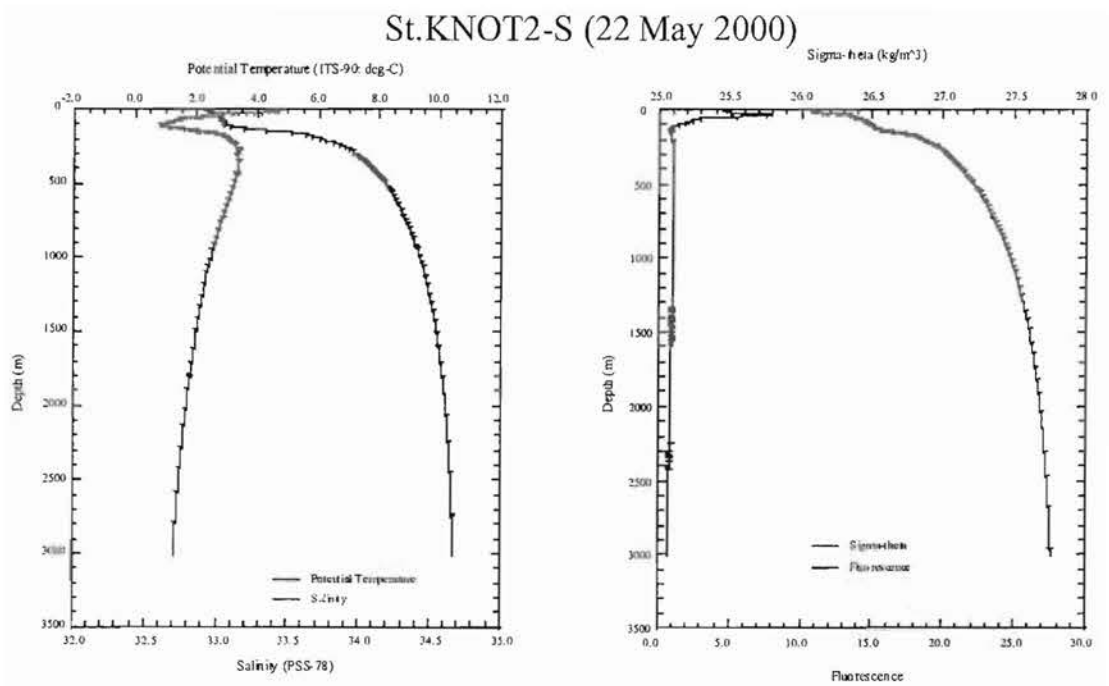
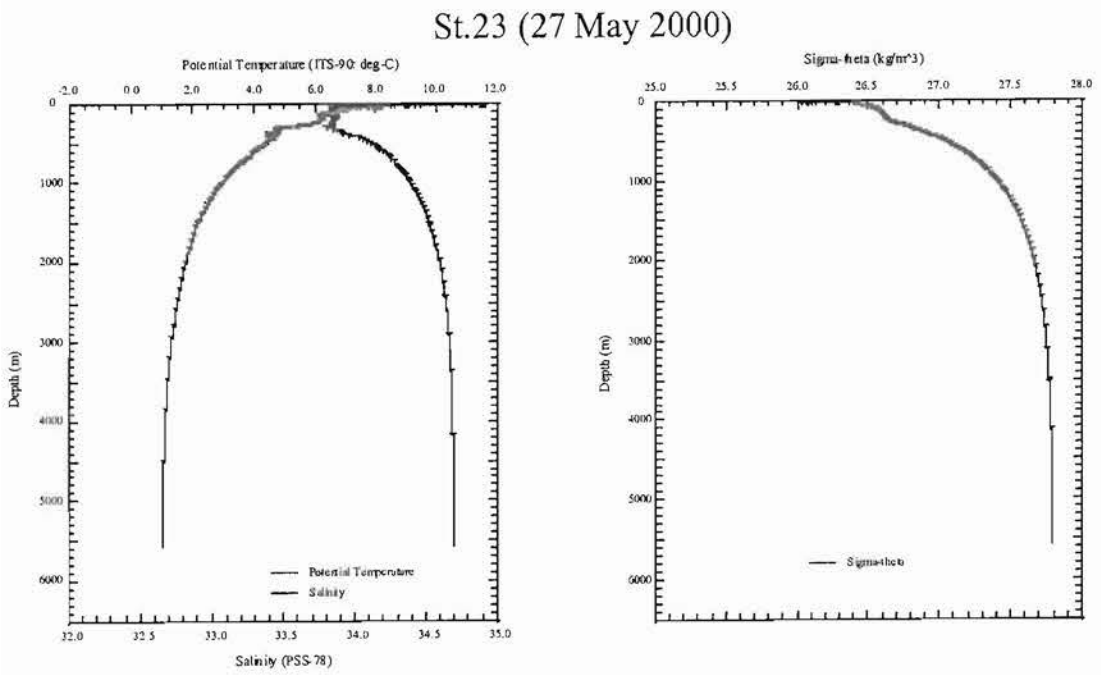
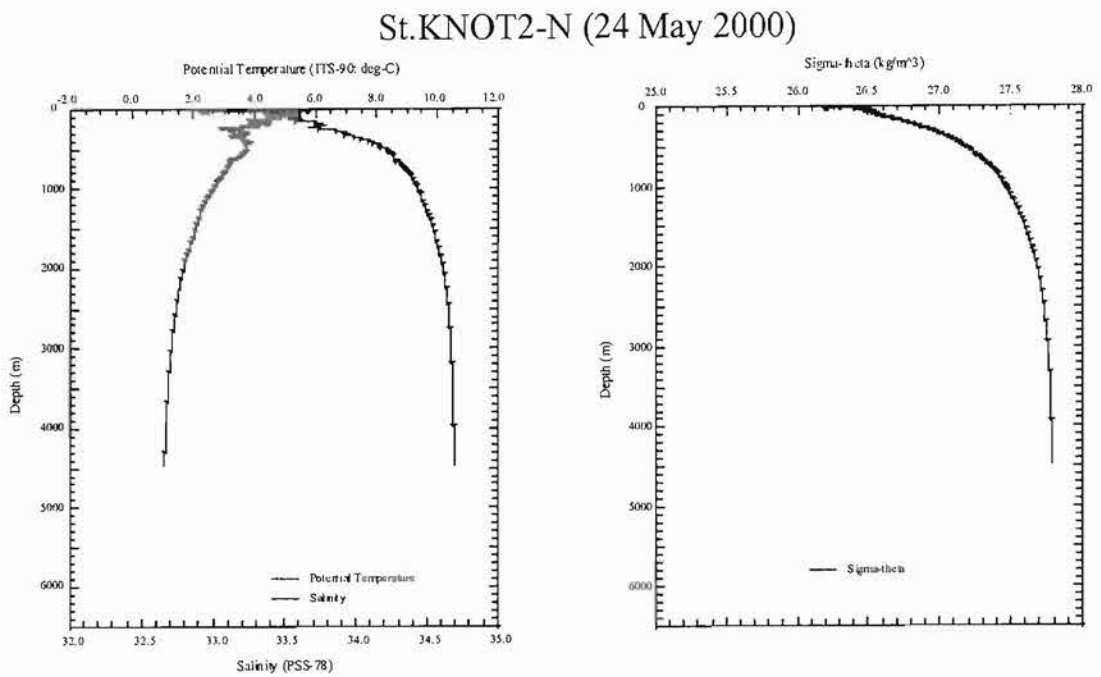
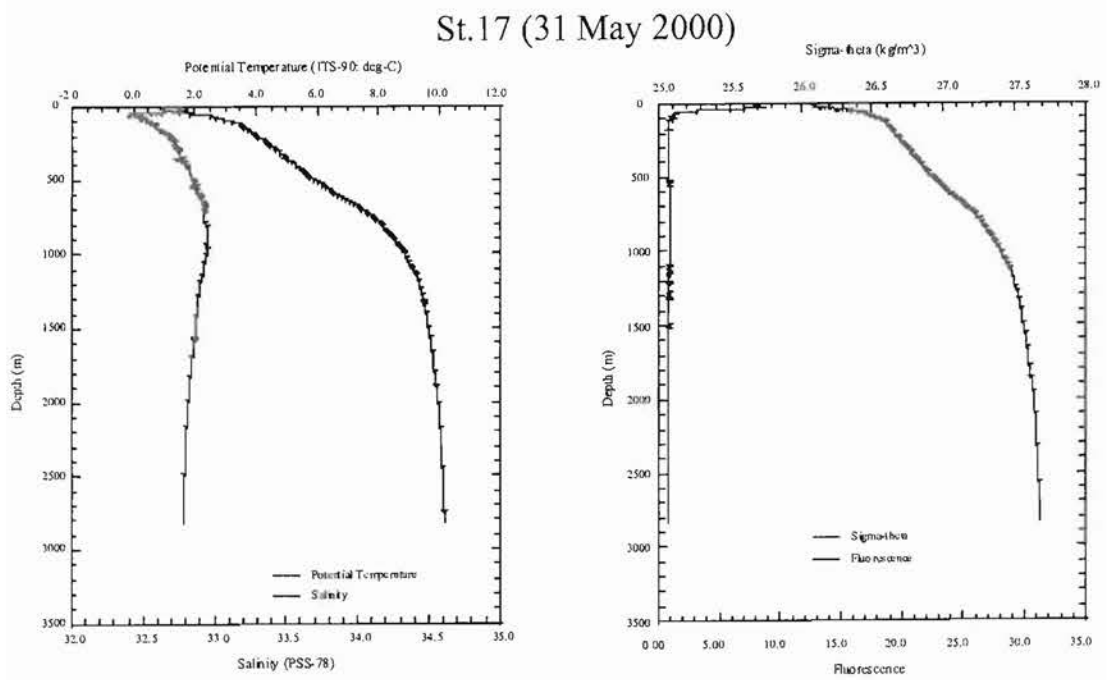
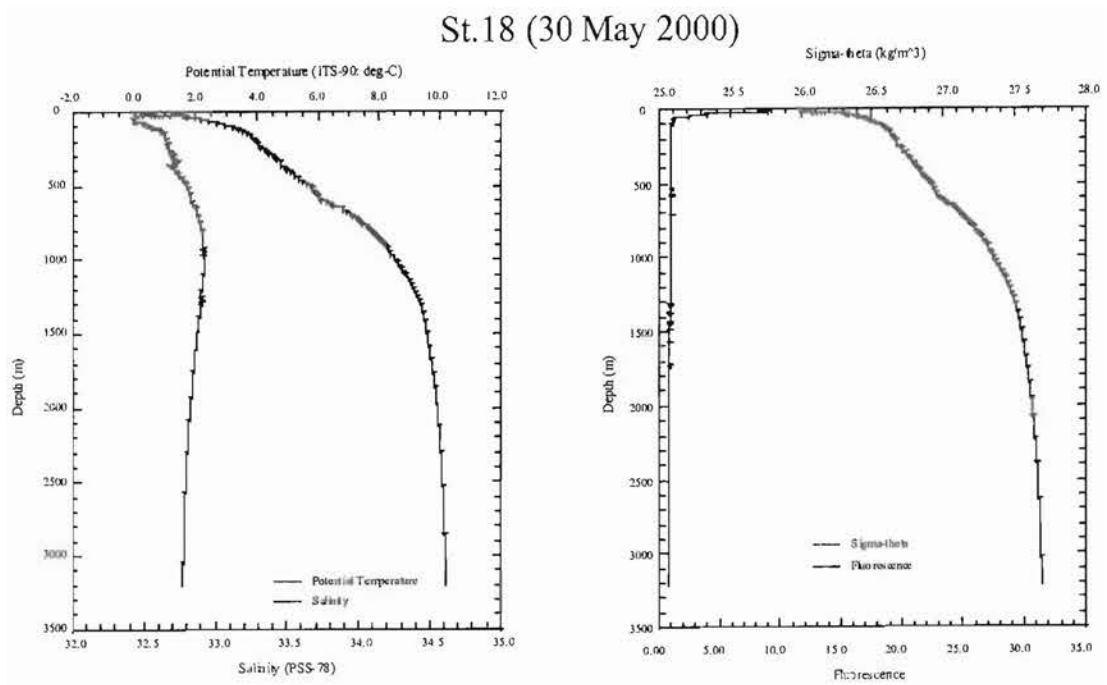


Fig 3. 2. 10

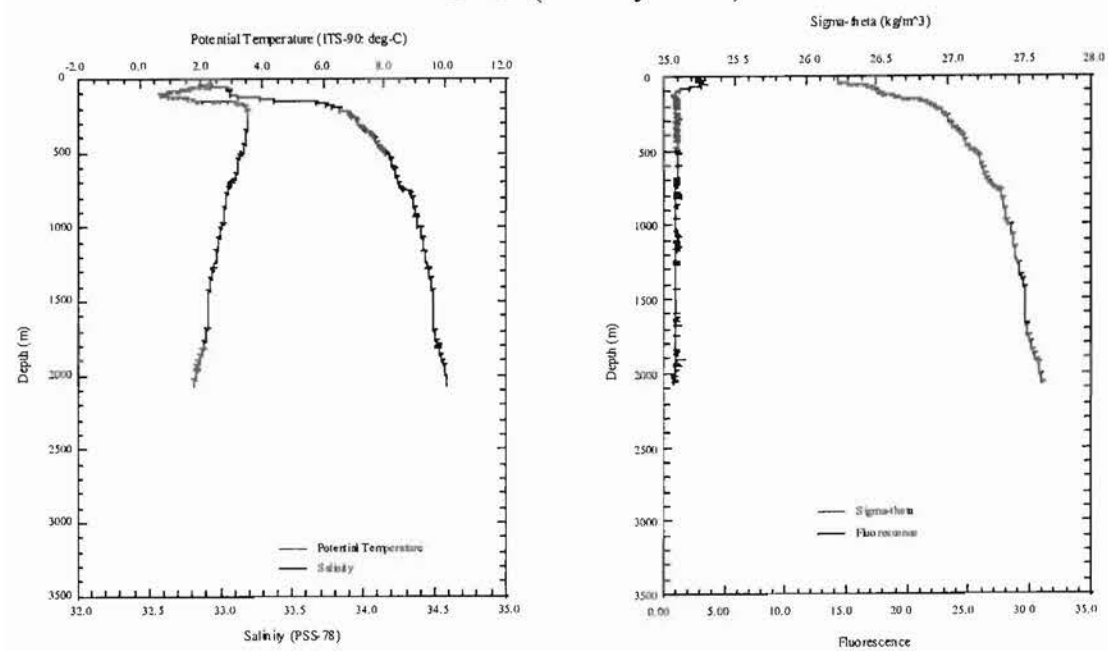


F i g 3 . 2 . 11

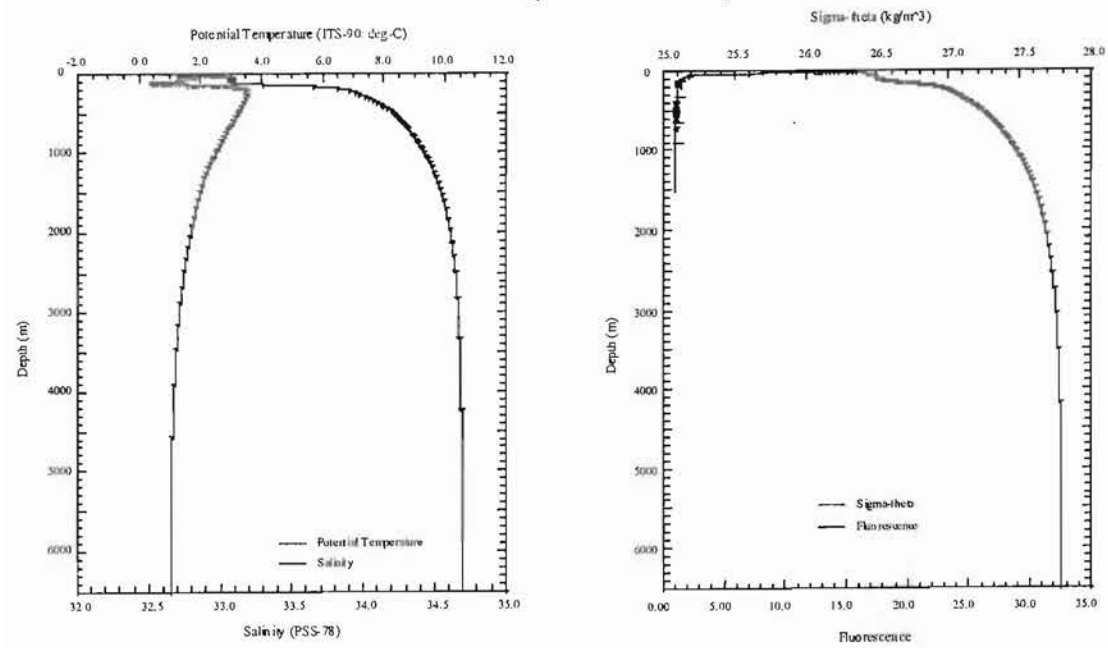


F i g 3 . 2 . 12

St.19 (31 May 2000)

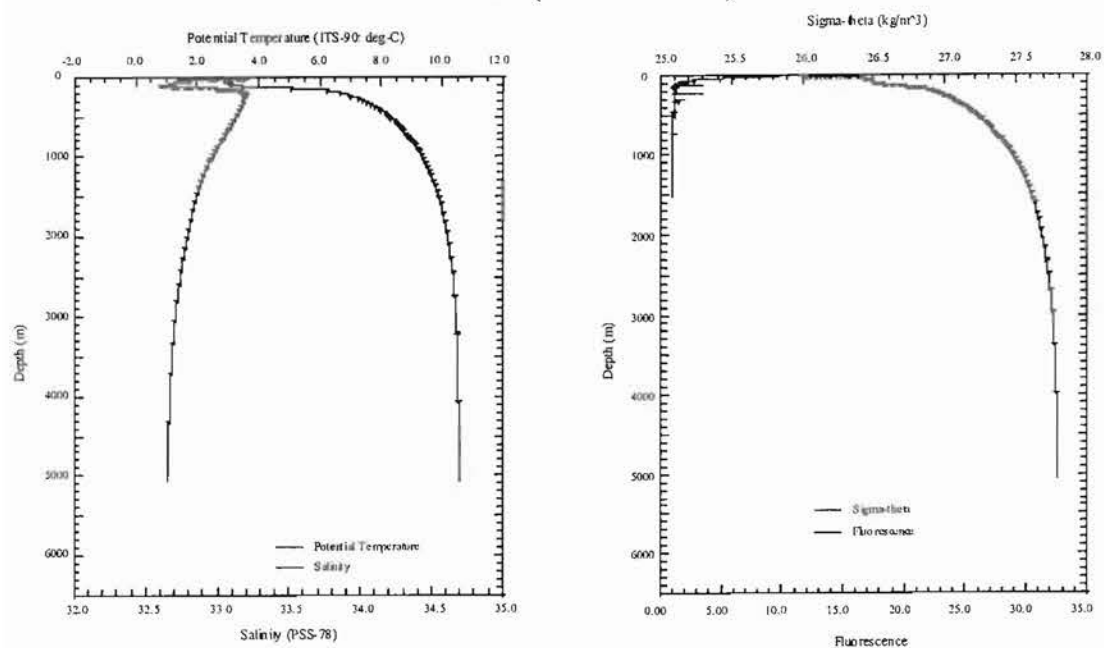


St.22 (01 Jun. 2000)

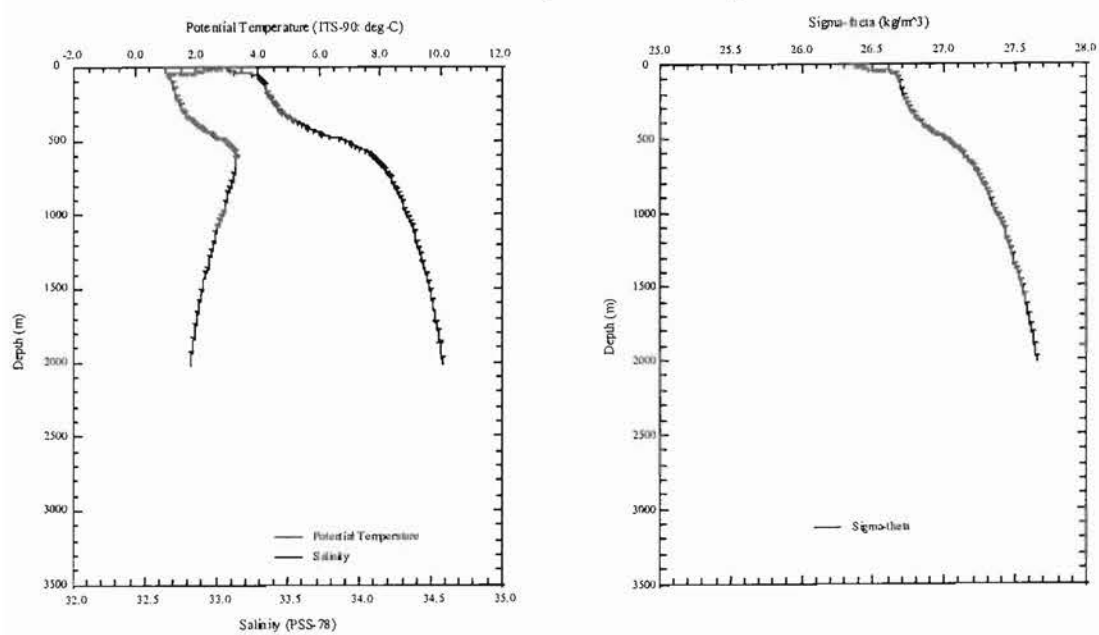


F i g 3 . 2 . 13

St.21 (02 Jun. 2000)

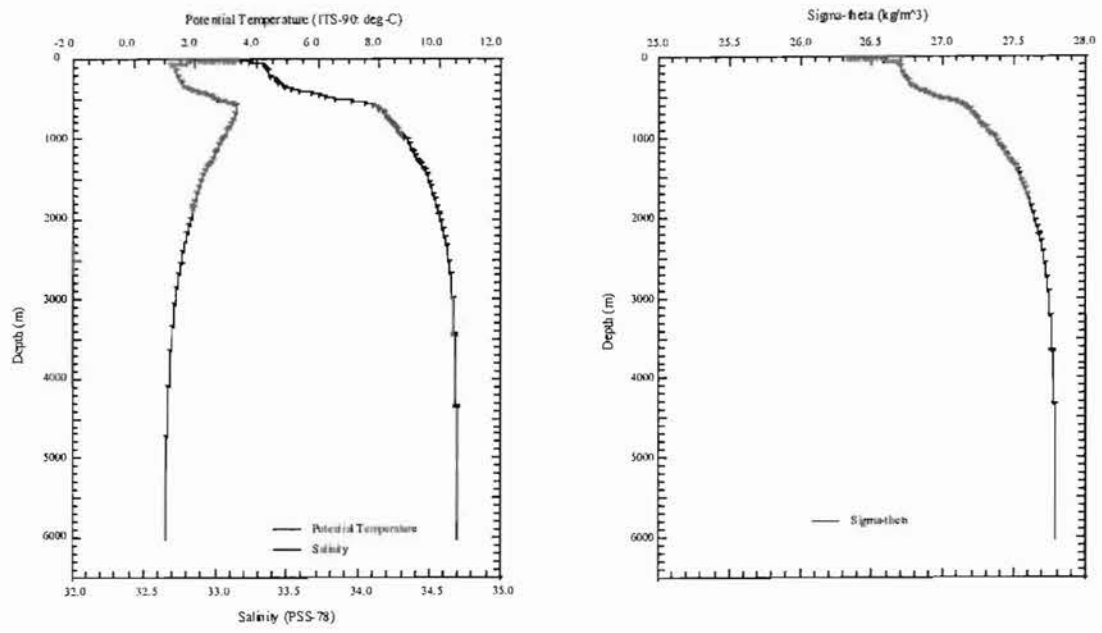


St.20-2 (02 Jun. 2000)

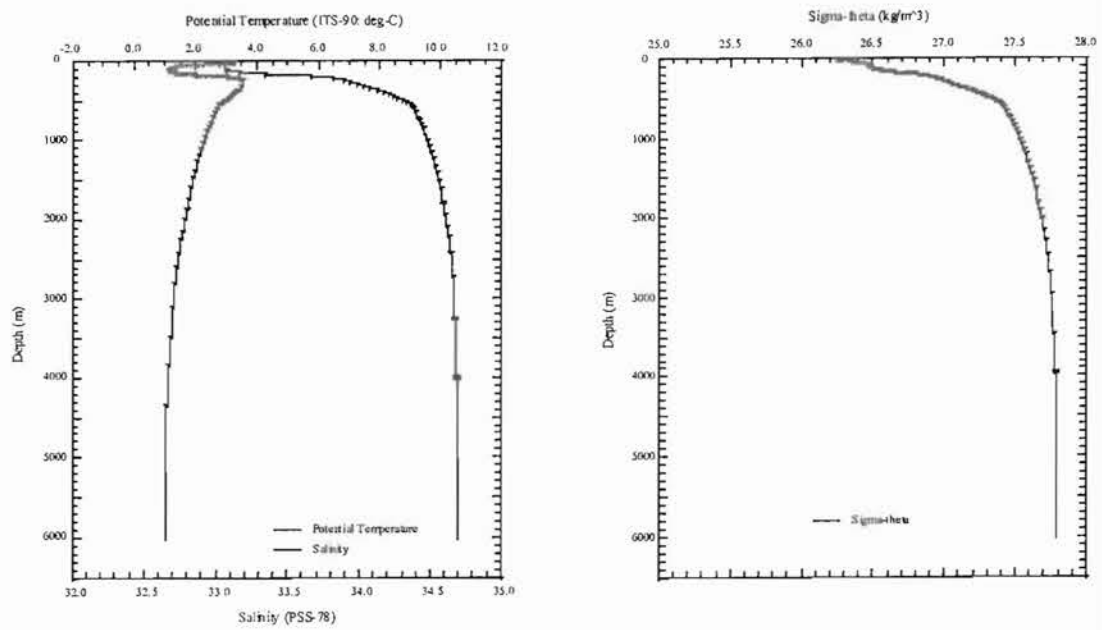


F i g 3 . 2 . 14

St.20-3 (03 Jun. 2000)

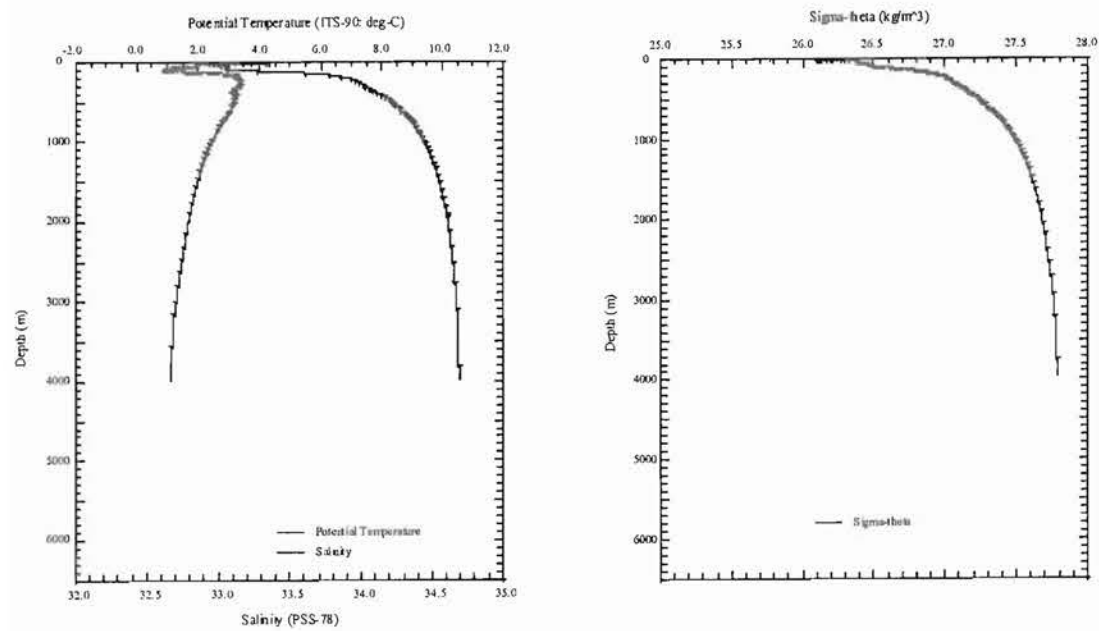


St.20-4 (03 Jun. 2000)

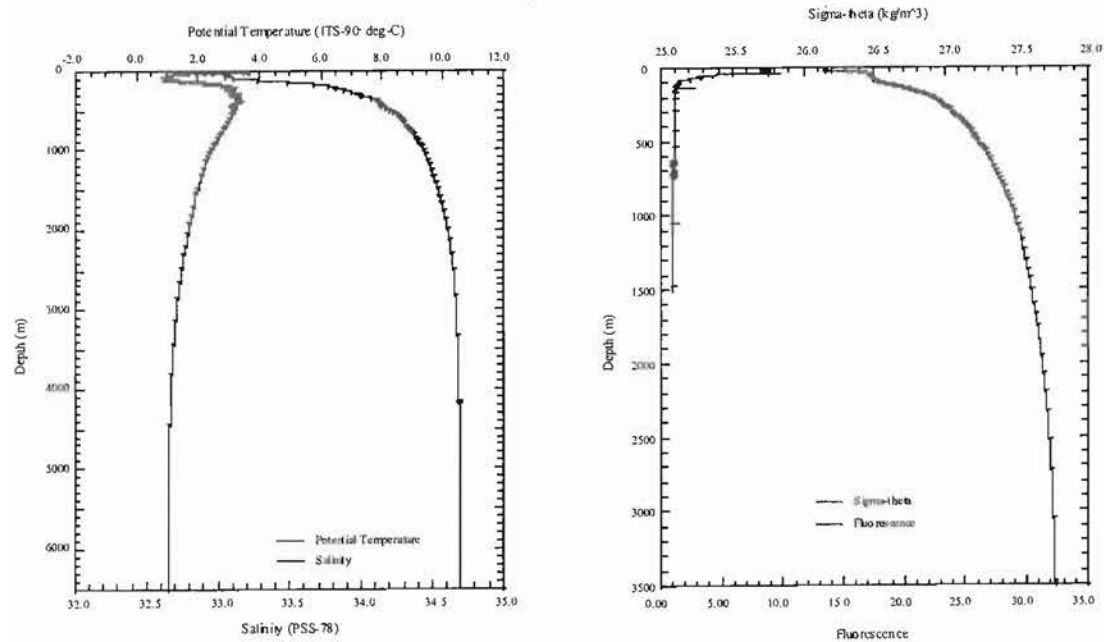


F i g 3 . 2 . 15

St.16 (03 Jun. 2000)

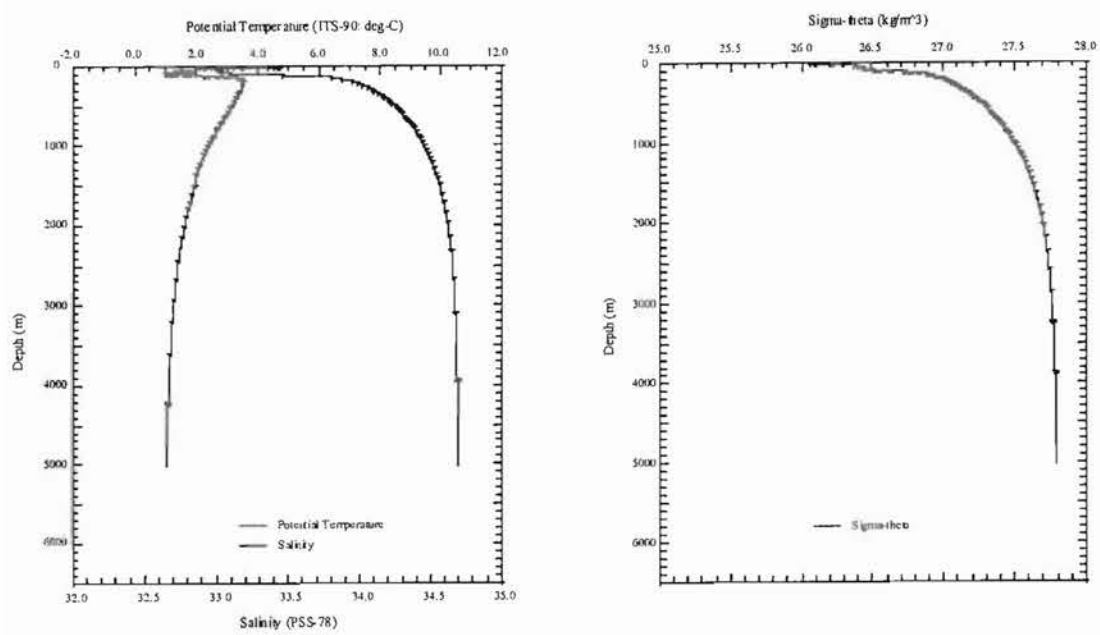


St.15 (04 Jun. 2000)

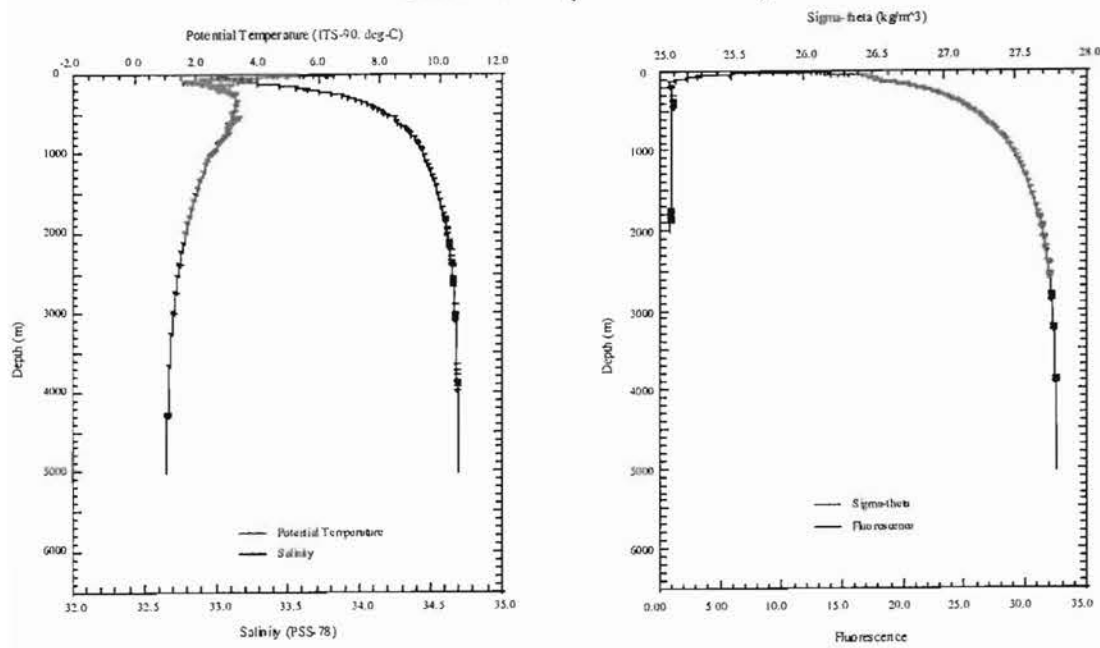


F i g 3 . 2 . 16

St.14 (05 Jun. 2000)



St.KNOT3 (05 Jun. 2000)



F i g 3 . 2 . 17

3.3 Dissolved oxygen, nutrients, and salinity

3.3.1 Dissolved oxygen

Katsunori Sagishima,

Takayoshi Seike

(Marine Works Japan Ltd.)

Chizuru Saito

(Japan Marine Science and Technology Center)

(1) Introduction

Dissolved oxygen is major parameter for deciding the seawater characteristic on oceanography. In this cruise, the method of dissolved oxygen determination is based on WHP Operations and Methods manual (Culberson, 1991, Dickson, 1994).

(2) Methods

(a) Instruments and Apparatus

Glass bottle: Glass bottle for D.O. measurements consist of the ordinary BOD flask(ca.180 ml) and glass stopper with long nipple, modified from the nipple presented in Green and Carritt (1966).

Dispenser: Eppendorf Comforpette 4800 / 1000 μ l
OPTIFIX / 2 ml (for MnCl_2 & NaOH / NaI aq.)
Metrohm Model 725 Multi Dosimat / 20 ml (for KIO_3)

Titrator: Metrom Model 716 DMS Titrino / 10 ml of titration vessel
Metrom Pt Electrode / 6.0403.100 (NC)

Software: Data acquisition and endpoint evaluation /

(b) Methods

Sampling and analytical methods were based on to the WHP Operations and Methods (Culberson, 1991, Dickson, 1994).

(b-1) Sampling

Sea water samples for dissolved oxygen measurement were collected from 30L Niskin bottles to calibrated dry glass bottles. During each sampling, 2 bottle volumes of seawater sample were overflowed to minimize contamination with atmospheric oxygen and the seawater temperature at the time of collection was measured for correction of the sample

volume. After the sampling, MnCl_2 (ap.) 1ml and NaOH / NaI (aq.) 1ml were added into the glass bottle, and then shook the bottle well. After the precipitation has settled, we shook the bottle vigorously to disperse the precipitate.

(b-2) D.O. analysis

The samples were analyzed by Metrohm titrators with 10 ml piston burette and Pt Electrode using whole bottle titration. Titration was determined by the potentiometric methods and the endpoint for titration was evaluated by software of Metrohm, “The Brinkmann Titrino Workcell”.

Concentration of D.O. was calculated by equation (8) and (9) of WHP Operations and Methods (Culberson, 1991). Salinity value of the equation (9) was used from the value of salinity of CTD. The amount of D.O. in the reagents was reported 0.0017 ml at 25.5 deg-C (Murray .et.al., 1968). However in this cruise, we used the value (=0.0027 ml at 21 deg-C) measured at 1995 WHCE cruise of R/V Kaiyo D.O. concentrations we calculated were not corrected by seawater blank.

We prepared and used one batch of 5 liter of 0.07N thiosulfate solutions and 5 liter of 0.0100N standard KIO_3 solutions (JM000420).

(3) Preliminary Result

(3-1) Comparison of our KIO_3 standards to CSK standard solution.

After this cruise, we compared our standards with CSK standard solution (Lot. ELQ9442) which is the commercially available standard solution prepared by Wako Pure Chemical Industries, Ltd. The results are shown in table 3.3.1-1.

We use only #B in this cruise. Because deviation value of #A is 0.0028 and titer value of #A and #B is different values. (It may be caused that actual dispense volume of the each titrators were different.)

Table 3.3.1-1. Comparison of each standards

Titrator	KIO_3 Lot No.	Nominal	Average Standard n		
		Normality	Titer (ml)	Deviation	n
#A	ELQ9442	0.0100	1.395	0.0028	10
#B	ELQ9442	0.0100	1.406	0.0007	10
	JM991216	0.010017	1.408	0.0009	10

(3-2) Reproducibility

In this cruise, 804 samples for D.O. samples were collected. 160 pairs (19.9%) of total samples were analyzed as “duplicates” which were collected from same Niskin bottle. Results of each station were shown Fig.3.3.1

(3-3) Attention

We missed analysis of 4 samples (Niskin No. 1- duplicate , 2, and 3) at Station 16.

(4) References

Culberson, C.H. (1991) Dissolved Oxygen, in WHP Operations and Methods, Woods Hole., ppl-15

Culverson, C.H., G.Knapp, R.T.Williams and F.Zemlyak(1991) A comparison of methods for the determination of dissolved oxygen in seawater. (WHPO 91-2)

Dickson, A.G. (1994) Determination of dissolved oxygen in sea water by Winkler titration, in WHP Operations and Methods, Woods Hole., ppl-14.

Green, E.J. and D.E.Carritt (1996) An Improved Iodine Determination Flask for Whole-bottle Titrations, Analyst, 91, 207-208.

Murray, N., J.P.Riley and T.R.S. Wilson (1968) The solubility of oxygen in Winkler reagents used for the determination of dissolved oxygen, Deep-Sea Res., 15, 237-238.

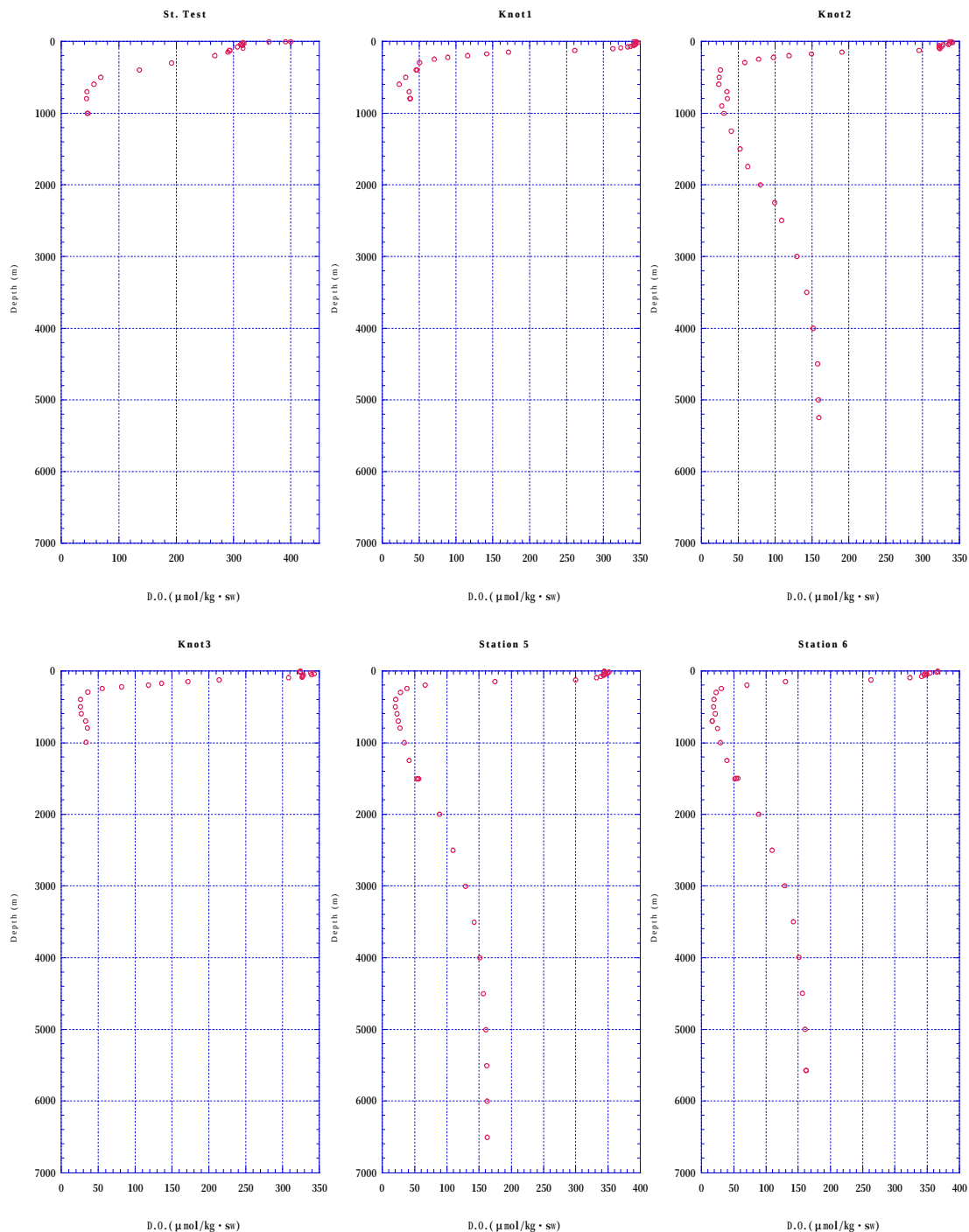


Fig. 3.3.1-1 Vertical profile of dissolved oxygen at MR00-K03 (Continue)

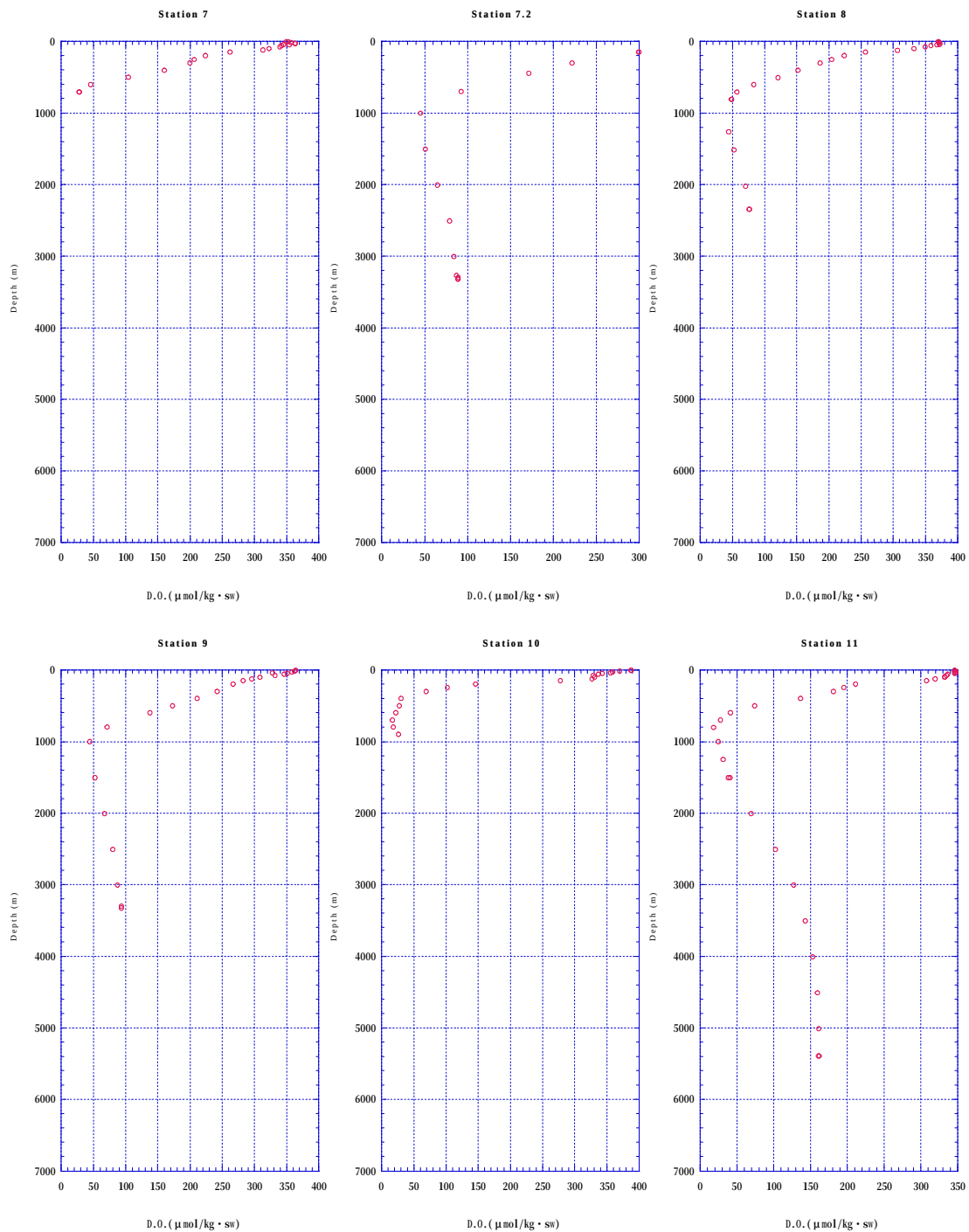


Fig. 3.3.1-2 Vertical profile of dissolved oxygen at MR00-K03 (Continue)

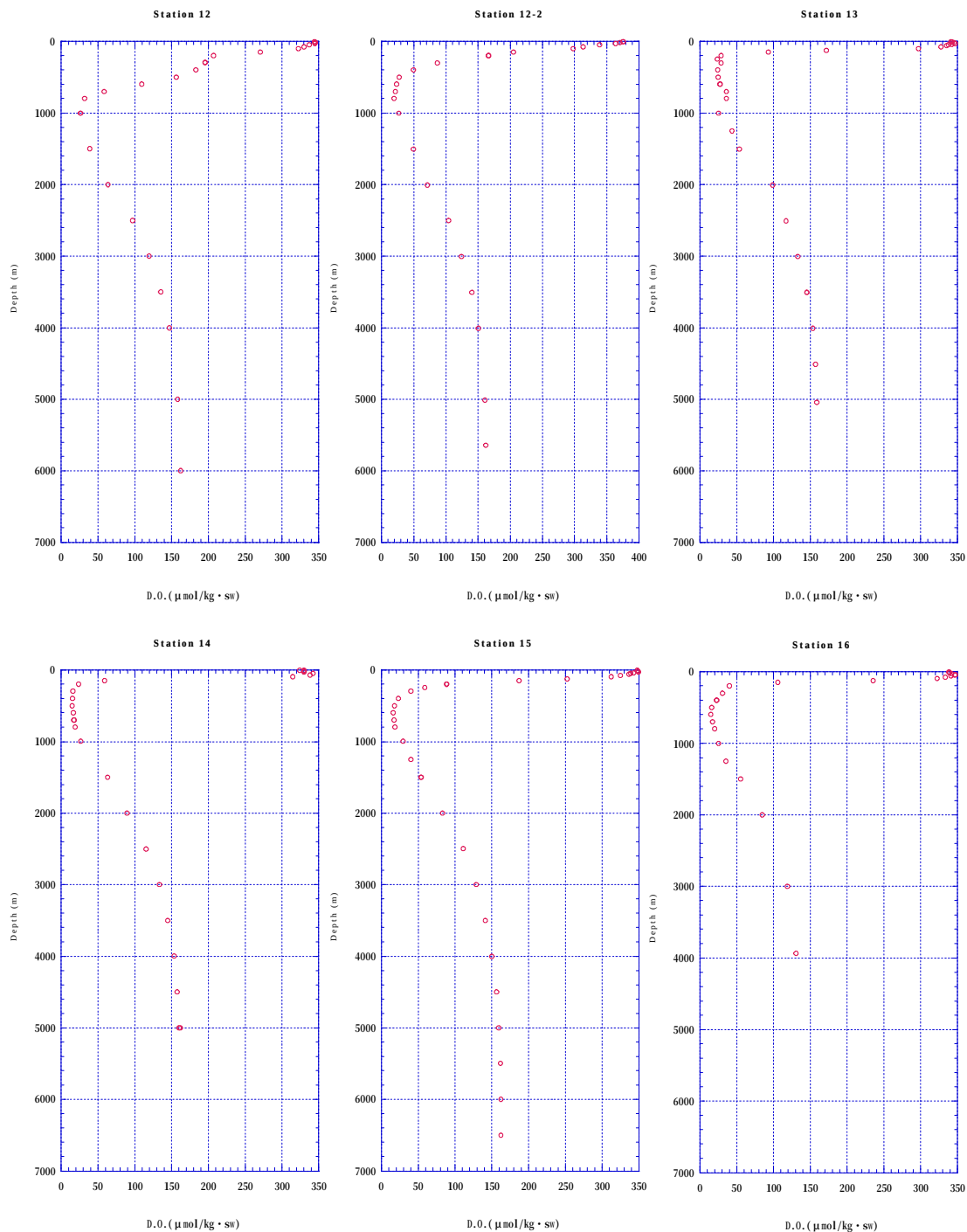


Fig. 3.3.1-3 Vertical profile of dissolved oxygen at MR00-K03 (Continue)

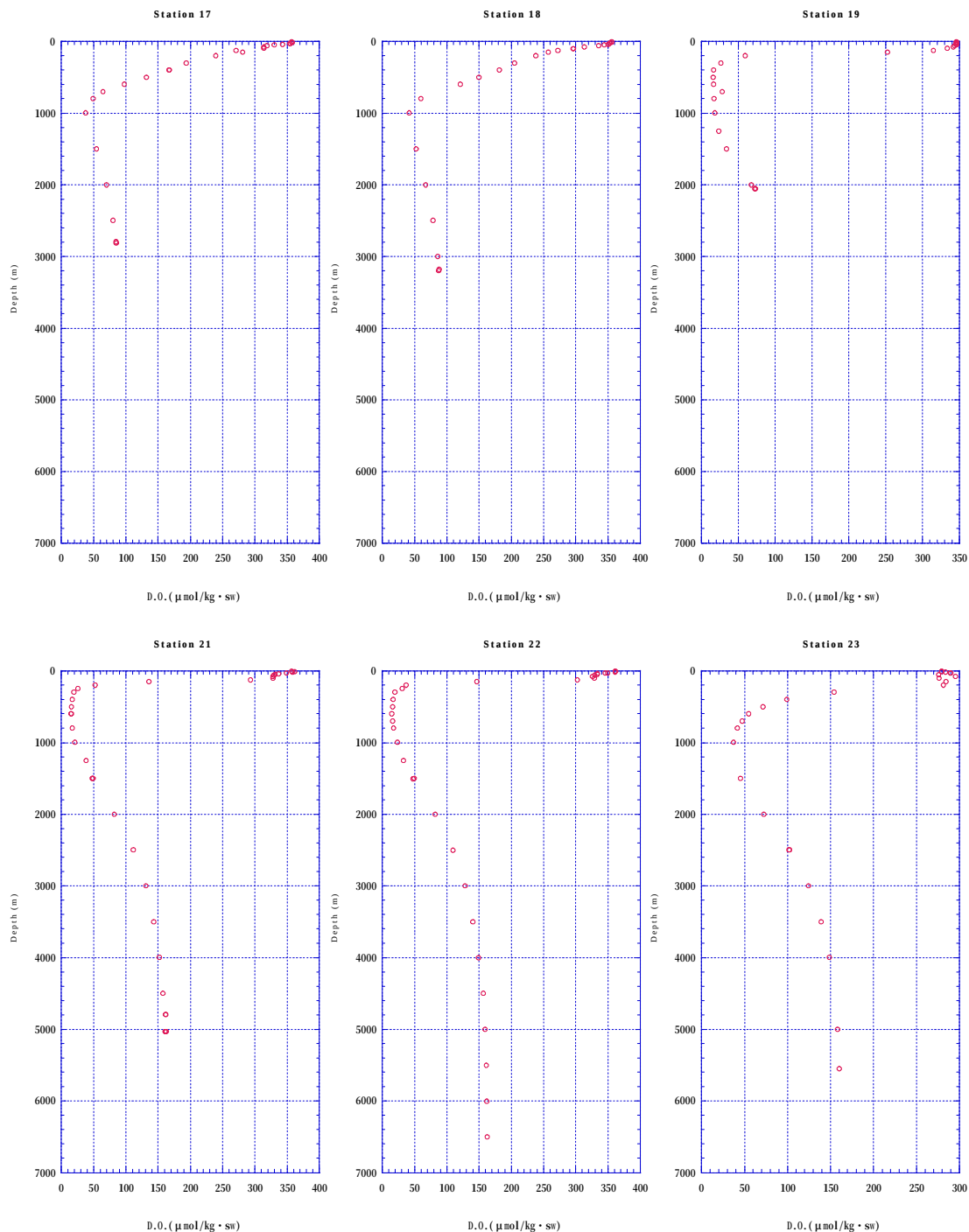


Fig. 3.3.1-4 Vertical profile of dissolved oxygen at MR00-K03.

3.3.2 Nutrient measurements of sea water sample

Kenichiro SATO (Marine Works Japan, Ltd.)

Shinichiro YOKOGAWA (Marine Works Japan, Ltd.)

Chizuru SAITO (JAMSTEC)

(1) Introduction

The vertical and horizontal distributions of the nutrients are one of the most important factors on the primary production. During this cruise nutrient measurements will give us the important information on the mechanism of the primary production or seawater circulation.

(2) Observation

There are 2 TRAACS 800 systems, which is BRAN+LUEBBE continuous flow analytical 4-channel system model, in the R/V MIRAI to analyze the nutrients in seawater. We usually used one system for nitrate+nitrite (1ch.), nitrite (2ch.), silicate (3ch.) and phosphate (4ch.). And the other one was for ammonia (3ch.) measurement, which was almost constructed for closed line system. The laboratory temperature was maintained between 20-25 °C.

a. Analytical conditions

Nitrite: Nitrite was determined by diazotizing with sulfanilamide and coupling with N-1-naphthyl-ethylenediamine (NED) to form a colored azo dye that was measured absorbance of 550 nm using 5 cm length cell.

Nitrate: Nitrate in seawater is reduced to nitrite by reduction tube (Cd - Cu tube), and the nitrite determined by the method described above, but the flow cell used in nitrate analysis was 3 cm length cell. Nitrite initially present in the sample is corrected.

Silicate: The standard AAII molybdate-ascorbic acid method was used. Temperature of the sample was maintained at 45-50 °C using a water bath to reduce the reproducibility problems encountered when the samples were analyzing at different temperatures. The silicomolybdate

produced is measured absorbance of 630 nm using a 3 cm length cell.

Phosphate: The method by Murphy and Riley (1962) was used with separate additions of ascorbic acid and mixed molybdate-sulfuric acid-tartrate. Temperature of the samples was adjusted to be 45-50 °C using a water bath. The phospho-molybdate produced is measured absorbance of 880 nm using a 5 cm length cell.

Ammonia: Ammonia in seawater was determined by coupling with phenol and sodium hypochlorite to form a colored indophenol blue and by being measured the absorbance of 630 nm using 3 cm length flow cell.

b. Sampling Procedures

Samples were drawn into polypropylene 100 ml small mouth bottles. These were rinsed twice before filling. The samples were analyzed as soon as possible. Five ml sample cups were used for analysis.

c. Low Nutrients Sea water (LNSW)

Ten containers (20L) of low nutrients seawater were collected in late 1999 at equatorial Pacific and filtered with 0.45µm pore size membrane filter (Millipore HA). They are used as preparing the working standard solution.

(3) Preliminary results

a. Precision of the analysis

We have made the repeat analysis of two layers (about 80 m and 3000 m depths) samples at each station. At those repeat analysis range of CV (concentration average to standard deviation) were 0.10 to 1.69 % in upper layer except nitrite and 0.07 to 1.32 % in deeper layer except nitrite and ammonia.

b. Distribution of nutrients

The vertical profiles of NO_3+NO_2 , P and Si in this cruise are shown in Fig.3.3.2. Unusual

phosphate concentrations were observed in stns. 5 and 6, so we recalculated these values using the N/P ratios of surrounding stations.

In this cruise we got valuable results in western North Pacific and Sea of Okhotsk in spring season. We observed some differences in these regions. Surface nutrient concentrations were classified into two types. In Sea of Okhotsk, nutrient concentrations that upper 1000m depths layer were obviously lower than in western North Pacific. On the other hand, bottom nutrient concentrations in Sea of Okhotsk were much higher.

These data are stored in MO disk in Ocean Research Department in JAMSTEC.

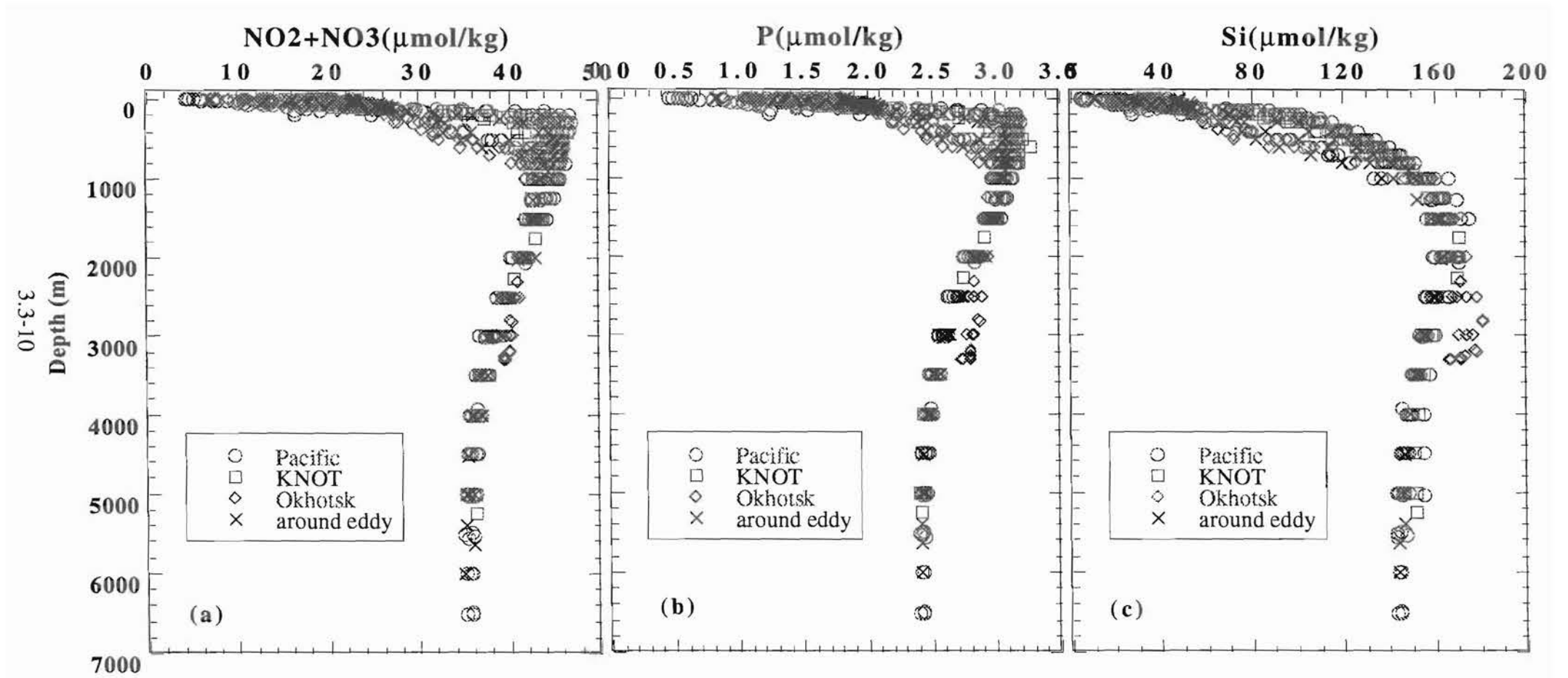


Fig.3.3.2 Vertical profiles of (a) $\text{NO}_3 + \text{NO}_2$, (b) PO_4 , and (c) SiO_2

3.3.3. Salinity measurements

Fujio KOBAYASHI

Hirokatsu UNO

Hiroshi MATSUNAGA

(Marine Works Japan Ltd.)

Chizuru SAITO

(Japan Marine Science and Technology Center)

Introduction

The aim of this salinity measurements is to analyze salinity in samples and to confirm the differences between the salinity data of CTD and the data of salinity measurements.

Observation

Salinity was measured with two laboratory salinometers (Model 8400B AUTOSAL; Guildline Instruments Ltd.), which were modified by addition of Ocean Science International peristaltic-type sample intake pumps and Hewlett-Packard quartz thermometers Model 2804A with 18111A quartz probes. These probes measured at room temperature. The resolution of the quartz thermometer was set to 0.001°C. The data of the salinometers was collected simultaneously by a personal computer. A double conductivity ratio was defined as median of 31 times readings of the salinometer. Data collection started after 5 seconds and it took about 10 seconds to collect 31 reading by a personal computer. The salinometers were operated in the air-conditioned ship's laboratory at bath temperature of 24°C.

The bottles in which the salinity samples were collected and stored are 250 ml brown glass bottles with screw caps. Each bottle was rinsed three times with sample water and was filled to the shoulder of the bottle. Its cap was also thoroughly rinsed. Salinity samples were stored more than 24 hours in same laboratory where the salinity measurement was made.

The salinometers were standardized before and after sequence of measurements by use of IAPSO Standard Seawater batch P134 whose conductivity ratios were 0.99989. We also used sub-standard sea water which was deep-sea water filtered by use of Millipore filter (pore size of 0.45 µm) and stored in a 20 liter container made of polyethylene. It was measured every 8 samples in order to check the trend.

Results

Analysis data for each layer were shown in Appendix. The standard deviation of the difference of salinity between with CTD and AUTOSAL was 0.0075.

The 50 pairs of duplicate samples taken by the same Niskin bottle were analyzed to estimate the precision of this method. The standard deviation of difference in duplicate samples was 0.0017.

3.4.1. pH measurements

Andrey Andreev (JAMSTEC)

Taeko Ohama (MWJ)

(1) Method and Instruments

pH ($-\log [H^+]$) of the seawater was measured potentiometrically in the closed cell at the temperature 25°C (pH_{25}). The cell with liquid junction or ‘salt bridge’ (saturated solution of KCl) was applied

Ag, AgCl| solution of KCL || test solution $[H^+]$ -glass –electrode (A)

The measurement of EMF of the cell (A) was conducted by pH/Ion meter (model PHM95), pH electrode and Ag/AgCl reference electrode of the ‘Radiometer’ company. The temperature of the test solution was monitored by temperature sensor (Radiometer) within 0.1°C. To calibrate the electrodes the TRIS (0.04 m TRIS+ 0.04 m TRISHCL) in the synthetic seawater (S=35 psu) (Total hydrogen scale) (Dickson and Goyet, 1996) was applied.

The pH was calculated by following equation

$$pH_{25} = pH_{25}(\text{standard}) + F(E_s - E_t)/RT \cdot \ln(10)$$

where $pH_{25}(\text{standard}) = 8.0936$ pH unit (DelValls and Dickson, 1998), $(E_s - E_t)$ is the difference in EMF of standard and test solutions, $RT \cdot \ln(10)/F$ is Nernst constant (59.16 mv/pH unit at the temperature 25 °C).

(2) Preliminary results.

The measured values of pH are presented in the cruise data report.

Fig.3.4.1.1 shows the vertical distribution of pH_{25} in the Northwestern Pacific and Okhotsk Sea. For the sake of comparison the vertical profiles of DO and potential vorticity (PV) are presented in Fig. 3.4. 1.2.

Below the euphotic layer the pH of seawater is determined by organic matter oxidation and carbonate dissolution. Organic matter oxidation leads to the decrease of pH (Fig. 3.4.1.1), and dissolved oxygen (Fig. 3.4.1.2) with depth in the intermediate water layer.

The low stratification (low PV) in 100- 200 m and high pH (and DO) in 100 – 500 m are observed at the stations in the Okhotsk Sea and Stn. 12 (45.2°N, 152.8°E) located in the central part of the anticyclonic eddy off Bussol’ Strait. High stratification (high values of PV) in 100- 200m of WSG region (Stns. 5, 6, 13, 14, 16, 19, 21 and 22) prevents the

water exchange between surface and deep water layers and thus results in the lowest values of pH (and DO) in the intermediate waters of Northwestern Pacific.

The water characteristics at stations located in the region of Oyashio current (Stns. 7, 10, 11, 12-2, 15) were formed by mixing between Western Subarctic Gyre waters and Okhotsk Sea waters.

The increase of temperature leads to the increase of pH (MR00-K01 cruise report) in the seawater due to decrease of solubility of CO₂. In 100- 200 m at the Stn. 23 (41°N, 165°E), located in the Subarctic frontal zone, the values of pH were higher than at stations in the WSG and Okhotsk Sea due to higher water temperature.

REFERENCES

- Dickson, A. G. and Goyet C. (Eds.). Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Seawater, ORNL/CDIAC-74. 1994. 107 p.
- DelValls T.A. and Dickson A.G. The pH of buffers based on 2-amino-2-hydroxymethyl-1,3- propanediol ('tris') in the synthetic sea water. 1998. V.45, P. 1541- 1554.

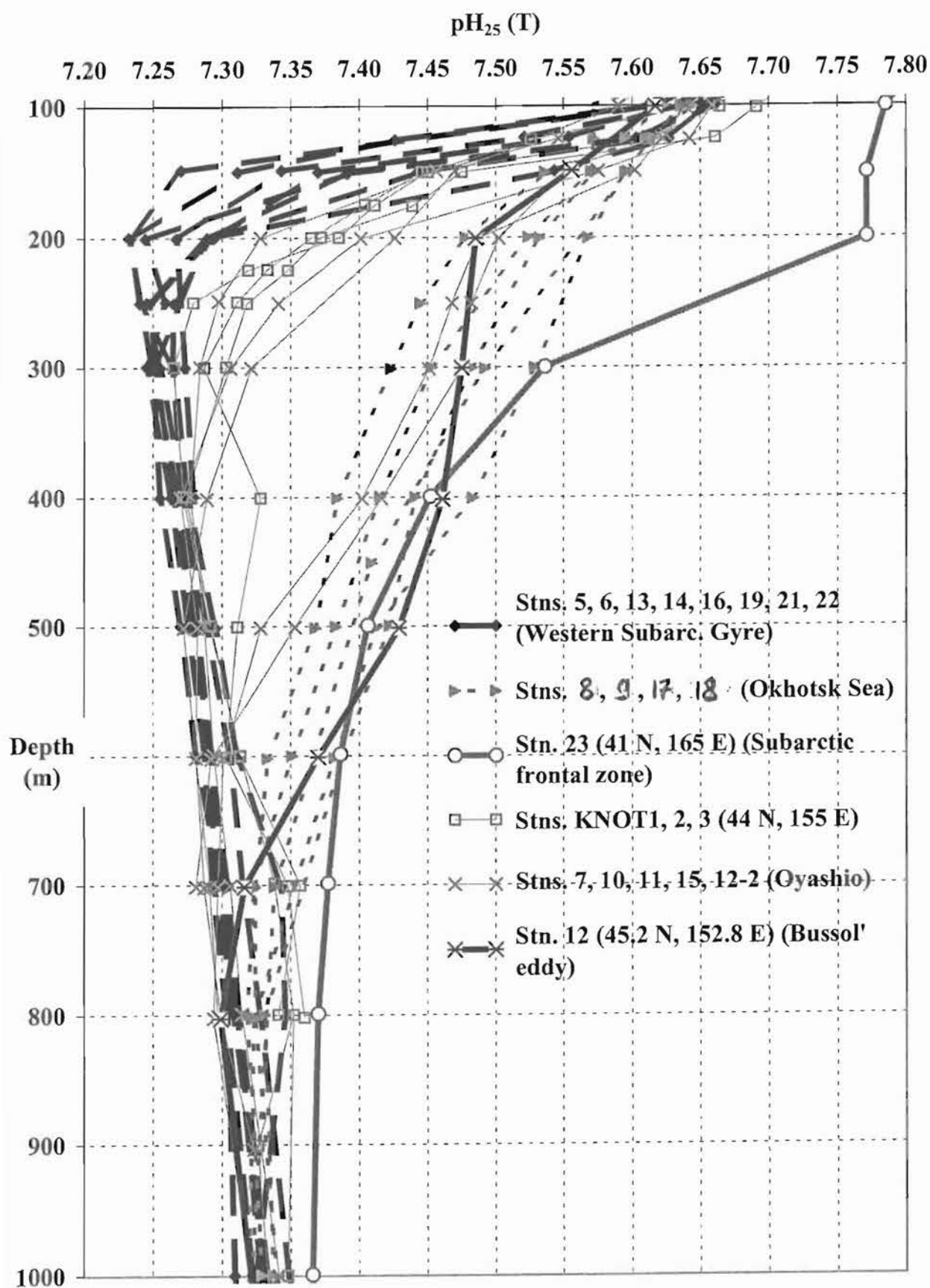


Fig. 3.4.1.1 Vertical distribution of $\text{pH}_{25} (\text{T})$ (pH measured at 25°C in Total hydrogen scale) at stations in the Northwestern Pacific and Okhotsk Sea. MR00K03 cruise.

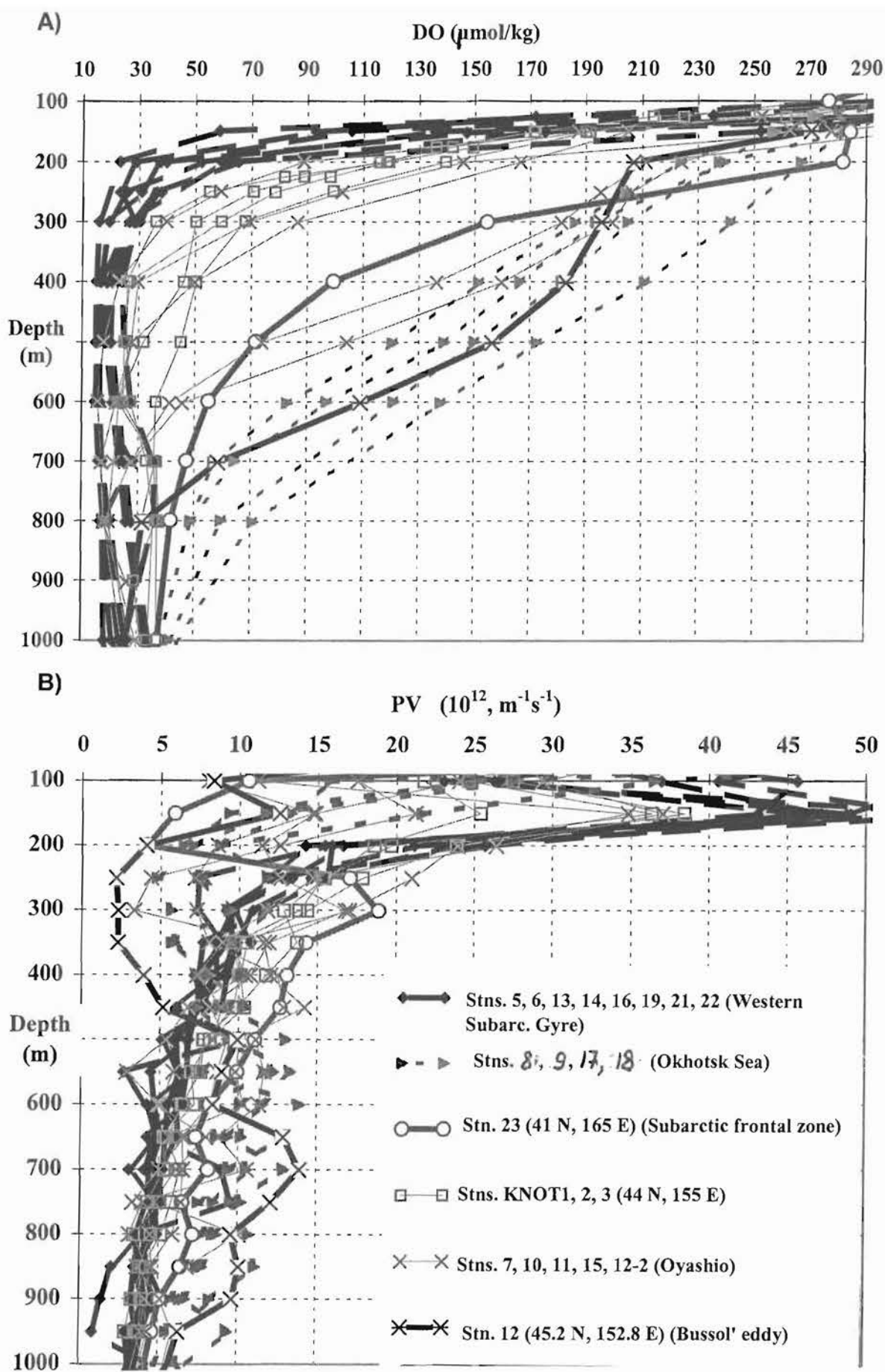


Fig. 3.4.1.2 Vertical distribution of DO ($\mu\text{mol/kg}$) (A) and potential vorticity (PV) (B) at stations in the Northwestern Pacific and Okhotsk Sea. MR00K03 cruise.

3.4.2 Total dissolved inorganic carbon

Yuichiro Kumamoto (JAMSTEC), Kazuhiro Hayashi (MWJ), Mikio Kitada (MWJ)

Global warming caused by green house gas such as CO₂ has become much attention all over the world. In order to verify carbon cycle in the northwestern North pacific, total dissolved inorganic carbon (TDIC) was measured with analytical instruments installed on R/V MIRAI.

3.4.2.1 Bottle sampling

Concentration of TDIC in seawater collected at the stations Test, 5, 6, 7, 7-2, 8, 9, 10, 11, 12, 12-2, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, KNOT-1, KNOT-2, and KNOT-3 was measured by a coulometer (Carbon Dioxide Coulometer Model 5012, UIC Inc.). A volume of seawater (35 cm³) was taken into a receptacle and 2 cm³ of 10 percents (v/v) phosphoric acid was added. The CO₂ gas evolved was purged by CO₂ free nitrogen gas for 12 minutes at the flow rate of 140 cm³ min.⁻¹ and absorbed into an electrolyte solution. Acids formed by reacting with the absorbed CO₂ in the solution were titrated with hydrogen ions using the coulometer. Calibration of the coulometer was carried out using sodium carbonate solutions (0-2.5mM). The coefficient of variation of 3 replicate determinations was approximately less than 0.1 percents for 1 sigma. All the data were referenced to the Dickson's CRM (Batch #47 & #48). The data and profiles are shown in the Appendix and Figure 1, respectively.

3.4.2.2 Continuous surface seawater sampling

Concentration of TDIC in surface seawater water collected by a pump from 4 m depth was continuously measured every 40 minutes by a coulometer (Carbon Dioxide Coulometer Model 5012, UIC Inc.). A volume of seawater (35 cm³) was taken into a receptacle and 2 cm³ of 10 percents (v/v) phosphoric acid was added. The CO₂ gas evolved was purged by CO₂ free nitrogen gas for 12 minutes at the flow rate of 140 cm³ min.⁻¹ and absorbed into an electrolyte solution. Acids formed by reacting with the absorbed CO₂ in the solution were titrated with hydrogen ions using the coulometer.

Calibration of the coulometer was carried out using sodium carbonate solutions (0-2.5mM). The coefficient of variation of 3 replicate determinations was approximately less than 0.1 percents for 1 sigma. All the data were referenced to the Dickson's CRM (Batch #47 & #48) and stored in a MO disk at JAMSTEC, Yokosuka. Figure 2 shows the horizontal distribution of normalized TDIC (salinity = 35 psu) in the surface seawater.

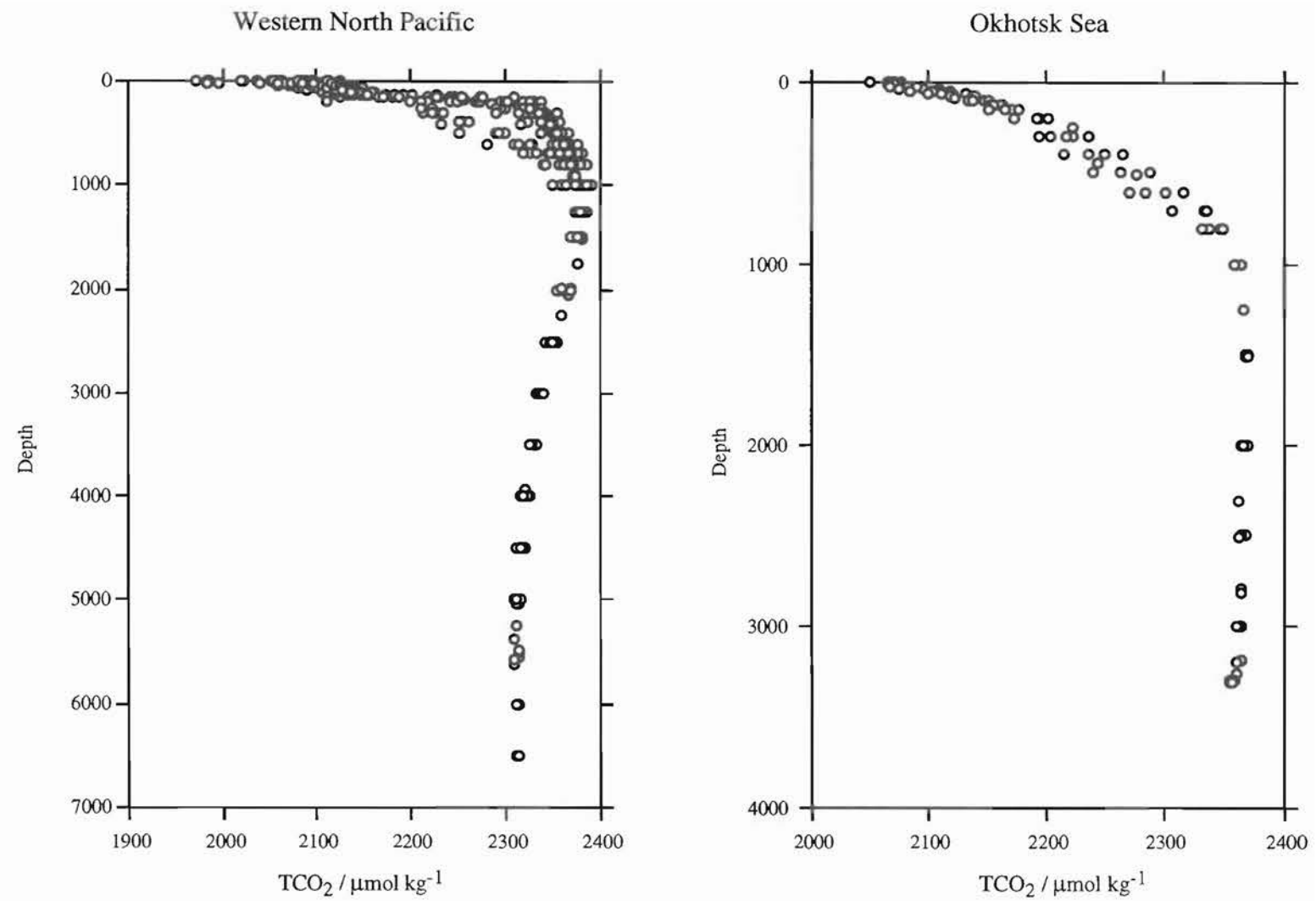


Figure 1. Vertical profiles of total dissolved inorganic carbon (TCO₂).

3-4-7

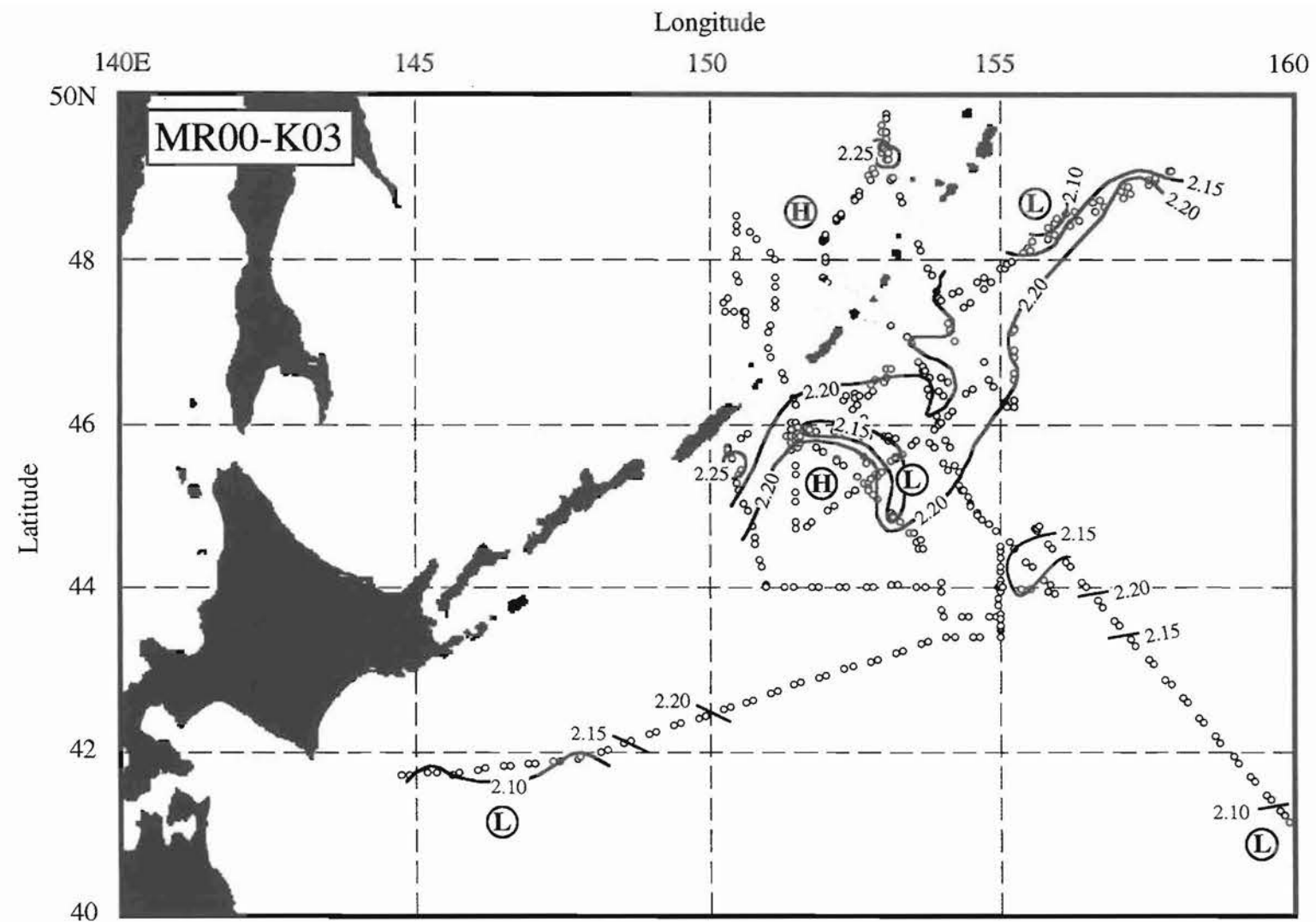


Figure 2. Distribution of normalized total dissolved inorganic carbon (salinity=35 psu) in surface seawater in May 2000.

3.4.3 Total Alkalinity

Akihiko Murata

(Japan Marine Science and Technology Center)

Fuyuki Shibata

Mikio Kitada

(Marine Works Japan Ltd.)

(1) Introduction

Global warming caused by green house gas such as carbon dioxide has become much attention all over the world. And in the flux study of northwestern pacific, to understand formation of NPIW and its volume of transportation is very important. In order to verify carbon cycle in the northwestern pacific and the sea of Okhotsk, we measured total alkalinity, one of carbon dioxide parameters, with analytical instruments installed on R/V MIRAI in this cruise.

(2) Observation

The station of observed were test, knot1, 5, 6, 7, 7.2, 8, 9, 10, 11, 12, 12.2, 13, knot2, 23, 18, 17, 19, 22, 21, 16, 15, 14 and knot3.

Seawater samples were drawn from 30L Niskin TM bottles into 250ml Nalgene polyethylene bottles with sampling tubes. Bottles were rinsed twice and filled from the bottom, overflowing a volume while taking care not to entrain any bubbles. The bottles were then sealed by a screw cap with an inner cap and stored at room temperature for maximum of 24 hours prior to analysis.

The method of total alkalinity measurement was titration of 0.1M hydrochloric acid based 0.7M sodium chloride. The titration system consists of a titration manager (Radiometer, TIM900), an auto-burette (Radiometer, ABU901), a pH glass electrode (Radiometer, pHG201-7), a reference electrode (Radiometer, REF201), a thermometer (Radiometer, T201) and two computer, the one was installed operating software (Lab Soft, TimTalk9) and the another one was for calculated.

Before titration, bottles were brought to 25 degree C in the water bath, and water sample taken by a Knudsen pipette (100ml) into a tall beaker(200ml). The titration carried out adding HCl (0.1N) to seawater past the carbonic acid point with a set of electrodes used to measure electromotive force at 25 degree C. After titration, data of titrated HCl volume and electromotive force and temperature when pipetted were calculated to total alkalinity.

(3) Preliminary results

Vertical profiles of total alkalinity were shown in Fig.3.4.3.1-4

The absolute differences of duplicate measurements were plotted sequentially to evaluate the precision of the measurement process. It was shown in Fig.3.2.3.5. The average and standard deviation from the differences of sets of duplicate measurement was 1.02 and 1.11, respectively.

Values obtained for repetitive measurements of a Dickson's CRM(Batch45,47,48) were plotted sequentially to evaluate the stability of the measurement process. It was shown in Fig.3.2.3.6. The average from the differences of measurement values from certified value is 6.26.

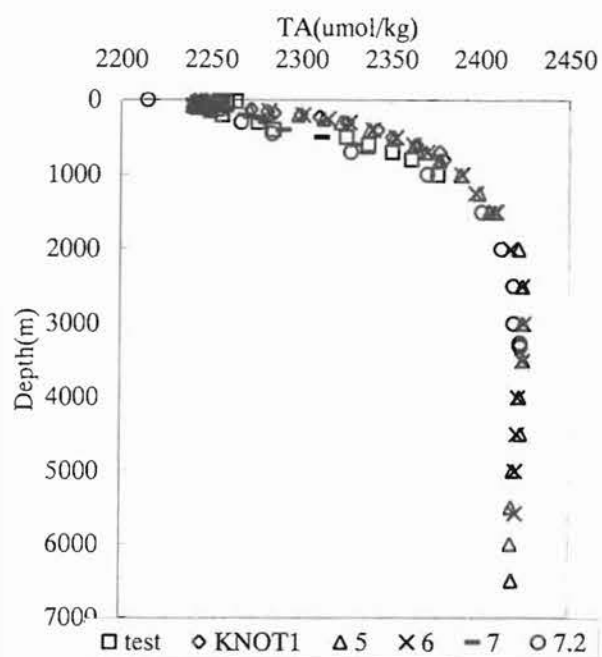


Fig.3.2.3.1 Vertical profile of total alkalinity

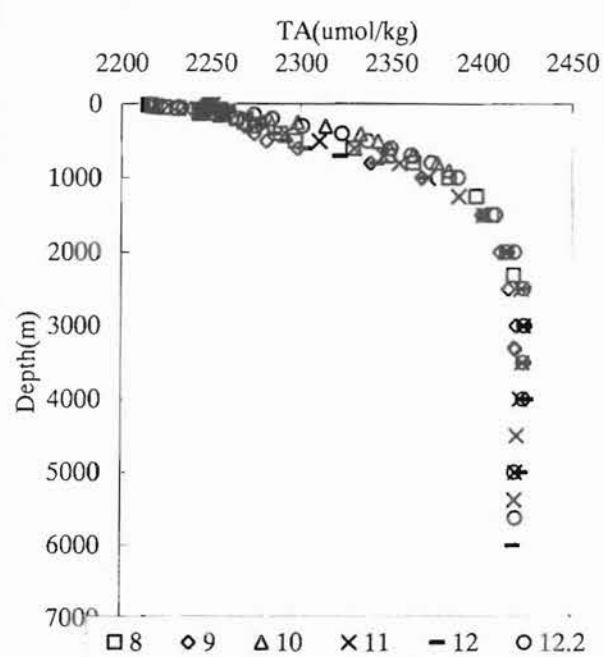


Fig.3.2.3.2 Vertical profile of total alkalinity

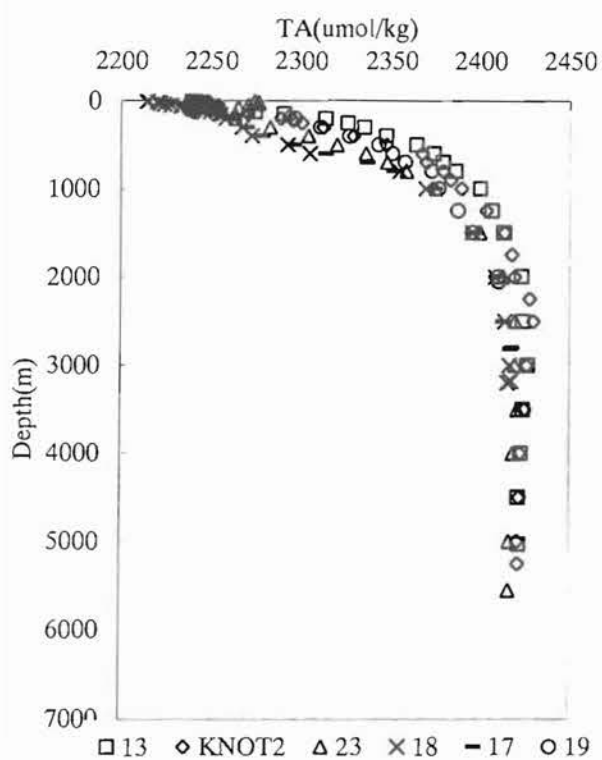


Fig.3.2.3.3 Vertical profile of total alkalinity

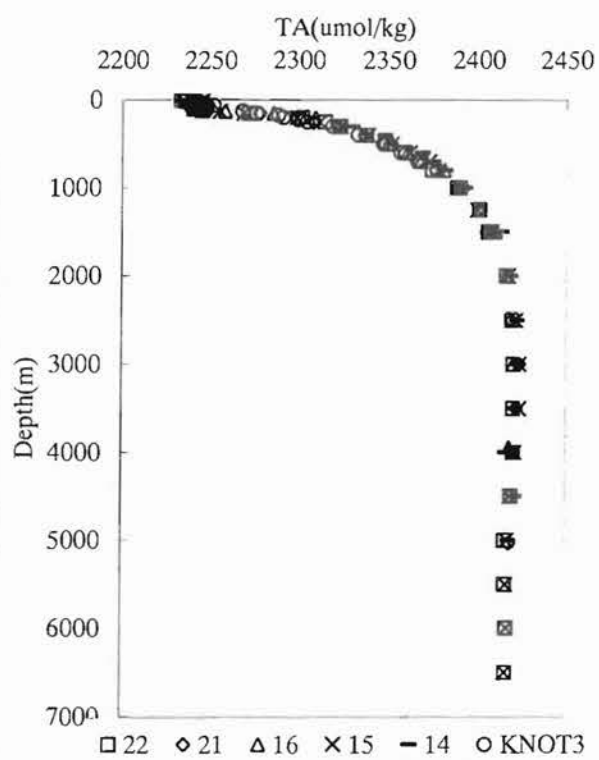


Fig.3.2.3.4 Vertical profile of total alkalinity

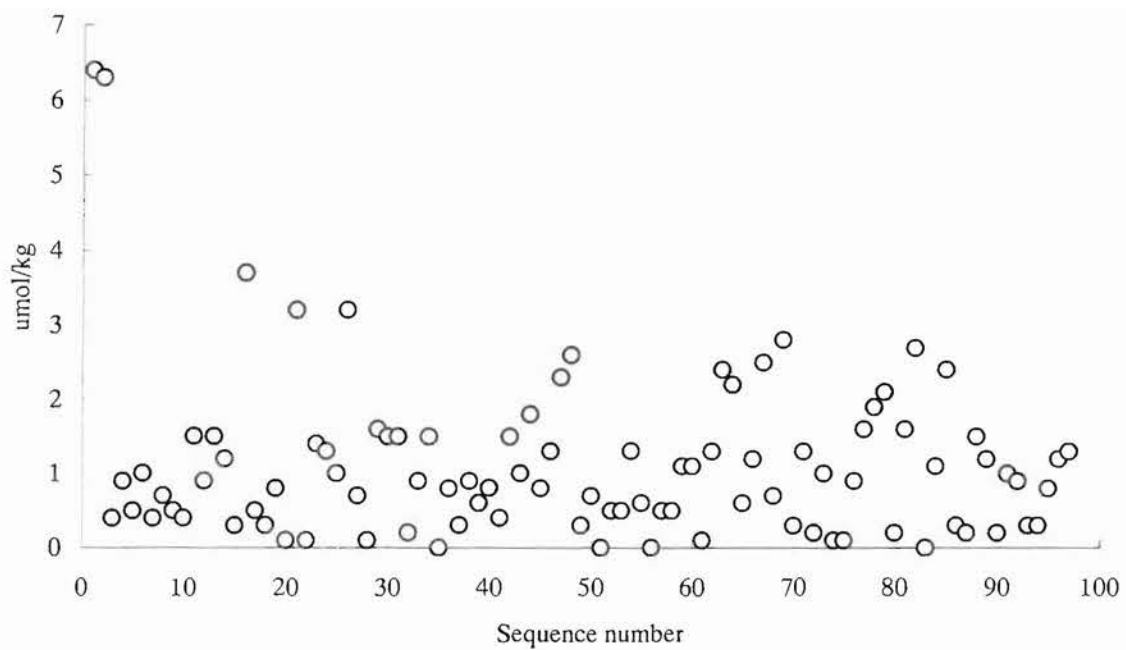


Fig.3.2.3.5 Range control chart of total alkalinity

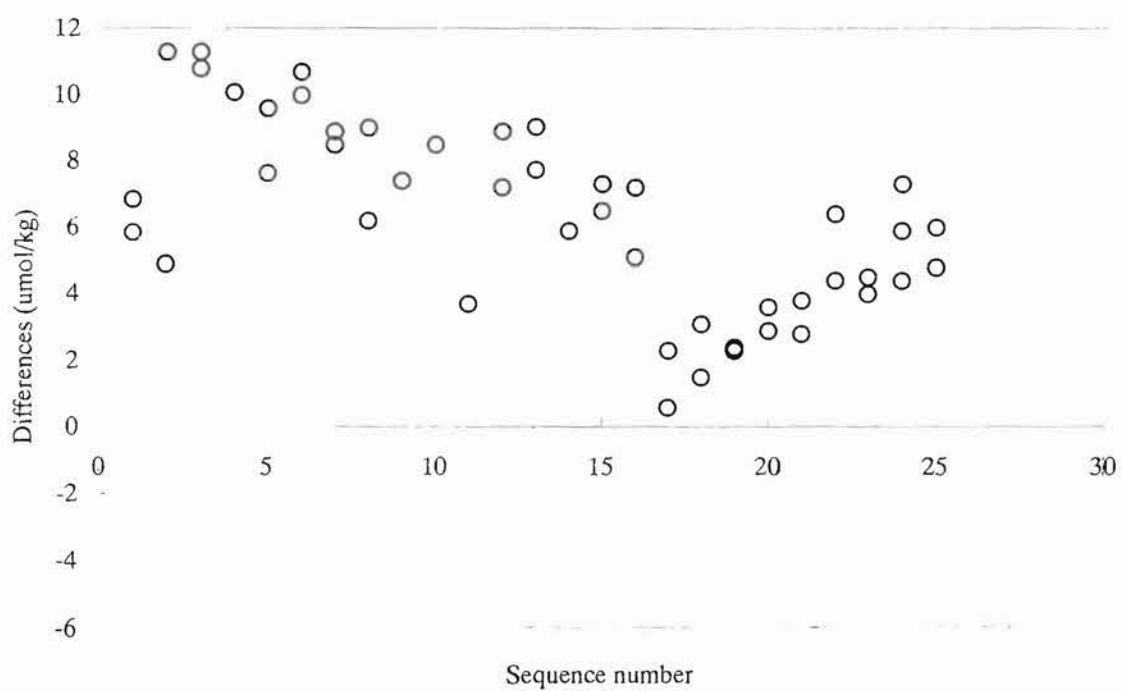


Fig.3.2.3.6 Differences of measurement values from certified value

3.4.4 Carbon isotopes

Yuichiro Kumamoto (JAMSTEC), Kazuhiro Hayashi (MWJ), Mikio Kitada (MWJ)

In order to study the role of surface water and intermediate water in carbon cycle in the western North pacific, seawater for radio and stable carbon isotopes of TDIC was collected by the hydrocast at the stations 5, 6, 7, 7-2, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, and 22 and the underway (continuous) surface seawater sampling. Seawater was collected in a 250 ml glass bottle. Then a head-space of 2 % of the bottle volume was left by removing seawater sample with a plastic pipette. Saturated mercuric chloride (HgCl_2) of 0.05 cm^3 was added as preservative. Finally, the bottle was sealed using a greased ground glass and a clip was secured. We collected about 468 seawater samples during this cruise. All the samples were stored in a laboratory of JAMSTEC Mutsu Branch in Mutsu City. In the laboratory, TDIC will be extracted as CO_2 and converted to graphite for measurements of stable and radio carbon isotopes, respectively.

3.5 Chlorophyll *a* concentration and absorption coefficient

Kousei Sasaoka

Faculty of Fisheries, Hokkaido University

(1) Introduction

The geochemical cycles in the ocean plays important role in the earth environment changes. In particular, the Subarctic North Pacific Ocean is one of the highest biological productivity region in the world, and has considerable remarks as one of the key areas recently. Understanding the role of biological pump in the ocean, and monitoring variability of the chlorophyll distribution is very important to clarify the geochemical cycles. The recent development of satellite ocean color remote sensing and its application to the observation of the temporal and spatial variability of chlorophyll distribution over broad area with synoptic scales has provided us with a unique tool to study these features. St. KNOT (Kyo-do North Pacific Time Series) was established in June 1998 as the Japan JGOFS time series station for the biogeochemical study. Since then, ship observation has been carried out frequently in this station. Now, we can compare ship data with satellite data for one and half year.

The objectives of this study is to clarify the temporal, spatial variability and vertical structure of chlorophyll *a* distribution, and to validate and to develop bio-optical algorithm for new series ocean color sensors, such as Sea-viewing Wide Field-of-view Sensor (SeaWiFS), Moderate Resolution Imaging Spectroradiometer (MODIS) and Global Imager (GLI) in the subarctic North Pacific Ocean. Therefore, we measured *in situ* bio-optical parameters, including upwelled spectral radiance, downwelled spectral irradiance, phytoplankton pigment concentrations (fluorometric method), and particle absorption coefficient.

(2) Methods

Water samples for chlorophyll *a* (Chl-*a*), pheopigment and absorption coefficient determinations were collected using Niskin bottles attached to a rosette on the CTD. Chl-*a* samples were collected at all stations by routine or *CREST* casts from surface to 200m depth and absorption coefficient samples were gathered at the stations from surface to 100m depth, which were carried optical measurements (Described 3.12).

Chl-*a* samples were collected in 250ml dark bottles and filtered through a Whatman

GF/F filter on board. Filtering Volume was 200ml. Filtered samples were extracted in 6 ml of N,N-dimethylformamide, under cold and dark conditions for later analysis. Chl-a and phaeophytin were determined by the fluorometric method (Parsons et al., 1984) with a Turner Designs Fluorometer (Model:10-AU). Chl-a obtained by the CTD casts, summarized in Table. 1. We will compare of these chlorophyll data sets and SeaWiFS data sets in future study.

The absorption coefficients samples were collected in 4000ml dark bottles and between 1000 and 3000 ml filtered on to a 25 mm Watman GF/F glass-fiber filters under low vacuum pressure (<100 mmHg) on board.

We will measure the absorption coefficients of phytoplankton (a_{ph}) and detritus (a_d) using the modified glass fiber technique with methanol treatment (Kishino et al., 1985), and then we will calculate a chlorophyll normalized specific absorption spectra, a^*_{ph} to divide a_{ph} by Chl-a concentration. In future study, we are going to use these chlorophyll a and absorption coefficients for the model parameter to estimate primary production from satellite ocean color data.

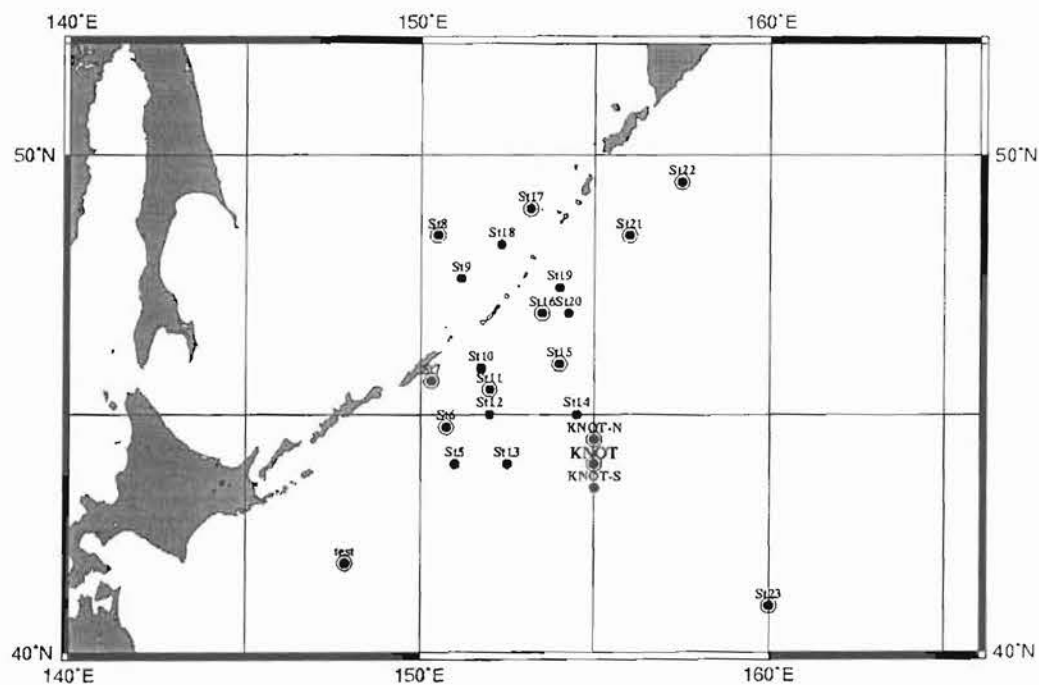


Fig.1 Map of water sampling stations in this cruise

- chl-a + absorption
- Chl-a only

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.34
date: 5/10	24	5	13.42
cast: TESL01	23	10	13.10
Stn.No: Test	22	20	3.93
	21	30	1.88
	20	40	1.12
	19	50	1.15
	18	60	1.77
	17	80	0.56
	16	100	0.36
	15	125	0.10
	14	150	0.07
	13	200	0.08

	Bottle No.	Depth	Chl-a (mg/m ³)
date: 5/11	Bucket	0	0.89
cast: KN1L02	24	5	0.77
Stn.No: KNOT1	23	10	0.90
	22	20	0.68
	21	30	0.58
	20	40	0.54
	19	50	0.47
	18	60	0.36
	16	80	0.19
	14	100	0.09
	13	125	0.07
	12	150	0.04
	10	200	0.02

	Bottle No.	Depth	Chl-a (mg/m ³)
date: 5/11	Bucket	0	0.94
cast: Surface			
Stn.No: KNOT-S			

	Bottle No.	Depth	Chl-a (mg/m ³)
date: 5/11	Bucket	0	0.73
cast: Surface			
Stn.No: KNOT			

	Bottle No.	Depth	Chl-a (mg/m ³)
date: 5/11	Bucket	0	1.21
cast: Surface			
Stn.No: KNOT-N			

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	0.86
	13	5	0.78
date: 5/11 - 12	12	10	1.04
cast: KN1L03	11	20	0.84
Stn.No: KNOT1	10	30	0.86
	9	40	0.83
	8	50	0.56
	7	60	0.40
	6	80	0.25
	5	100	0.13
	4	125	0.05
	3	150	0.04
	2	200	0.03

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	0.50
	24	5	0.51
date: 5/14	23	10	0.56
cast: 005L01	22	20	0.53
Stn.No: St5	21	30	0.50
	20	40	0.63
	19	50	0.54
	18	60	0.55
	17	80	0.25
	16	100	0.17
	15	125	0.07
	14	150	0.02
	13	200	0.01

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	3.03
	24	5	2.40
date: 5/15	23	10	2.75
cast: 006L02	22	20	2.81
Stn.No: St6	21	30	1.02
	20	40	0.54
	19	50	0.52
	18	60	0.52
	17	80	0.39
	16	100	0.42
	15	125	0.15
	14	150	0.12
	13	200	0.02

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	3.00
	24	5	3.31
date: 5/15	23	10	0.53
cast: 006L03	22	20	2.65
Stn.No: St.6	21	30	1.82
	20	40	0.90
	19	50	0.66
	18	60	0.55
	17	80	0.40
	16	100	0.14
	15	125	0.05
	14	150	0.13
	13	200	0.14

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	2.32
	24	5	1.90
date: 5/15 - 16	23	10	1.97
cast: 007L01	22	20	1.80
Stn.No: St7	21	30	2.16
	20	40	0.94
	19	50	1.51
	18	60	0.55
	17	80	0.40
	16	100	0.19
	15	125	0.57
	14	150	0.20
	13	200	0.08

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	2.16
	24	5	1.94
date: 5/17	23	10	1.61
cast: 008L02	22	20	1.33
Stn.No: St8	21	30	1.03
	20	40	0.91
	19	50	0.76
	18	60	0.64
	17	80	0.40
	16	100	0.16
	15	125	0.14
	14	150	0.14
	13	200	0.03

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	7.36
	24	5	9.98
date: 5/18 - 19	23	10	7.46
cast: 010L01	22	20	9.89
Stn.No: St10	21	30	6.21
	20	40	7.24
	19	50	4.99
	18	60	2.90
	17	80	1.68
	16	100	1.24
	15	125	0.47
	14	150	0.37
	13	200	0.28

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.43
	24	5	1.26
date: 5/17	23	10	1.39
cast: 009L01	22	20	1.43
Stn.No: St9	21	30	1.13
	20	40	0.47
	19	50	0.72
	18	60	0.49
	17	80	0.45
	16	100	0.23
	15	125	0.26
	14	150	0.26
	13	200	0.22

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.21
	24	5	0.81
date: 5/19	23	10	0.79
cast: 011L02	22	20	0.78
Stn.No: St11	21	30	1.19
	20	40	0.88
	19	50	0.91
	18	60	0.35
	17	80	0.22
	16	100	0.20
	15	125	0.13
	14	150	0.08
	13	200	0.05

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.36
	24	5	1.39
date: 5/19	23	10	1.25
cast: 011L03	22	20	1.06
Stn.No: St11	21	30	0.73
	20	40	0.46
	19	50	0.44
	18	60	0.45
	17	80	0.24
	16	100	0.22
	15	125	0.09
	14	150	0.04
	13	200	0.01

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.02
	24	5	0.97
date: 5/20	23	10	1.02
cast: 012L01	22	20	0.69
Stn.No: St12	21	30	0.71
	20	50	0.38
	19	75	0.28
	18	100	0.13
	17	150	0.04
	16	200	0.01

	Bottle No.	Depth	Chl-a (mg/m ³)
	24	5	3.59
	23	10	3.00
date: 5/21	22	20	3.84
cast: 122L01	21	30	3.34
Stn.No: St12-2	20	50	0.68
	19	75	0.28
	18	100	0.15
	17	150	0.07
	16	200	0.04

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.05
	24	5	0.85
date: 5/22	23	10	0.85
cast: 013L01	22	20	0.76
Stn.No: St13	21	30	0.80
	20	40	0.55
	19	50	0.32
	18	60	0.27
	17	80	0.13
	16	100	0.09
	15	125	0.06
	14	150	0.02
	13	200	0.04

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.55
	24	5	1.60
date: 5/23	23	10	1.94
cast: KN2L02	22	20	0.93
Stn.No: KNOT2	21	30	0.76
	20	40	0.63
	19	50	0.35
	18	60	0.28
	16	80	0.22
	14	100	0.16
	13	125	0.05
	12	150	0.02
	10	200	0.01

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.69
	24	5	1.56
date: 5/30	23	10	1.76
cast: 018L01	22	20	1.90
Stn.No: St18	21	30	0.92
	20	40	0.78
	19	50	0.63
	18	60	0.31
	17	80	0.13
	16	100	0.05
	15	125	0.08
	14	150	0.10
	13	200	0.05

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	0.55
	24	5	0.45
date: 5/27	23	10	0.43
cast: 023L01	22	20	0.58
Stn.No: St23	21	30	0.51
	20	50	0.55
	19	75	0.72
	18	100	0.18
	17	150	0.04
	16	200	0.03

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	2.05
	24	5	1.69
date: 5/31	23	10	1.83
cast: 017L02	22	20	2.01
Stn.No: St17	21	30	1.35
	20	40	0.63
	19	50	0.28
	18	60	0.15
	17	80	0.00
	16	100	0.08
	15	125	0.03
	14	150	0.03
	13	200	0.04

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	0.45
	24	5	0.38
date: 5/31	23	10	0.37
cast: 019L01	22	20	0.30
Stn.No: St19	21	30	0.39
	20	40	0.40
	19	50	0.32
	18	60	0.45
	17	80	0.27
	16	100	0.14
	15	125	0.07
	14	150	0.06
	13	200	0.05

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.58
	24	5	1.48
date: 6/2	23	10	2.36
cast: 021L01	22	20	1.58
Stn.No: st21	21	30	0.92
	20	40	0.41
	19	50	0.38
	18	60	0.30
	17	80	0.18
	16	100	0.12
	15	125	0.12
	14	150	0.12
	13	200	0.08

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	3.68
	24	5	3.78
date: 6/1	23	10	2.71
cast: 022L02	22	20	3.37
Stn.No: St22	21	30	3.87
	20	40	0.46
	19	50	0.36
	18	60	0.26
	17	80	0.21
	16	100	0.14
	15	125	0.10
	14	150	0.11
	13	200	0.04

	Bottle No.	Depth	Chl-a (mg/m ³)
	Bucket	0	1.26
	24	5	1.24
date: 6/4	23	10	0.97
cast: 016L01	22	20	1.24
Stn.No: St16	21	30	1.14
	20	40	0.90
	19	50	0.78
	18	60	0.54
	17	80	0.26
	16	100	0.16
	15	125	0.11
	14	150	0.07
	13	200	0.04

Table 1. Chlorophyll a (mg/m³) obtained by CTD casts (continued)

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	1.81
	24	5	1.39
date: 6/4	23	10	1.15
cast: 015L01	22	20	1.44
Stn.No: St15	21	30	1.00
	20	40	0.36
	19	50	0.44
	18	60	0.39
	17	80	0.20
	16	100	0.16
	15	125	0.10
	14	150	0.09
	13	200	0.07

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	1.93
	24	5	1.71
date: 6/5 - 6	23	10	1.96
cast: KN3L02	22	20	1.94
Stn.No: KNOT3	21	30	1.15
	20	40	0.96
	19	50	0.71
	18	60	0.50
	17	80	0.24
	16	100	0.12
	15	125	0.03
	14	150	0.01
	13	200	0.02

	Bottle No.	Depth	Chl-a (mg/m³)
	Bucket	0	1.44
	24	5	1.32
date: 6/5	23	10	1.05
cast: 014L01	22	20	1.15
Stn.No: St14	21	30	1.18
	20	50	0.45
	19	75	0.36
	18	100	0.15
	17	150	0.01
	16	200	0.01

3.6 Iron study in the Sea of Okhotsk and the subarctic NW Pacific Ocean

J. Nishioka and S. Takeda

Central Research Institute of Electric Power Industry

Introduction

After the development of trace metal clean techniques for the sampling and analysis of Fe in seawater, vertical profiles of Fe have been characterized in many regions of the open ocean. Recent onboard bottle enrichment and large scale *in situ* Fe enrichment experiments, examining the relationship between Fe supply and phytoplankton production in HNLC regions, clearly showed that Fe is an important factor controlling phytoplankton growth in these waters (Martin and Fitzwater, 1988; Martin et al., 1994; Coale et al., 1996). However, it is not known whether Fe concentrations in northwestern (NW) Pacific ocean are as low as northeastern (NE) Pacific ocean and the concentrations influence on limiting phytoplankton production, because few studies exist and thus there is still little information on the Fe concentration in NW Pacific ocean. Also there is little number of Fe study which investigate Fe concentration around the Kuril islands and in the sea of Okhotsk. The Kuril islands and the sea of Okhotsk might be very important for Fe source to subarctic NW Pacific ocean and Fe rich water supplied from around the Kuril islands might be one of the factor which control phytoplankton production and species in subarctic NW Pacific ocean.

With growing concern about Fe dynamics in the open ocean ecosystem, there is a greater interest in determining Fe speciation in seawater. However, the complexity of Fe chemistry in oxic seawater in addition to the difficulty of direct measurement of chemical Fe species have hampered our understanding of biogeochemical dynamics of Fe in seawater. Most research studying Fe dynamics in seawater examines traditional categories of particulate and dissolved Fe. Operationally, these categories are defined based on simple membrane filtration with 0.2 or 0.45 μm pore size filters. The traditional dissolved fraction, however, can include small colloidal particles (Wu and Luther, 1994). Moreover recent reports indicate that a high percentage of dissolved Fe ($< 0.45 \mu\text{m}$) in seawater is bound to organic ligands in open ocean environments (Rue and Bruland, 1995). However, there is little information about the characteristics of these dissolved organic ligands in open ocean.

In this study, spatial variation of size-fractionated Fe concentrations in the sea of Okhotsk and the subarctic NW Pacific ocean, around the Kuril islands, was examined. Also trace metal clean filtration methods using different pore size filters (0.2 μm and 200 kDa (200,000 nominal molecular weight = 200

kilo-Dalton)) were used to estimate soluble and small colloidal Fe concentrations. Moreover, in our observation on this cruise, we tested new technique of ultra-clean UV irradiation system for decompose organic ligands before Fe analysis. To investigate biological availability of ambient Fe in seawater, onboard incubation experiments were also conducted on this cruise.

Observation

1) Sample collection for spatial distribution of Fe concentration

To characterize vertical profiles of total labile Fe (detectable at pH 3.2 without filtration) and dissolved Fe (detectable at pH 3.2 in 0.22 μm filtrate) concentration, seawater samples were collected using trace metal CTD rosette system consisted of twelve 12-L Niskin-X bottles suspended on stainless steel frame. The 12-L Niskin-X samplers were coated inside with Teflon and the drain cock was replaced by an all-Teflon stop cock. The samplers were cleaned inside by filling sequentially with alkali detergent and 1N HCl solution, soaking for each solution at least 1 week and soaked and rinsed with Milli-Q water. Sampling was conducted at major stations on this cruise. Sampling depth for each stations are shown in Table 1. Acid cleaned 0.22 μm Durapore membrane filters (Millipac 100, Millipore Co. Ltd) were used to fractionate seawater in this study. For subsampling from Niskin-X sampler, the 0.22 μm Durapore filters which were in polycarbonate housings were connected to the Niskin-X spigot. Then the filtrate was collected in acid-cleaned 125-ml LDPE bottle (Nalgene Co., Ltd) under gravity pressure. We did comparison test of this filtration method with another method conducted in onboard clean-air laboratory using same and another type of filter (Omupore and Nucrepore), and the result showed there is not significant difference between these methods. The filtrate and unfiltered samples were adjusted pH to 3.2 with addition 2.4M ammonium-10M formic buffer. Sample treatments were performed in a laminar flow clean-air hood in a clean-air laboratory.

2) Size-fractionation and UV irradiation for Fe species study

Sample for investigate size-fractionated colloidal Fe concentration were collected in 500 ml polycarbonate bottles at station 17, 22 and KNOT-3. Then these samples were immediately size-fractionated by a clean filtration method in clean-air laboratory, which used an acid cleaned 0.2 μm pore size Teflon membrane filter (25 mm i.d., Omupore, Millipore Co., Ltd.) mounted in an in-line Teflon filter holder and an acid cleaned 200 kDa polyethylene hollow-fiber ultra-filter unit (filter area 70 cm^2 , STERAPORE, Mitsubishi-rayon Co., Ltd.). Sample for UV irradiate study were collected at station 8, 11, 23, KNOT-2 and KNOT-3, and UV irradiated to filtrate samples and unfiltered samples using

in-line ultra-clean UV irradiation system. These samples were adjust pH to 3.2 with buffer solution after these treatments. These sample treatments were performed in a laminar flow clean-air hood in a clean-air laboratory. Measured total labile Fe concentrations were divided into three size fractions: large labile particulate Fe ($> 0.22 \mu\text{m}$), small colloidal Fe (200 kDa– $0.22 \mu\text{m}$) and soluble Fe ($< 200 \text{ kDa}$).

3) *Fe analysis in this study*

Concentration of Fe (III) in the buffered sample was determined using an automatic Fe (III) analyzer (Kimoto Electric Co. Ltd.) using chelating resin concentration and chemiluminescence detection during the cruise (Obata et al., 1993,1997). Total labile Fe concentration that may contain the chemically labile fraction of particulate Fe at pH 3.2 was also measured by adding the buffer solution directly to the unfiltered samples. The detection limit (three times the standard deviation) of Fe (III) concentrations for purified seawater (seawater which through 8-quinolinol resin column three times for replace Fe) was 0.017 nM. The relative standard deviation was within 3.8 % ($n=12$) for replicate measurements of a seawater sample containing 0.9 nM Fe(III) during the cruises.

4) *Onboard incubation study for investigate Fe availability*

To investigate ambient Fe availability and Fe requirement for phytoplankton community, Fe chelate (desferrioxamine B: DFB) addition incubation experiment and Fe enrichment incubation experiment were conducted at station 8, KNOT-N and 22. DFB is one of the chelate which has strong affinity with only Fe, and convert Fe to unavailable form for phytoplankton (Hutchins et al., 1999). We prepared three treatment in this incubation experiment. The surface water sample (from 20 m depth) for control treatment was dispensed into ten, acid-cleaned, replicate 500 ml (or 250 ml) polycarbonate incubation bottles. For the DFB addition treatment, surface water sample which placed in ten 500 ml (250 ml) polycarbonate bottles were added DFB (300 nM) and then immediately homogenized. Fe enriched treatment was prepared surface water enriched with 0.1-10 nM FeCl_3 solution. These preparations procedures were done in the clean-air laboratory. These incubation polycarbonate bottles were sealed in three plastic bags and then incubated on deck in running surface seawater baths to maintain surface seawater temperatures for 6-8 days. The incubation baths were covered with neutral density screens, and incubate light intensity was 27 % of the ambient light level.

During the course of the incubations, two bottles for each treatment were withdrawn from the incubation bath at day 0, 2, 4, 6 and 8 and submitted to the measurements of nutrients, size-fractionated Chl.*a*, and microscopic analysis for phytoplankton species.

Result

Vertical distributions of total labile and dissolved Fe concentration

At the sampling station in Pacific ocean side from the Kuril islands (station 6, 11, 21, 22, 23 and KNOT), total labile Fe concentration had nutrient type distribution. However these values in surface water and deep water were higher than reported Fe concentration in NE Pacific. Total labile Fe concentration was not undetectable level in surface mixed layer. Meanwhile, dissolved Fe ($< 0.22 \mu\text{m}$) concentrations also had nutrient-type distributions characterized by depletion in surface mixed layer 0.04-0.19 nM, and gradually increased below 80-100 m and reached maximum at 0.99-1.79 nM in intermediate water (600-1500 m depth). The dissolved Fe concentration converged to 0.56-0.8 nM in deep water (3000-5000 m) in these station. Vertical Fe profile at station 23 is shown in Figure 1A.

At the sampling station in the sea of Okhotsk side from the Kuril islands (station 8, 9 and 17), total labile Fe concentration was higher than Pacific side stations and did not have nutrient like distribution except station 17. Also dissolved Fe concentration was not depleted in surface layer. Vertical Fe profile at station 8 is shown in Figure 1 B.

Iron species in seawater

Vertical Fe profile at station 22 is shown in Figure 2 A and vertical profile of Fe in each size-fractions is shown in 2 B. Regarding the size-fractionated Fe concentrations at station 22, soluble Fe ($< 200 \text{ kDa}$) had nutrient-type distributions characterized by depletion in surface mixed layer (0–0.1 nM), with a minimum at 80 m depth and increased in deep water (0.90 nM at 800 m). The small colloidal Fe (200 kDa– $0.22 \mu\text{m}$) concentrations were low ($\sim 0.01 \text{ nM}$) in the upper 80 m and getting higher below 100 m. The small colloidal Fe corresponded to 45 % of the dissolved Fe ($< 0.22 \mu\text{m}$) in 800 m water. Large labile particulate Fe ($> 0.22 \mu\text{m}$) concentrations were high in 10-20 m depth, and decreased with depth and observed minimum at 80 m depth.

At station KNOT-2, the vertical distribution of total labile Fe and dissolved Fe ($< 0.22 \mu\text{m}$) concentration had nutrient-type profiles (Fig. 3). With UV irradiation, the total labile Fe concentration increased 51-122 % from surface to deep water and the dissolved Fe concentration increased 20-40 % below 150 m (Fig. 3).

Discussion

The dissolved Fe profiles at the subarctic NW Pacific ocean near the Kuril islands had nutrient-type

distributions in this cruise. At station near the Kuril islands, station 6, 11, 21 and 22, the maximum of Fe concentration in intermediate water (600-1000) was higher than that at station 23 and KNOT away from the Kuril islands. This result might suggest that the higher concentration was influence of the Kuril islands, water current and water from the sea of Okhotsk. Meanwhile, Fe concentration in the sea of Okhotsk was higher than station around the Kuril islands in the subarctic NW Pacific. It indicates that Fe for the sea of Okhotsk was not only supplied from the Kuril islands, there might have been another Fe source for increase Fe concentration in this area.

With regard the size-fraction at station 22, the concentrations of small colloidal Fe were low in the surface mixed layer with higher concentrations observed below 100 m. Small colloidal Fe corresponded to 45–92 % of the dissolved Fe below 125 m. These results suggest that a substantial portion of the small colloidal Fe exists in the dissolved Fe fraction ($< 0.22 \mu\text{m}$) in seawater. With increased depth (80–800 m), the soluble and small colloidal Fe profiles appeared similar to the remineralized like nutrients at these depths. This may suggest that the increased the soluble and the small colloidal Fe concentration below the surface mixed layer due to the remineralization of Fe from biogenic sinking organic matter.

With UV irradiation analytical method, we can decompose organic matter in seawater which include or adsorb Fe. And the result of the UV irradiated Fe concentration shows that high concentration of Fe combine with organic matter, especially large labile particle fraction ($> 0.22 \mu\text{m}$) in intermediate layer (150-800 m).

These results indicate that we need to consider the existence of colloidal Fe and Fe in organic matter in seawater to better understand the Fe dynamics in the ocean.

Future Plan

We will analyze the stored sample of incubation experiments from this cruise. It will reflect that the information of Fe availability of ambient Fe in the sea of Okhotsk and the subarctic NW Pacific ocean. And also we will compare the Fe data to routine data to understand Fe dynamics in this region.

Acknowledgements

We express our appreciation and thanks to Dr. S. Nakabayashi for supply bottles and filters for observation of Fe concentration in this cruise. Thanks are also extended to the crew and officers of R/V MIRAI for there assistance.

Reference

- Coale, K. H. and others, 1996. A massive phytoplankton bloom induced by an ecosystem-scale iron fertilization experiment in the equatorial Pacific Ocean. *Nature*, 383: 495-501.
- Hutchins, D. A., Frank, V. M. and Brzezinski, M. A., 1999. Inducing phytoplankton iron limitation in iron-replete coastal waters with a strong chelating ligand. *Limnol. Oceanogr.*, 44: 1009-1018.
- Martin, J. H. and Fitzwater, S. E., 1988. Iron deficiency limits phytoplankton growth in the north-east Pacific subarctic. *Nature*, 331: 341-343.
- Martin, J. H. and others, 1994. Testing the iron hypothesis in ecosystems of the equatorial Pacific Ocean. *Nature*, 371: 123-129.
- Obata, H., Karatani, H. and Nakayama, E., 1993. Automated determination of Iron in seawater by chelating resin concentration and chemiluminescence detection. *Anal. Chem.*, 65: 1524-1528.
- Obata, H., Karatani, H., Matsui, M. and Nakayama, E., 1997. Fundamental studies for chemical speciation of iron in seawater with an improved analytical method. *Mar. Chem.*, 56: 97-106.
- Rue, E. L. and Bruland, K. W., 1995. Complexation of iron(III) by natural organic ligands in the central North Pacific as determined by a new competitive ligand equilibration/adsorptive cathodic stripping voltammetric method. *Mar. Chem.*, 50: 117-138.
- Wu, J. and Luther III, G. W., 1994. Size-fractionated iron concentrations in the water column of the western North Atlantic Ocean. *Limnol. Oceanogr.*, 39: 1119-1129.

Table 1 Depth for iron sampling for each stations

St. TEST		St. 6		St. 7.2	
Species	depth	Species	depth	Species	depth
total labile Fe	-10	total labaille Fe	-10	total labile Fe	-150
	-20	dissolved Fe	-20		-300
	-40		-40		-450
	-80		-80		-700
	-100		-100		-1000
	-125		-125		-1500
	-150		-150		-2000
	-200		-200		-2500
	-300		-300		-3000
	-400		-400		-3260
	-700		-600		-3290
	-1000		-800		-3313
			-1000		
			-1250		
			-1500		
			-2000		
			-2500		
			-3000		
			-3500		
			-4000		
			-4500		
			-5000		
			-5500		
St. 8		St. 9		St.11	
Species	depth	Species	depth	Species	depth
total labile Fe	-10	total labaille Fe	-10	total labaille Fe	-10
dissolved Fe	-20	dissolved Fe	-20	dissolved Fe	-20
UV irradiated dissolved Fe	-30		-40	UV irradiated total labile Fe	-40
	-40		-80	UV irradiated dissolved Fe	-80
	-80		-100		-100
	-100		-125		-125
	-125		-150		-150
	-150		-200		-200
	-175		-300		-300
	-200		-400		-400
	-250		-600		-600
	-300		-800		-800
	-400		-1000		-1000
	-600		-1250		-1250
	-800		-1500		-1500
	-1000		-2000		-2000
	-1250		-2500		-2500
	-1500		-3000		-3000
					-3500
					-4000
					-4500
					-5000
St. 13		St. 15		St. 16	
Species	depth	Species	depth	Species	depth
total labaille Fe	10	total labaille Fe	-10	total labaille Fe	-10
dissolved Fe	20	dissolved Fe	-20	dissolved Fe	-20
	40		-40		-40
	80		-80		-80
	100		-100		-100
	125		-125		-125
	150		-150		-150
	200		-200		-200
	300		-300		-300
	400		-400		-400
	600		-600		-600
	800		-800		-800
	1000		-1000		-1000
	1250		-1250		-1250
	1500		-1500		-1500
	2000		-2000		-2000
	2500		-2500		-2500
	3000		-3000		-3000
	3500		-3500		-3500
	4000		-4000		
	4500		-4500		
			-5000		
St. 17					
Species	depth				
total labaille Fe	-10				
dissolved Fe	-20				
soluble Fe	-40				
	-80				
	-100				
	-125				
	-150				
	-200				
	-300				
	-400				
	-600				
	-800				
	-1000				
	-1250				
	-1500				
	-2000				
	-2500				

Table 1 continue

St. 20-3		St. 21		St. 22	
Species	depth	Species	depth	Species	Depth
total labaille Fe	-25	total labaille Fe	-10	total labaille Fe	-10
dissolved Fe	-50	dissolved Fe	-20	dissolved Fe	-20
	-100		-40	soluble Fe	-40
	-250		-80		-80
	-500		-100		-100
	-1000		-125		-125
	-1500		-150		-150
	-2000		-200		-200
	-2500		-300		-300
	-3000		-400		-400
	-4000		-600		-600
	-6000		-800		-800
			-1000		-1000
			-1250		-1250
			-1500		-1500
			-2000		-2000
			-2500		-2500
			-3000		-3000
			-3500		-3500
			-4000		-4000
			-4500		-4500
					-5000
St. 23		St. KNOT-1		St. KNOT-2	
Species	depth	Species	depth	Species	depth
total labaille Fe	-10	total labaille Fe	-10	total labaille Fe	-10
dissolved Fe	-20	dissolved Fe	-20	dissolved Fe	-20
UV irradiated total labile Fe	-40		-40	UV irradiated total labile Fe	-40
UV irradiated dissolved Fe	-80		-80	UV irradiated dissolved Fe	-80
	-100		-100		-100
	-125		-125		-125
	-150		-150		-150
	-200		-200		-200
	-300		-300		-300
	-400		-400		-400
	-600		-700		-500
	-800		-1000		-600
	-1000				-700
	-1250				-800
	-1500				-1000
	-2000				-1250
	-2500				-1500
	-3000				-2000
	-3500				-2500
	-4000				-3000
	-4500				-3500
	-5000				-4000
					-4500
					-5000
St. KNOT-2-N		St. KNOT-3		total labile Fe = unfiltered fraction dissolved Fe = filtered by 0.22 µm soluble Fe = filtered by 200 kDa	
Species	depth	Species	depth		
total labaille Fe	-10	total labaille Fe	-10		
dissolved Fe	-20	dissolved Fe	-20		
	-40	soluble Fe	-40		
	-80	UV irradiated total labile Fe	-80		
	-100	UV irradiated dissolved Fe	-100		
	-150	UV irradiated soluble Fe	-120		
	-200		-140		
	-300		-160		
	-600		-180		
	-1000		-200		
			-230		
			-260		
			-300		
			-350		
			-400		
			-500		
			-600		
			-700		
			-800		
			-1000		
			-2000		
			-3000		
			-4000		
			-5000		

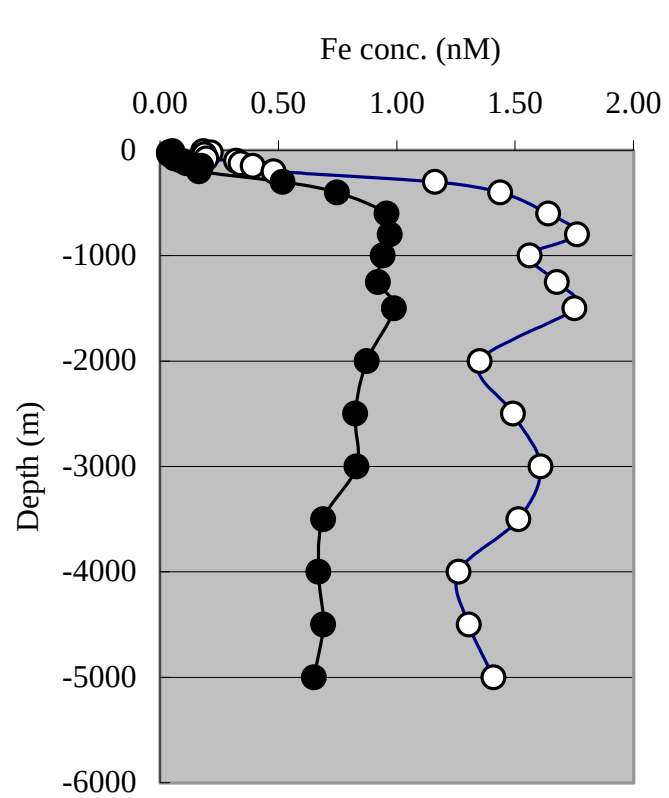


Fig. 1A Vertical profile of Fe at station 23

—○— total labile Fe —●— dissolved Fe (< 0.22 μ m)

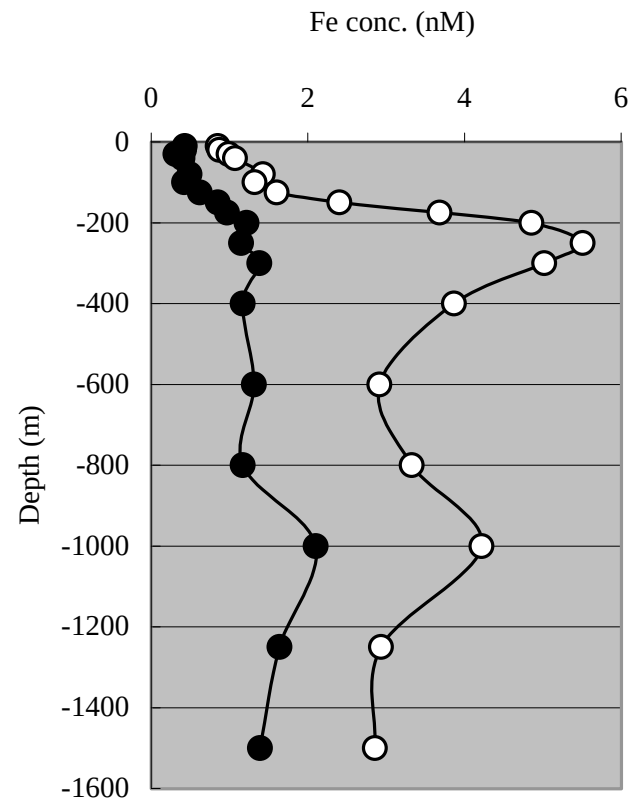


Fig. 1B Vertical profile of Fe at station 8

—○— total labile Fe —●— dissolved Fe (< 0.22 μ m)

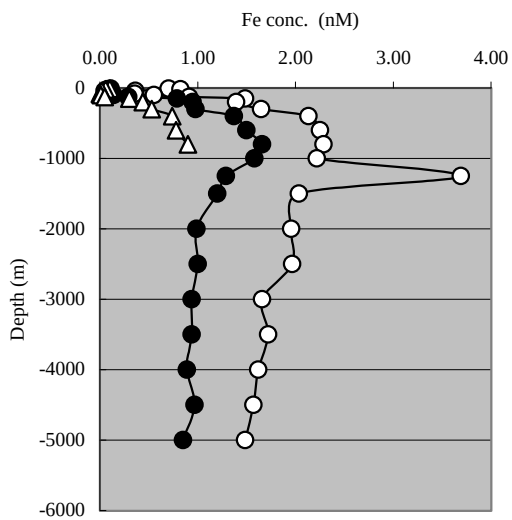


Fig. 2A Vertical profile of Fe at station 22

- total labile Fe
- dissolved Fe (< 0.22 μm)
- △ soluble Fe (< 200 Kda)

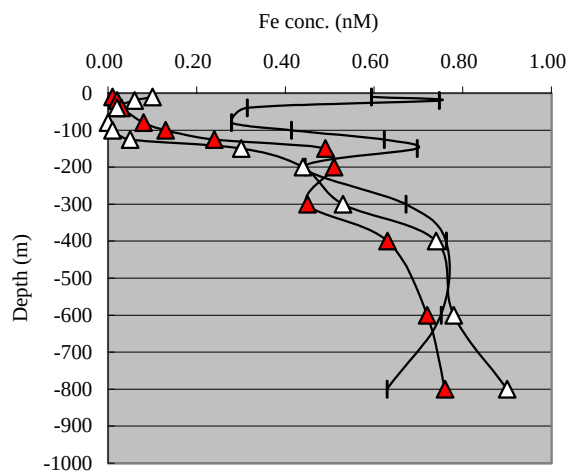


Fig 2B Vertical profile of Fe in each size fraction at station 22

- large labile particulate Fe (> 0.22 μm)
- ▲ colloidal Fe (200 kDa-0.22 μm)
- △ soluble Fe (< 200 kDa)

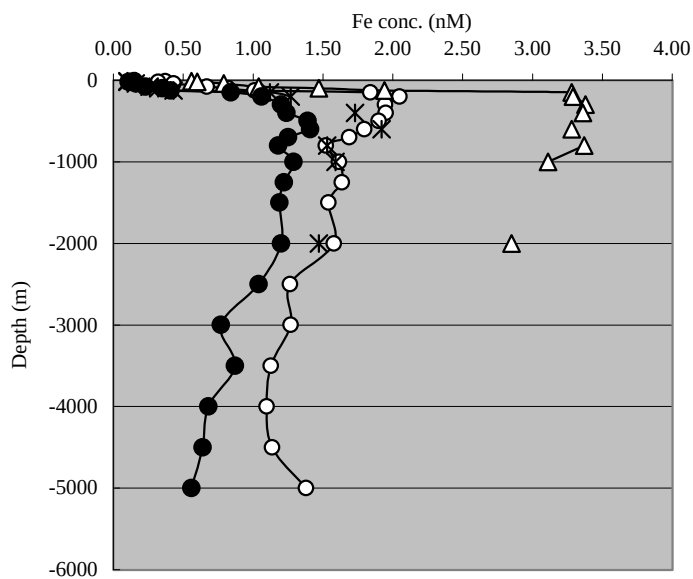


Fig. 3 Vertical profile of Fe at station KNOT-2
(with and without UV irradiate)

- total labile Fe
- △ UV irradiated total labile Fe
- dissolved Fe (< 0.22 μm)
- * UV irradiated dissolved Fe (< 0.22 μm)

3.7 Gas exchange

3.7.1 Measurements of N₂, O₂ and Ar in the northern North Pacific Surface Water

Noriko Nakayama

Marine & Atmospheric Geochemistry Lab. Division of Ocean & Atmospheric Science,
Graduate School of Environmental Earth Science, Hokkaido University

Introduction.

Global carbon dioxide budget can be understood by estimating its amount absorbed into the ocean. One of the key factors to regulate it is the gas transfer velocity at the air-sea surface, usually expressed as a function of wind speed. It has not yet been made clear about the gas exchange mechanism, in particular, on the role of bubbles. In this cruise, primary studies are to evaluate biological and physical factors on the gas exchange based on nitrogen, oxygen and argon measurements in the surface seawater as well as bubbles, followed by the estimation of their exchange rates in the northern North Pacific.

Methods.

Seawater samples were collected in duplicate by utilizing a Niskin sampler at every depth, and then transferred into a 100 ml glass bottle to determine oxygen, nitrogen and argon concentrations. After collection, a 100 μ aliquot of saturated HgCl₂ solution was added to each sample to prevent any biological activity that would alter the gas concentration in seawater, and then stored in a cold seawater bath placed in a dark room until analysis.

All samples were analyzed on board by using a gas chromatography (GC) equipped with a thermal conductivity detector (TCD). First, the 2.5 seawater sample, treated by HgCl₂, was placed in a stripping chamber to release all dissolved gasses, by applying the carrier gas helium pressure into the sample water. Two separation columns, which are placed parallel to each other, were used to analyze N₂, O₂ and Ar simultaneously. One column was immersed in a dry ice-ethanol bath (-72 °C) to separate Ar from O₂, and the other in a water bath, which was kept in ambient

temperature, to separate O₂ and Ar combined from N₂. Reference gas was measured for each analysis. It takes approximately 15 minutes from pretreatment to final measurement. Accuracy was less than 0.3 % for all three gases.

Future Plan.

An upcoming project is to evaluate the physical mechanism on gas exchange by using nonbiological gases, N₂ and Ar, and the influence on biological activities by oxygen concentration. If bubbles produced by breaking waves at the air-sea interface are mixed with seawater, these gases should be supersaturated in surface water. An attempt will be made to evaluate effects of bubbles on gas exchange in relation to wind speed. At the end, this project should be able to clarify the role of the ocean in determining global fluxes of chemical substances and heat energy.

3.7.2 O₂, N₂, Ar, and Ne

Steven Emerson

University of Washington

Gas concentration measurements

I collected samples to determine oxygen, nitrogen, argon and neon concentrations on three visits to station KNOT during this cruise (KNOT I, May 12 - 14; KNOT II, May 23 - 25; and KNOT III, June 6 - 7). The surface 100 meters was sampled on all visits and a deep profile was sampled on KNOT II. Eighty discrete depths were sampled for O₂, N₂, and Ar, and 40 for Ne. All depths were sampled in duplicate.

Our group determines primary production from oxygen mass balance. We have measured oxygen, nitrogen and argon from samples collected on five previous KNOT time series cruises. Oxygen concentrations are affected by biological and physical processes. The non-biological gases (N₂, Ar and Ne) are used to correct for the physical effects on O₂ such as gas exchange, bubbles and mixing through the thermocline. Then we can calculate how much of the O₂ is due to biological production, and therefore how much organic carbon was produced. (Emerson et al, 1997) The Ne samples are essential to constrain the mechanism of gas saturation caused by bubbles created by breaking waves because the solubility of this gas is only weakly temperature sensitive.

O₂ samples were analyzed on board the ship by Winkler titration, using a visual endpoint. Comparison between our O₂ method and those of JAMSTEC and Dr. Nojiri's group indicate that our method is about 1 % lower than these two methods. No discrepancy was found between our standards; they were the same to within my ability to determine the KIO₃ strength. The difference seems to stem from the different ways the three groups are dealing with blanks. The U.W. method corrects for the amount of O₂ in the reagents and determines the blank using both distilled and sea water samples.

Water for O₂, N₂, Ar (ONAR) analysis was collected in evacuated glass flasks. The flasks were half filled. The water was allowed to equilibrate with the headspace at a constant temperature for eight hours and then removed. Back in Seattle, the O₂/N₂ and O₂/Ar ratios will be determined on a mass spectrometer. The Winkler titration O₂ values are used to solve for total N₂ and Ar. (Emerson et al, 1999)

Ne samples were collected in two different ways to compare methods. Twenty samples were collected in glass flasks, the same as ONAR samples. The necks of these samples were kept under constant vacuum to prevent air from leaking across the O-ring seals. Forty samples were collected in copper tubes. Water was flushed through the copper tubes and then the ends were pinched shut with clamps. Results of these two methods will be compared to determine which method is most effective. Back in Seattle, Ne concentrations are determined using isotope dilution and a quadrupole mass spectrometer.

References

Emerson, S., P. Quay, D. Karl, C. Winn, L. Tupas and M. Landry, Experimental determination of the organic carbon flux from open-ocean surface waters, *Nature*, 389, 951-954, 1997.

Emerson, S., C. Stump, D. Wilbur and P. Quay, Accurate measurement of O₂, N₂, and Ar gases in water and the solubility of N₂, *Marine Chemistry*, 64, 337-347, 1999.

3.8 Radionuclides

3.8.1 Radionuclides (^{234}Th and Ra isotopes)

Hazime Kawakami and Masashi Kusakabe (JAMSTEC)

(1) ^{234}Th

1) Purpose of the study

By using particle-reactive radionuclide (^{234}Th), fluxes of particulate organic carbon (POC) and particulate organic nitrogen (PON) in the northwestern North Pacific Ocean are estimated.

2) Sampling

Twenty liters of seawater sample were collected from 12 depths (10m, 20m, 30m, 40m, 50m, 60m, 75m, 100m, 150m, 200m, 250m, 300m) at 8 stations (Stn. KNOT, 6, 8, 11, 12, 15, 17, 22). Samples for POC and PON measurement were also taken separately.

Seawater samples were filtered through a 47mm GF/F filter on board immediately after water sampling.

3) Chemical analyses

After addition of ^{230}Th spike to the filtered seawater samples, U was separated from Th by anion exchange method on board the ship. Separation of Th in particulate samples were done in a land-based laboratory.

Th separated will be electroplated on a 25mm stainless steel disk electrically, and measured by a β -ray counter and α counter.

(2) Ra isotopes (^{228}Ra , ^{226}Ra)

1) Purpose of the study

Ra isotopes (^{228}Ra , ^{226}Ra) in seawater will be used to analyze water mass mixing.

2) Sampling

Two hundred liter s of surface seawater were filtered through Mn fiber at 13 stations to concentrate Ra isotopes. The filtration took about one day.

3) Chemical analyses

Mn fiber is dissolved in H_2O_2 solution. Then, Ba^{2+} is added to the solution to form $\text{Ba}(\text{Ra})\text{SO}_4$ precipitate. Ra isotopes in the precipitate will be counted by a γ -ray counter.

3.8.2 Time-series observation of ^{234}Th at KNOT station

Hisashi Narita (Graduate School of Hokkaido University)

Koh Harada (National Institute for Resources and Environment)

Yoko Shibamoto (National Institute for Resources and Environment)

(1) Introduction

The estimation of export flux from the euphotic layer to deeper layer is important to understand the carbon cycles in the surface water. Since the export flux is strongly related to the biological productivity in the euphotic zone, it is predicted large seasonal variation. For understanding the seasonal variation of the export fluxes and the prime cause of its variation, time-series observation of short lived radionuclides in the surface water, such as Th-234, Pb-210 and Po-210, and also drifting sediment trap experiments were started from June 1998 at St. KNOT in the northwestern North Pacific. These nuclides are good tracers to understand the removal processes of the insoluble chemical species from surface water and particulate materials. The particulate fluxes observed by the drifting sediment trap should be compared with the fluxes estimated from the disequilibrium in the seawater, because of non-quantitative collecting efficiency due to shape of the trap and complicated hydrodynamics in the surface water. In order to understand the export fluxes and its controlling factors in spring of the northwestern North Pacific, we conducted seawater sampling and drifting sediment trap experiment three times at St. KNOT in this cruise.

(2) Method

The seawater sampling, for the analysis of Th-234, Pb-210 and Po-210 and the drifting sediment trap experiments were conducted three times in this cruise. About 20 L seawater samples were collected from each station. Samples are immediately fixed by addition of nitric acid and spiked with a known activity and amount of yield tracers and carriers. After standing at least 6 hours, the nuclides were coprecipitated with iron hydroxide by addition of ammonia water, and the precipitates were collected on cartridge filters one hour later. After purifying and separating by ion exchange and extraction techniques, radioactivity of each nuclide will be counted by alpha spectrometry and scintillation counter on land in National Institute for Resources and

Environment. Sediment trap samples are going to be separated and counted in a land laboratory too.

(3) Future work

The export fluxes will be estimated by using independence methods, namely seawater analysis for Th-234 and drifting sediment trap experiment, and then compared each other. We will be discussed about seasonal variation of the export fluxes and relationship between these fluxes and oceanic environments.

3.9 Primary production

Keiri Imai (Japan Science and Technology Corporation)

Yukihiro Nojiri (National Institute for Environmental Studies)

Introduction

In western region(Station KNOT) of North Pacific Ocean time series survey was started since June 1998. In this region it is very important to estimate primary production by phytoplankton in spring, and the spring blooms of phytoplankton were found near Station KNOT by Mirai cruise last year. Therefore the mission of this cruise is to measure the primary production by phytoplankton in the bloom and to investigate the mechanism of the spring bloom in more expanded area.

Method

In this cruise, using ^{13}C as a tracer for inorganic ^{13}C uptake by phytoplankton photosynthesis, incubation experiments carried out in two types procedures(*in-situ* and/or simulated *in-situ*). Water samples were collected with Niskin-X bottles attached CTD-RMS from the 6 layers corresponding to 100, 34, 17, 8.5, 4, 0.9% of surface irradiance and drained into 250ml polycarbonate bottles. After addition of $^{13}\text{C}\text{-NaHCO}_3$ those bottles were incubated for 24h. And particle matter was filtered onto precombusted (450°C, 4h) grass fiber filter (Whatman GF/F) after incubation. Primary production will be calculated with concentration and ^{13}C atom % of particle organic carbon(POC) determined by Tracer. Incubation data and station and sampling depth are as follows.

Table Incubation data and station and sampling depth

Date	Station	Sampling Depth (m)
12-May	KNOT 1	0, 7, 13, 20, 28, 49
15-May	6	0, 3, 8, 12, 18, 35
20-May	11	0, 4, 10, 18, 27, 45
23-May	KNOT 2	0, 2, 7, 12, 18, 34
1-Jun	22	0, 2, 6, 9, 14, 23
2-Jun	21	0, 4, 10, 15, 20, 34
4-Jun	15	0, 3, 9, 15, 22, 37
6-Jun	KNOT3	0, 5, 10, 15, 20, 25, 30, 45

3.10 Sediment trap experiments

3.10.1 Time-series sediment trap experiment by JAMSTEC

Makio Honda and Masashi Kusakabe

(Japan Marine Science and Technology center)

Toshikatsu Sugawara, Yoshitaka Matsuura, Aya Kato, and Hiroaki Muraki

(Marine Works Japan Ltd.)

(1) Introduction

One of characteristics in the northwestern North Pacific is strong seasonal variability in the biological activity and its related marine chemistry. In order to study seasonal variability in biological pump and its role in materials cycle with the emphasis on the carbon cycle, time-series sediment trap experiment has been conducted since December, 1997 at three stations (stn. KNOT : Japanese biogeochemical time-series station, stn. 50N: western subarctic gyre, and stn. 40N: subarctic front). During MR00-K03 cruise, the sediment trap mooring systems at stn. KNOT was recovered and re-deployed.

(2) Methods

1) Mooring system

The mooring system at stn. KNOT consists of three sediment traps with 21 collecting cups (McLane Mark 7G-21 or Mark 78-21), glass floatation, wire / nylon ropes, and acoustic release (Benthos 865A). Sediment traps were positioned at approximately 1000 m, 3000 m, and 5000 m depths. Before deployment, collecting cups were filled with sea water based 5 % buffered formalin to preserve collected settling particles. Each cup was scheduled to rotate every 17.38 days and started in May, 1999.

2) Recovery

Thanks to the enthusiastic assistance by captain Hashimoto, chief officer Dowaki and crew members, the sediment trap mooring systems was recovered successfully during this cruise. Collecting cups rotated on schedule except last three cups at 5000 m and valuable samples were collected.

(3) Preliminary results

1) Seasonality in fluxes

On board, heights of total mass flux (TMF) in collecting cups were measured as the first analysis. Fig. 1 shows seasonal variability in TMF since December, 1997. TMF observed during last experiment (observed in this cruise) are expressed as solid bars.

In general, seasonal variability in TMF observed at three depths synchronized well. TMF increase in June and July, 1999. Increase in TMF was also observed in same period in 1998. Although TMF scale is height and accuracy is low, increase in TMF in May, 1999 is the largest since sediment trap experiment started. TMF decreased toward winter and started increasing again toward spring, 2000.

2) Future plan

These samples will be transported to laboratory being kept in refrigerator. At laboratory, chemical components such as carbon, nitrogen, carbonate, opal and trace elements will be measured. Based on our results obtained until now, TMF in 1998 at stn. KNOT was relatively smaller than that observed in the early 1990s (Noriki et al., 1999). It is of interest to certify whether it was attributed to the effect of 1997/1998 El Nino. Annual averages of concentration of opal and CaCO_3 are ~ 50 % and ~ 28 %, respectively. Comparison of these ratio between 1998 and 1999 is another concern.

3) Redeployment

The above mooring systems were re-deployed at same positions after sample collection, data acquisition, and exchange of battery and preservative. Each cup was scheduled to rotate every 17.38 days, start on the 1st June 2000. Specification of above sediment trap mooring system are shown in Table 2. Outlines of mooring systems are shown in Table 1 and Fig. 2. The mooring system is planned to be recovered in June, 2001 by R/V MIRAI.

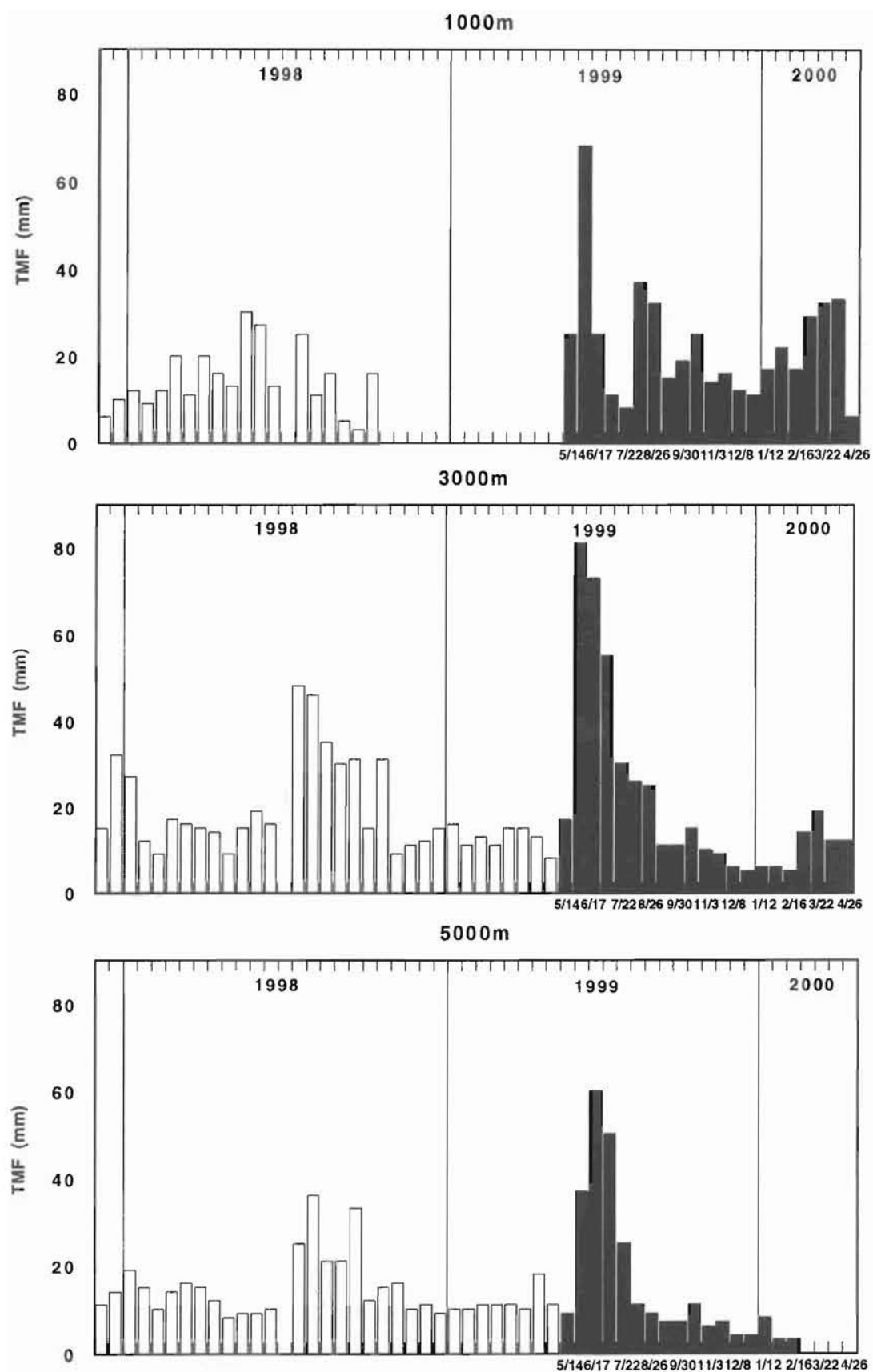


Fig. 1 Seasonal variability in Total Mass Flux (TMF).
Solid bars show TMF observed during the
last experiment. TMF scale is height (mm).

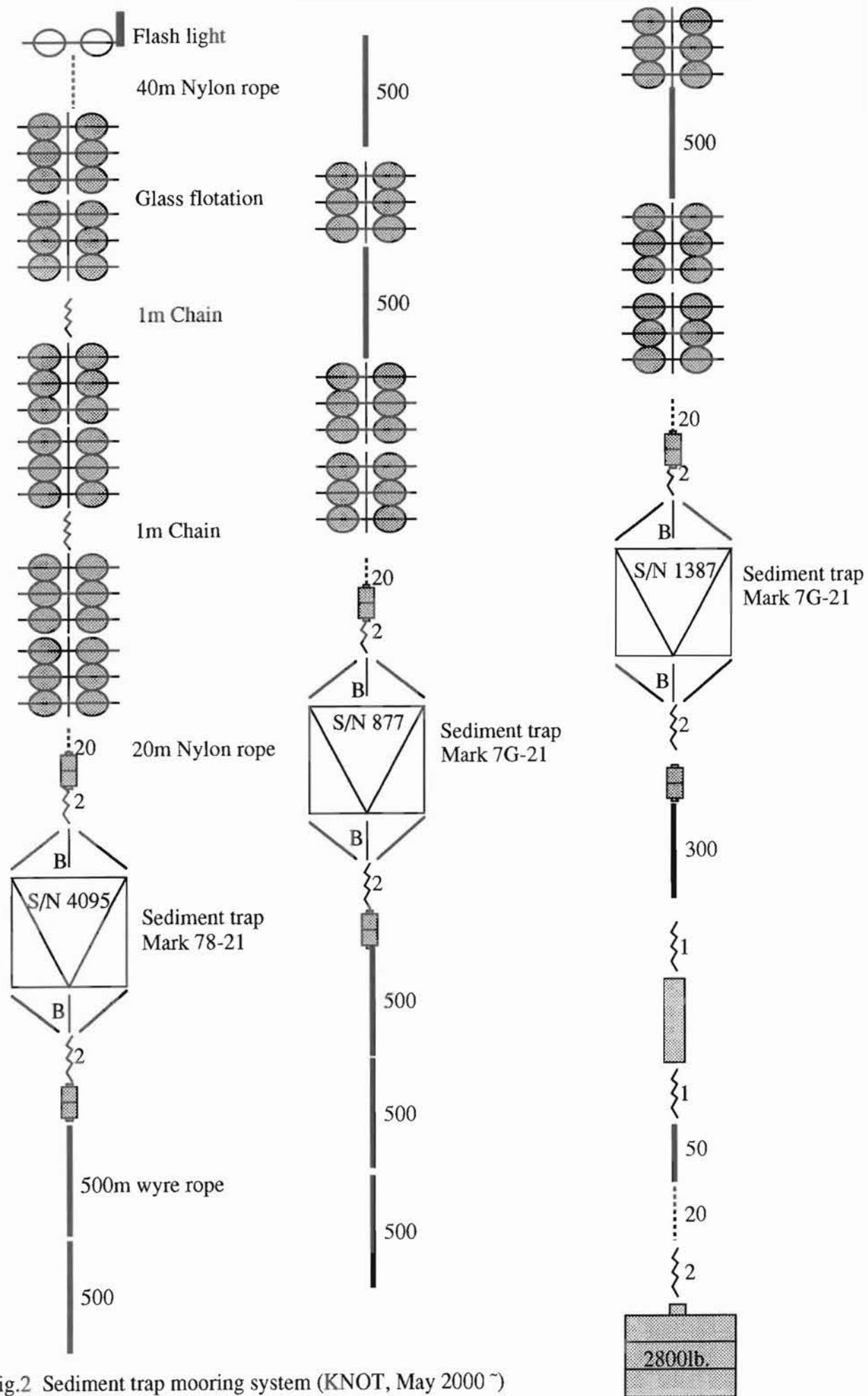


Fig.2 Sediment trap mooring system (KNOT, May 2000 ~)

Table 1 Sediment trap mooring system (stn. KNOT)									
Mooring ID	NEW	JAST01HL (KNOT)	Water Depth			5367m	2000 May		
		Item	Item	Item	Mooring	Mooring	Above	Below	
Description		Weight	Quantity	Length	Weight	Length	Weight	Bottom	Surface
		(lb/ea)	(#)	(m)	(lbs)	(m)	(lbs)	(m)	(m)
Start of Mooring		0	0	0	0	0	0	4,513	854
Beacon Float		-64	1	0	-64	0	-64	4,513	854
Nylon rope 3/4"		1	1	40	1	40	-63	4,513	854
FLOTATION MODULE		-64	6	2	-384	42	-447	4,473	894
Chain 3/8"		4	1	1	4	43	-443	4,471	896
FLOTATION MODULE		-64	6	2	-384	45	-827	4,470	897
Chain 3/8"		4	1	1	4	46	-822	4,468	899
FLOTATION MODULE		-64	6	2	-384	48	-1,206	4,467	900
Nylon rope 3/4"		1	1	20	1	68	-1,205	4,465	902
Sieve		10	1	0	10	68	-1,195	4,445	922
Chain 3/8"		9	1	2	9	70	-1,186	4,445	922
Bridle (1m x 3 wire rope)		9	1	1	9	71	-1,177	4,443	924
SEDIMENT TRAP MK7-21	S/N 4095	121	1	2	121	73	-1,056	4,442	925
Bridle (1m x 3 wire rope)		9	1	1	9	74	-1,047	4,440	927
Chain 3/8"		9	1	2	9	76	-1,038	4,439	928
Sieve		10	1	0	10	76	-1,028	4,437	930
wire rope 3/16"		75	1	500	75	576	-953	4,437	930
wire rope 3/16"		75	1	500	75	1,076	-878	3,937	1,430
wire rope 3/16"		75	1	500	75	1,576	-803	3,437	1,930
FLOTATION MODULE		-64	3	1	-192	1,577	-995	2,937	2,430
wire rope 3/16"		75	1	500	75	2,077	-920	2,936	2,431
FLOTATION MODULE		-64	6	2	-384	2,079	-1,304	2,436	2,931
Nylon rope 3/4"		1	1	20	1	2,099	-1,303	2,434	2,933
Sieve		10	1	0	10	2,099	-1,293	2,414	2,953
Chain 3/8"		9	1	2	9	2,101	-1,284	2,414	2,953
Bridle (1m x 3 wire rope)		9	1	1	9	2,102	-1,275	2,412	2,955
SEDIMENT TRAP MK7-21	S/N 877	121	1	2	121	2,103	-1,154	2,411	2,956
Bridle (1m x 3 wire rope)		9	1	1	9	2,104	-1,145	2,410	2,957
Chain 3/8"		9	1	2	9	2,106	-1,136	2,409	2,958
Sieve		10	1	0	10	2,107	-1,126	2,407	2,960
wire rope 3/16"		75	1	500	75	2,607	-1,051	2,406	2,961
wire rope 3/16"		75	1	500	75	3,107	-976	1,906	3,461
wire rope 3/16"		75	1	500	75	3,607	-901	1,406	3,961
FLOTATION MODULE		-64	3	1	-192	3,608	-1,093	906	4,461
wire rope 3/16"		75	1	500	75	4,108	-1,018	905	4,462
FLOTATION MODULE		-64	6	2	-384	4,109	-1,402	405	4,962
Nylon rope 3/4"		1	1	20	1	4,129	-1,401	404	4,963
Sieve		10	1	0	10	4,130	-1,391	384	4,983
Chain 3/8"		9	1	2	9	4,132	-1,382	383	4,984
Bridle (1m x 3 wire rope)		9	1	1	9	4,133	-1,373	381	4,986
SEDIMENT TRAP MK7-21	S/N 1387	121	1	2	121	4,134	-1,252	380	4,987
Bridle (1m x 3 wire rope)		9	1	1	9	4,135	-1,243	379	4,988
Chain 3/8"		9	1	2	9	4,137	-1,234	378	4,989
Sieve		10	1	0	10	4,137	-1,224	376	4,991
wire rope 3/16"		45	1	300	45	4,437	-1,179	376	4,992
Chain 3/8"		4	1	1	4	4,438	-1,174	76	5,292
ACOUSTIC RELEASE		55	1	1	55	4,439	-1,119	75	5,293
Chain 3/8"		4	1	1	4	4,440	-1,115	74	5,294
wire rope 3/16"		5	1	50	5	4,490	-1,110	73	5,295
Nylon rope 3/4"		1	1	20	1	4,510	-1,109	23	5,345
Chain 3/8"		9	1	2	9	4,512	-1,100	3	5,365
ANCHOR		2,800	1	1	2,800	4,513	1,700	1	5,367

Table 2 Specification of Sediment Trap Mooring system at KNOT

Stn.		KNOT
Date of deploy		2000.5.24
Position	sinker drop	43-57.53N 155-03.42E
	calibration	43-57.82N 155-02.87E 5367m
Sediment trap (McLane Mark7G-21 * Mark78-21) w.depth/tilt sensor	depth and S/N	
	shallow	925m (S/N: 6854)*
	intermediate	2956m (S/N: 1386)
	deep	4987m (S/N: 1388)
	start	2000.6.1 0:00
	interval	17.38 day
	end	2001.6.1 0:00
	preservative	5% buffered formalin (sea water base)
Acoustic Release (Benthos 865A) NOTE: Re/Tr reverse for Deck Unit	S/N	782
	Receive	10.5 kHz
	Trans	12.0 kHz
	ENABLE	A
RELEASE		B

Note
* Positions are on the scale of WGS-84.

3.10.2 Time-series sediment trap experiment

Hisashi Narita and Shinitiro Noriki (Hokkaido University)

(1) Introduction

The most important feature in the northwestern North Pacific is the strong seasonal variation of biological productivity. The sediment trap experiment was conducted for understanding the seasonal variations of the biological productivity, its related oceanic environments and its influence on biogeochemical cycles of various chemical species. At St. KNOT, which is a Japanese biogeochemical time-series station, the sediment trap experiment had been carried out during three years from 1989 by our group and has been going on by JAMSTEC since December 1997.

The sediment trap experiment has been deployed by using T/V Bose Maru on October 1999, where located in the northwestern Pacific basin about 50 miles northwest of the St. KNOT (44° 42.478 N, 155° 37.811E, 5085 m). Our objectives are investigation into the biogeochemical cycles in the northwestern North Pacific, and the comparison with results of the St. KNOT. The sediment trap mooring system was recovered and re-deployed in this cruise.

(2) Methods

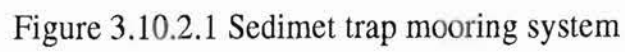
The sediment trap mooring system is shown in Figure 3.10.2.1. Sediment trap was deployed on 20 October 1999. The settling particle samples were collected at about 1000 m with sediment trap consisting twin cones type (NICHYU GIKEN KOGYO CO., Ltd., STM-13-6000) each with 13 cups working in time series. Sampling cups were rotated 10 to 30 days interval in winter and 10 days interval from early spring to the recovered time.

(3) Future work

Samples were transported to the laboratory on land, and will be separated into several portions by rotary splitting systems. Chemical analysis, such as organic and inorganic carbon, biogenic opal and trace elements will be measured, and will be discussed their variations and its reflects of the oceanic environments.

3) Redeployment

The above mooring systems were re-deployed at almost same positions (calibrated position; 44° 42.550 N, 155° 37.410 E) after exchange of cups and maintenance. The cord number of using acoustic release (NICHYU GIKEN KOGYO CO., Ltd., L type) was 3D. Sediment trap was started collection of settling particles on 26 May 2000 and will be collected 13 samples until 20 June 2001. These mooring systems are planning to be recovered next spring by R/V MIRAI.



3.11 Drifting sediment trap experiment

Hisashi Narita (Hokkaido University)

Keiri Imai (Japan Science and Technology Corporation)

Koh Harada (National Institute of Resource and Environment)

(1) Introduction

In the studies of biogeochemical cycles in the surface ocean, it is importance to know export flux from the euphotic zone. Because of the export flux is strongly related to the biological productivity in the euphotic zone, it is predicted large seasonal variation. In order to understand the seasonal variation of the export fluxes and the prime cause of its variation, time-series observation of export fluxes by drifting sediment trap experiments were started from June 1998 at St. KNOT in the northwestern North Pacific. Since non-quantitative collecting efficiency due to shape of the trap and complicated hydrodynamics in the surface water, it is necessary to correct the particulate fluxes observed by the drifting sediment trap. In order to solve this problem, the measurement of Th-234 in seawater should be conducted coupling with the drifting sediment trap experiment. Furthermore, another important things made clear by the drifting sediment trap are chemical and biological composition of settling particles and its seasonal variations connecting with change of primary production. For the better understanding of biogeochemical cycles in spring of the northern North Pacific, we conducted drifting sediment trap experiment three times at St. KNOT in this cruise (Table 3.11.1).

(2) Methods

The sediment trap array consists of eight polycarbonate cylinders mounted onto PVC cross, which were modified from Knauer et al. (1979) and were deployed at eight depths (20, 40, 60, 80, 100, 120, 140 and 180 m). In order to reduce advective-diffusive exchange of trap contents with ambient seawater during deployment, each cylinder of trap array was filled with the density gradient solution, which was filtered through 0.5 μm and 0.2 μm cartridge filter and prepared by adding 5g NaCl to 20 l seawater. Several thermometer and depth sensor were attached on trap array. The trap array was shown in Figure 3.11.1.

Sediment experiments were conducted three times at interval of about 10 days

in this cruise and drifted during about 48 hours. During the experiment, the location of mooring system was monitored on board by GPS tracking system.

(3) Preliminary results and future analysis

The preliminary results of the total mass fluxes are shown in Figure 3.11.2. These samples will be distributed to participants for the following various analysis.

1. Dry weight
2. Org-C, inorganic carbon, Total-N
3. Carbonate, Opal
4. Stable isotopes
5. Trace elements
6. Radionuclides
7. Microscopic analysis

Table3-11-1; Drifting sediment trap experiments

Station	Deployment position	Deployment time	Recovery position	Recovery time Interval (days)
Experiment I				
St. KNOT	44-00.866 N	2000/05/12 08:08	44-17.325 N	2000/05/14 08:15
44-00 N, 155-00 W	154-58.213 E		154-43.700 E	2.005
Experiment II				
St. KNOT	43-59.809 N	2000/05/23 06:10	43-59.987 N	2000/05/25 04:51
44-00 N, 155-00 W	154-59.946 E		154-00.030 E	1.945
Experiment III				
St. KNOT	44-00.605 N	2000/06/06 02:54	44-02.797 N	2000/06/07 03:23
44-00 N, 155-00 W	155-01.126 E		154-54.539 E	1.020

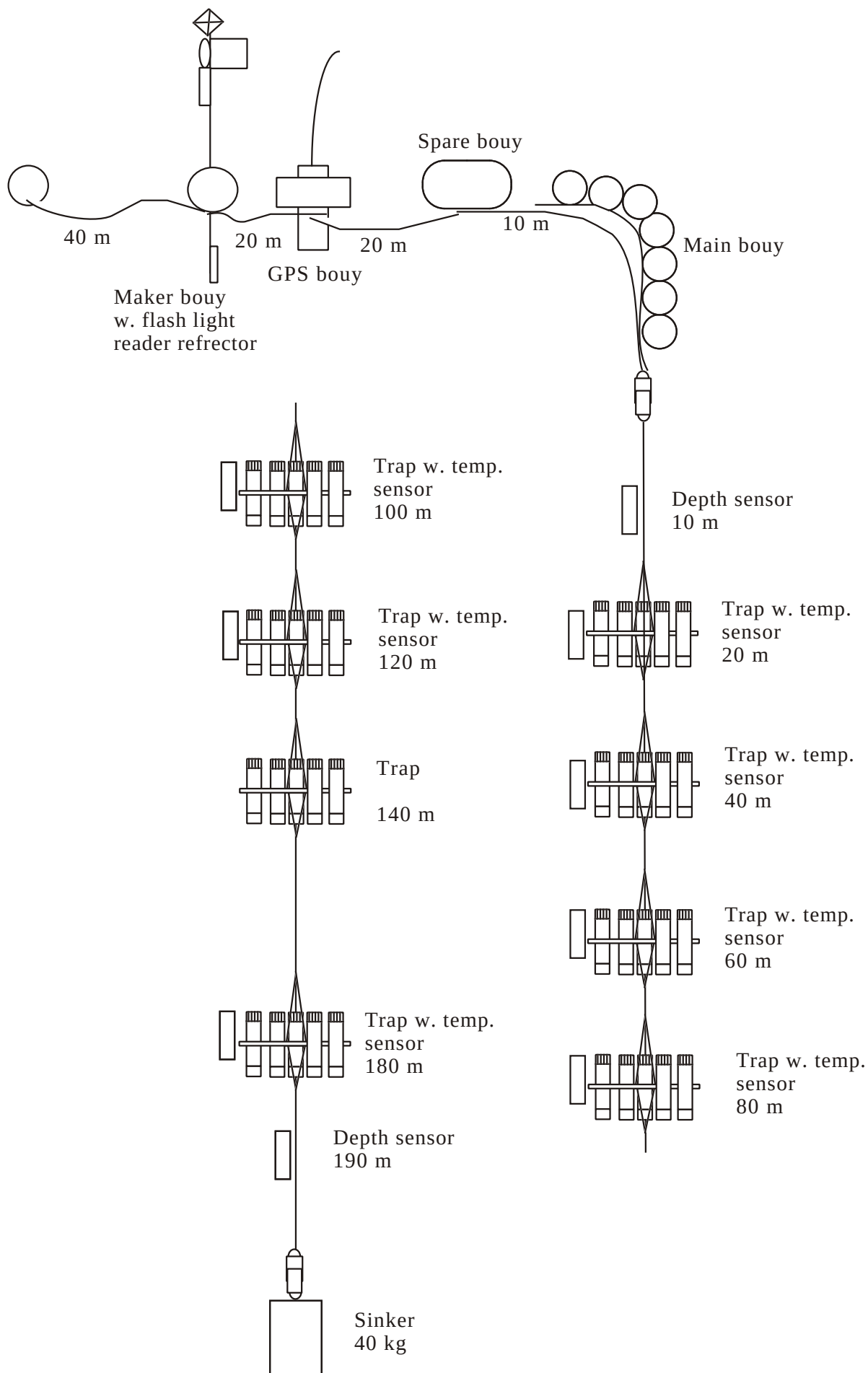


Figure 3.11.1; Drifting sediment trap mooring system

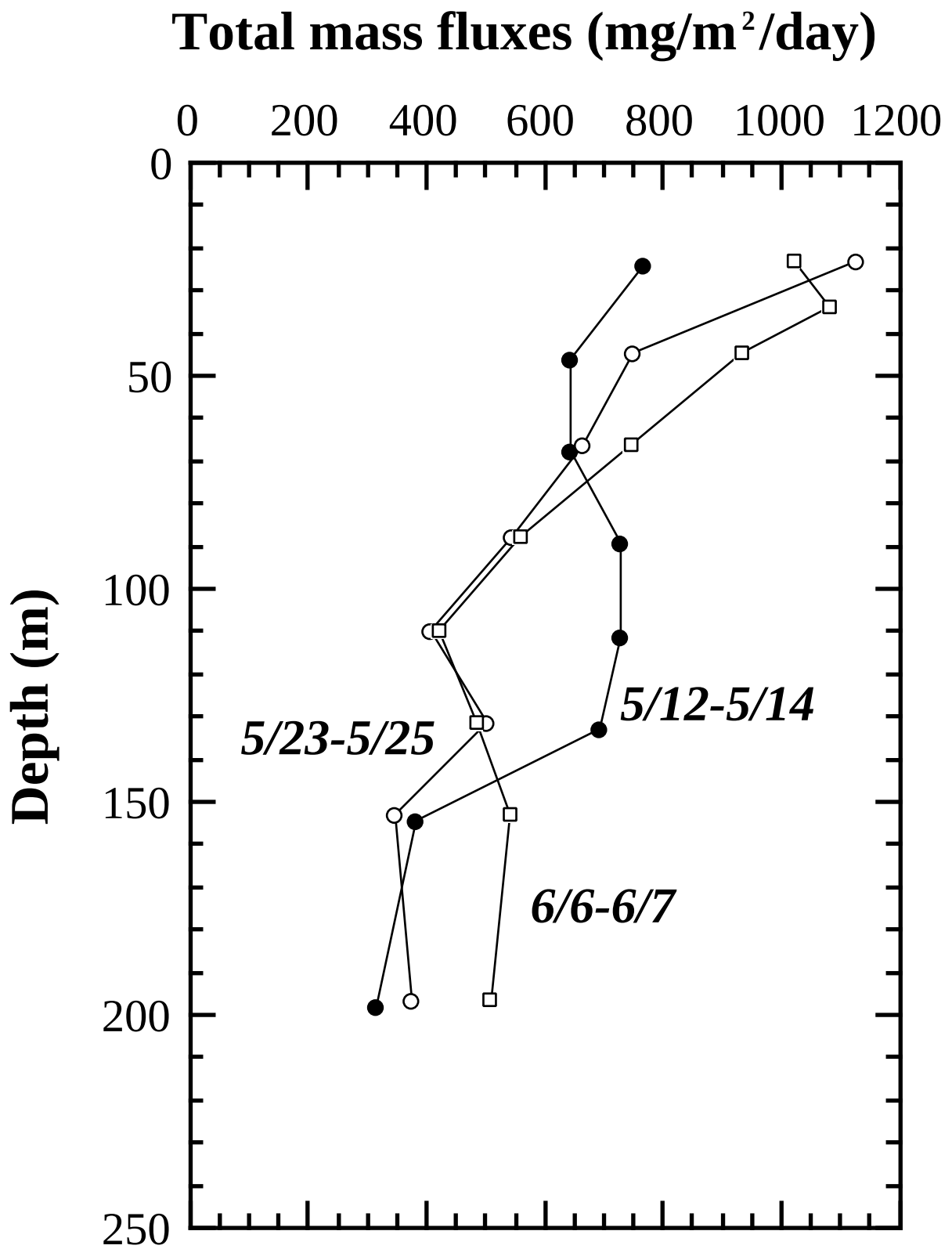


Figure 3.11.2; Preliminary results of total mass fluxes at St. KNOT.

3.12 Bio-optical measurement for Ocean Color Remote Sensing : MER (Multi-wavelength Environmental Radiometers)

Kousei Sasaoka

Faculty of Fisheries, Hokkaido University

(1) Introduction

Subarctic North Pacific Ocean is one of the highest biological productivity regions in the world. The quantitative assessment of phytoplankton production in this region is very important to estimate global primary production. Ocean color remote sensing is very useful as a new tool for monitoring temporal and spatial variability of chlorophyll concentration continuously. However, there are some problems of in-water algorithms for ocean color remote sensing in the subarctic North Pacific. The solar incoming radiation in the subarctic North Pacific shows large seasonal variability by sky conditions. These radiant environments could effect the photosynthetic characteristics of phytoplankton in the waters. The bio-optical algorithms in the high latitude regions were different from the general algorithms (Mitchell, 1992). Then, the new bio-optical algorithms for the high latitude regions need to be developed as soon as possible.

The objective of this study is to validate and to develop bio-optical algorithm for new series ocean color sensors, such as Sea-viewing Wide Field-of-view Sensor (SeaWiFS) , Moderate Resolution Imaging Spectroradiometer (MODIS) and Global Imager (GLI) in the subarctic North Pacific Ocean. Therefore, we measured *in situ* bio-optical parameters including upwelled spectral radiance, downwelled spectral irradiance and PAR (Photosynthetically available radiation) using MER2040/2041.

(2) Methods

The underwater spectral downward irradiance and upward radiance were measured using the underwater unit, MER-2040 (Biospherical Instrument Inc.). The measurements were carried out from the sea surface down to depth 100m depending on the water turbidity. The incident solar spectral irradiance was measured using the deck unit, MER-2041 (Biospherical Instrument Inc.). The measurements were carried out near the satellite overpassing time (about 9:00 A.M. to 13:00 P.M.). Fig.1 shows the map of MER-2040/2041 measurement stations in this cruise. The spectral channels of MER-2040/2041 covered the wavelength of 412, 443, 465, 490, 510, 520, 555, 565, 625,

665, 670, 683 nm and PAR (710nm for upward radiance). These channels were selected for compatible satellite ocean color sensor, Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Global Imager (GLI). Upward and downward PAR (Photosynthetically available radiation) was determined optical depth for the *in-situ* and *in-vitro* primary productivity measurement (CREST group).

In future study, we will calculate normalized water leaving radiance (L_{wn}) and remote sensing reflectance (R_{rs}) using these bio-optical parameters and examine the relationship between in situ measured chl-a values and estimated chl-a values using the several bio-optical algorithm developed by NASA, NASDA and other researchers. We are going to develop the new bio-optical algorithms for the high latitude regions and make high accuracy chl-a image in this region.

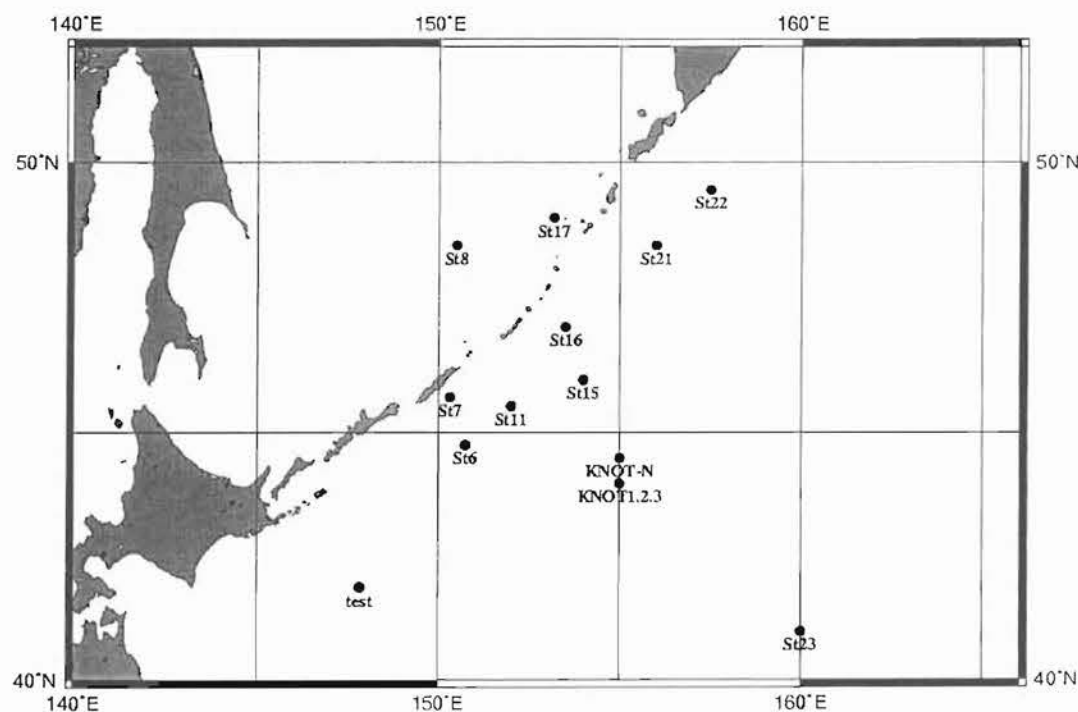


Fig.1 Map of MER observation stations in this cruise

Table 1. The list of MER2040/2041 measurement in this cruise

St.	Date	Time(JST)	Lat.	Long.
Test	5/10	9:53-10:03	41-54.58	147-50.15
KNOT1	5/11	13:28-13:36	44-00	155-0.1
KNOT-N	5/11	15:41-15:52	44-29.9	155-00
St.6	5/15	12:07-12:16	44-44.8	150-44.9
St.7	5/16	8:35-8:43	45-39.8	150-19.7
St.8	5/17	9:14-9:22	48-29.9	150-30.22
St.11	5/19	12:02-12:10	45-33.1	152-12.0
KNOT2	5/23	15:11-15:18	44-00	155-00
KNOT2	5/24	11:25-11:32	44-01.5	154-56.7
St.23	5/27	15:50-15:59	41-06.47	159-58.5
St.17	5/31	13:35-13:41	49-00	156-10.0
St.22	6/1	17:28-17:37	49-05.0	157-54.9
St.21	6/2	11:17-11:27	48-30	155-59.8
St.16	6/4	11:13-11:21	46-45	153-37.0
St.15	6/4	16:53-17:01	46-00	154-00
KNOT3	6/6	10:02-10:10	43-59.7	154-59.3

3.13 Satellite observation

Kousei Sasaoka

Faculty of Fisheries, Hokkaido University

(1) Introduction

The Subarctic North Pacific is well known as one of the highest biological productivity region in the world. Understanding the role of biological pump in the ocean and monitoring variability of the chlorophyll *a* (Chl-*a*) distribution is very important to clarify the geochemical cycles.

Our objectives of this study are, to grasp the temporal and spatial variability of chl-*a* distribution in the Subarctic northwestern Pacific, and to understand the mechanisms of chl-*a* distribution. We can receive the satellite data on board including ocean color (Orbview2/SeaWiFS), sea surface temperature(SST) (NOAA/AVHRR). Ocean color and SST images are applied to study interannual variability of primary productivity and front dynamics.

(2) Method

Temporal and spatial distribution of Chl-*a* and SST in this cruise area were analyzed using the Orbview2 Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and NOAA Advanced Very High Resolution Radiometer (AVHRR) data. Both data were received on board using TaraScan HRPT Receiving System developed by SeaSpace Inc. SST(AVHRR) data(Noaa-12, 14, 15) was received about 10 times a day and SeaWiFS data was one or two a day. AVHRR data were processed with the TeraScan software package developed by SeaSpace Inc. SeaWiFS data were transferred from TaraScan HRPT format to HDF format, then processed with the SeaDAS_Ver3.3 software package developed by NASA (<http://seadas.gsfc.nasa.gov/>).

(3) Product

AVHRR: Daily composite images, Raw data (TeraScan Format)

SeaWiFS: HRPT LAC(Local Area Coverage) daily data(HDF format)

(4) Data storage

Media: 4mm DAT (DDS-2)

Place: JAMSTEC and Dr. Asanuma (EORC NASDA(Earth Observation Research Center, National Space Development Agency of Japan))

3.14 Plankton

Keiri Imai (Japan Science and Technology Corporation)

Yukihiro Nojiri (National Institute for Environmental Studies)

Tamotsu Takemitsu (Hokkaido University)

Introduction

To estimate the biomass of phytoplankton and zooplankton community be necessary to define starting point of planktonic food webs. Seasonal values of plankton species and number did not have been made clear. Therefore collecting plankton samples in this cruise, spring ocean are importance. On the other hand, we can fine the biomass of phytoplankton using the pigments of phytoplankton and the particle organic carbon(POC), and the value measured by HPLC can guess more small size plankton community than with microscopy.

Plankton samples

Plankton samples were gathered by the seawater and the plankton net sampling. Phyto- and microzooplankton community were obtained in the seawater collected from 12 layer(5, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200m depth) by niskin sampler attached to CTD-RMS and the surface water was collected using plastic bucket. Those samples after draining into sample bottles were fixed immediately using formalin(final conc. 1%), PFA(final conc. 1%) and rugol eosin(final conc. 3%). After this cruise the samples fixed using formalin and rugol eosin will be carried out sorting and numbering with optical microscope, and the samples fixed using PFA will be carried out numbering by flow cytometry. Wire out of single(NXX7; ca. 200um mesh size) and twin(XX13 and GG54; ca. 0.1 and 0.33mm mesh size) Norpac net were respectively 200m depth and 150,500m. And vertical closing net(Gamaguthi-net) was used making vertical hauls in 5 layers(0-50m, 50-250m, 250-500m, 500-1000m, 1000-1500m). These plankton net samples were fixed immediately by formalin(final conc. 5%), and will be counted cell number with microscope after this cruise. Sample collection data and station and sampling depth are as follows.

Table Plankton net sample collection data and station and sampling depth

Net	Station	date	Sampling time	Wire out(m)	Wire angle
NORPAC net(singl)	KNOT1	5/12	13:37	200(+8)	16
	KNOT1	5/13	2:31	200(+0)	2
	st.6	5/15	12:53	200(+2)	9
	KNOT2	5/23	10:42	200(+1)	6
	KNOT2	5/24	0:37	200(+2)	9
	st.22	6/1	18:09	200(+17)	23
	st.15	6/4	17:38	200(+0.6)	3
	KNOT3	6/6	0:32	200(+0)	5
	KNOT3	6/6	9:50	200(+5.3)	13
NORPAC net(twin)	KNOT1	5/12	13:00	500(+2)	7
	KNOT1	5/12	13:26	150(+0)	3
	KNOT1	5/13	1:57	500(+0)	5
	KNOT1	5/13	2:20	150(+0)	5
	st.5	5/15	2:07	500(+0)	1
	st.5	5/15	2:33	150(+0)	9
	st.6	5/15	12:20	500(+0)	1
	st.6	5/15	12:42	150(+2)	10
	st.7-1	5/16	7:55	500(+0)	2
	st.7-1	5/16	8:22	150(+0)	4
	st.8	5/17	8:39	500(+6)	9
	st.8	5/17	9:05	150(+0)	4
	st.9	5/17	16:55	500(+26)	19
	st.9	5/17	17:19	150(+0)	4
	st.11	5/19	12:13	500(+39)	22
	st.11	5/19	12:37	150(+8)	18
	st.12	5/20	11:24	500(+4)	5
	st.12	5/20	11:48	150(+0)	6
	st.13	5/22	12:02	500(+21)	16
	st.13	5/22	12:24	150(+0)	3
	KNOT2	5/23	10:11	500(+1)	4
	KNOT2	5/23	10:33	150(+0)	6
	KNOT2	5/24	0:01	500(+26)	18
	KNOT2	5/24	0:27	150(+0)	4
	st.18	5/30	18:37	500(+56)	26
	st.18	5/30	19:03	150(+2.6)	9
	st.17	5/31	13:44	500(+2.4)	5
	st.17	5/31	14:06	150(+0.5)	3
	st.19	6/1	2:56	500(+0)	2
	st.19	6/1	3:21	150(+0.7)	3
	st.22	6/1	17:44	500(+56)	26
	st.22	6/1	18:18	150(+21)	29
	st.21	6/2	11:29	500(+8.9)	9
	st.21	6/2	11:58	150(+2.1)	9
	st.16	6/4	11:24	500(+6.8)	9
	st.16	6/4	11:47	150(+0.5)	5
	st.15	6/4	17:07	500(+11)	12
	st.15	6/4	17:30	150(+0.9)	6
	KNOT3	6/5	23:56	500(+11)	12
	KNOT3	6/6	0:21	150(+2.4)	10
	KNOT3	6/6	9:19	500(+6.0)	8
	KNOT3	6/6	9:42	150(+1.4)	3
Closing net	KNOT1	5/12	14:00	1500(+8)	7
	KNOT1	5/12	15:05	1000(+10)	8
	KNOT1	5/12	15:41	500(+8)	9
	KNOT1	5/12	16:04	250(+4)	9
	KNOT1	5/12	16:16	29(+0)	-

Phytoplankton pigments

Chlorophyll *a* and pigments separated by HPLC are measured for comparison with phytoplankton species and number. The seawater subsamples for Phytoplankton pigments collected from 12 layer(0, 10, 20, 30, 40, 50, 60, 80, 100, 125, 150, 200m) by niskin sampler attached to CTD-RMS at same stations as primary production experiments. Chlorophyll *a* samples were carried out size fraction with nuclepore filter(pore size 10, 2um) and grass fiber filter (Whatman GF/F). These Chlorophyll *a* samples will be measured with Turner.

Particle organic carbon (POC)

The stock of particle organic carbon (POC) in euphotic layer is related to the consequences of biogeochemical processes. Therefore In this cruise it is very important to estimate vertical distribution of POC. Water samples were collected with 30L rosette samplers from 13 layers (5,10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 250, 300 and 500m) at the stations of KNOT1, KNOT2, and KNOT3. Particle matter of subsamples was filtered onto precombusted (450°C, 4h) grass fiber filter (Whatman GF/F). A filter after filtration was rinsed with particle free salt water and stored frozen (-20 °C) until analysis.

3.15 Sediments

Naomi Harada, Toshiya Kanamatsu, Katsunori Kimoto (JAMSTEC)

Hisashi Narita, Masahito Shigemitsu (Hokkaido Univ.)

Sayuki Koyama (Toyama Univ.)

Toshikatsu Sugawara, Hiroaki Muraki, Aya Kato, Kazue Matsuo, Yutaka Matsuura (Marine Works Japan Ltd.)

3.15.1. Objectives

Main objective of sediment coring in this cruise (MR00-K03) is to understand the past environmental change in the north western North Pacific and the Okhotsk Sea throughout the late Quaternary period (ca 150,000yr) as follows; (1) the sea surface temperature, (2) the paleo flux of biogenic particles, (3) deep-water circulation, (4) paleo distribution of nutrients in the deep-water, (5) how far the terrigenous materials and ice rafted debris (IRD) were transported from the Okhotsk coast to the Okhotsk Sea and the Pacific, (6) how much amount of terrigenous materials and IRD were transported. Furthermore, paleomagnetic study is carried out to determine the geological age and the magnetic field reversal events.

3.15.2. Coring equipment

(1) Multiple core sampler

A Multiple core sampler produced by Rigosha Co. was used for taking the surface sediment. This core sampler consists of a main body of 620kg-weight and 8 sub-core samplers (I.D. 73mm and length of 60cm).

(2) 20m-long piston core sampler

Piston core sampler consists of a 1500kg-weight, a total 20m-long duralumin pipe (5m x 4), and a pilot core sampler. The inner diameter of pipe is 80mm. We used a multiple core sampler “Ashura” equipped with an 80kg-weight and three sub-cores of 60cm in length and 73mm I.D. for a pilot core sampler.

(3) Site survey

Site survey is very significant to determine the coring position. The site survey was carried out with the 12kHz SEA BEAM 2100 Multibeam Bathymetric Survey System in order to take a sea-bottom topographic. Survey area at every site will be a quadrilateral in the range of about 30 minutes.

(4) Positioning System

Global positioning system (GPS) of WGS84 were used to determine a geographic position.

3.15.3. Sampling Location

Total four piston and four multiple cores were obtained in the northwestern Pacific and Okhotsk Sea (Table 1 and Figs.1 to 4). The MC-01 was collected at the southwestern off the Kulzenshutana Strait (45° 52.77'N, 151° 33.15'E, water depth

1121m). The PC-01 and the MC-02 were collected at southeastern off the Kulzenshutana Strait (46° 18.65'N, 152° 32.16'E, water depth 2796m). The PG-02, PC-03 and the MC-03 were collected at the northeastern area of Kuril Basin (48° 15.00'N, 151° 59.95'E, water depth 3244m, 48° 15.00'N, 151° 59.89'E, water depth 3244m, 48° 14.96'N, 151° 59.94'E, water depth 3245m, respectively). The PG-04 and the MC-04 were collected at the western off the Kamchatka peninsula (49° 22.03'N, 153° 00.63'E, water depth 1821m, 49° 22.02'N, 153° 00.64'E, water depth 1822m, respectively).

3.15.4. Sampling Procedures

The multiple core was sliced in 1 or 2 cm each which depended on researcher.

The piston core tube was marked and the sediment sample was cut into 1m in length each with a rotary hand saw. The 1m-long sediment section was pushed out with a core pusher. The edge of each section was capped with a urethane board, then marked with colored tapes, white to identify the top of section and red for the bottom.

After carrying the sections into the laboratory, whole-round sections were measured the length and run through the multisensor core logger (MSCL). The MSCL includes the gamma-ray attenuation porosity evaluator (GRAPE), the P-wave logger, and a volume magnetic susceptibility meter. After the MSCL analysis, each section was split lengthwise into working and archive halves with a stainless wire. After splitting, working and archive halves of each section was designated and the length of the core in each section and the core-catcher sample were measured to the nearest centimeter again.

Archive halves of cores were first scraped across to expose a smooth, fresh surface, then were described visually. Visual core description summarized in the visual core description forms with core color in standard Munsell notation. This analysis was followed by the determination of the archive halves using Minolta CM-2002 color refractometer. The cores were photographed with a color film, a whole core at a time. Close-up photographs were taken of particular features. After that process, slab samples of 1cm thick were taken for soft X-ray analysis using a plastic case of 20 cm-long and 3cm-wide. The sub-sample photographed by soft X-ray is going to store as archives. Then half of archive core was sub-sampled for organic geochemical analysis such as total carbon, organic carbon, total nitrogen, alkenone, sterol, hydrocarbon, and fatty acid by using glass bottle. Stable carbon isotopes ratio and ^{14}C age of molecular level of some organic compounds are also going to be analyzed. After this process, archive halves of the samples were placed into plastic bags, and then its inside air was replaced with Ar gas and sealed. The archive halves were transferred to cold storage aboard the R/V MIRAI. After the cruise finished, the archive halves are going to be stored at JAMSTEC under 4 °C.

The working halves of the core were continuously sub-sampled for future analysis (see chapter 3.17.9). The sub-sample for water content analysis was taken 2cm each using plastic containers of 22.5mm x 22.5mm x 22.5mm (ca.7cc). These plastic cube samples were also used for microfossil assemblage analysis such as planktonic foraminifera and benthic foraminifera, $\delta^{18}\text{O}$, ^{14}C , and trace metal (Cd/Ca,

Mg/Ca) analyses of microfossil. The sediment materials were completely sub-sampled for biogenic silica analysis, radio and stable isotope analysis (C, U, Th, Pa, Po, Pb etc.), particle size distribution analysis of terrigenous materials using plastic bag, and magnetic analysis using U-channel containers (20mm x 20mm x 1000mm).

3.15.5 Visual Core Descriptions

Katsunori Kimoto (Ocean Research Dept., JAMSTEC)

Total 4 multiple cores and 4 piston cores were obtained from the continental slope, Off Kuril Islands and Kuril Basin in the Sea of Okhotsk, the northwestern Pacific. Visual core description was executed to represent lithologic features, components, and sedimentary stratigraphy. For the piston corer samples, working half was used for visual core description. For multiple corer samples, the longest core, which was recovered in one cast, was used. Schematic illustrations of visual core description of all cores are shown in Appendix 2.

Station 10

MC-01: Multiple core MC-01, 6.5 cm long, is composed mainly of medium sand. Dark gray colored pumice grains and well-rounded sandstone, up to 2-cm size are scattered through this core. Sandy silt is included at 5.5 to 6.5 cmbsf (centimeter below sea floor). Some biological sand pipes are identified at the core top.

Station 15

PC-01: Piston core PC-01, 865.9 cm long, is composed chiefly of dark olive colored homogeneous diatomaceous silt. At the core top, oxygenated layer is lost. Scattered medium grain pumiceous sand, is observed through this core. Lenticular grayish colored tuff zone, is observed at 334.5 cmbsf, middle part of Sec.4. Four pumiceous sand, 4 to 10 cm thickness, are intercalated below Sec. 6-7. Slightly to moderately biogenic disturbance is developed through this core.

MC-02: Multiple core MC-02 HAND 2, 27.5 cm long, is composed mainly dark olive (7.5Y3/2) colored diatomaceous silty clay with sandy silt.

Oxygenated layer is identified at 0 to 5 cmbsf. Foraminifera bearing fine sand layer, 2 cm thickness, occurs at 13 ~ 15 cmbsf. Slightly biogenic disturbance occurs at the whole sections. Shell fragment is identified at 26 cmbsf.

Station 18

PC-02, PC-03: Cores PC-02 and PC-03, 482.5 cm and 461.5 cm long respectively, are composed of grayish olive (7.5Y4/2) foraminifera-bearing diatomaceous clay and very fine sand layer. Especially Sec 1 and 2 are composed of purely diatomaceous clay. Flow-in sediment (mainly composed of fine sand) occurs probably below Sec. 5.

MC-03: Core MC-03 HAND 7, 38.5 cm long, is composed of olive black (5Y 3/2) colored homogeneous diatomaceous dull clay. Brownish black ~ black (10YR2/2 ~ 10YR17/1) colored oxygenated layer occurs at the top ~ 5 cmbsf. Moderate bioturbation is developed in whole depth. Isolated pumice is identified at

29 and 36 cmbsf. Core bottom (2-mm thickness) is slightly disturbed by coring operation.

Station 17

PC-04: Core PC-04, 2060.0 cm long, is composed chiefly of olive black (7.5Y3/2) colored homogeneous Diatomaceous Silt. At the core top – 50 cm in core depth, it contains grayish olive (5Y4/2) diatom-rich layer. Biogenic disturbance is weakly developed at the whole sections. A few foraminifera are included. Scattered pumice (3 mm ~ 3 cm in size) occurs through this core. Well-rounded pebble (probably basaltic rock) is identified in whole depth. Faintly laminated coarse – fine sand layers are identified at Sec. 1, 4-5, and 16 – 18.

MC-04: Core MC-04 HAND 4, 39.0 cm long, is composed of olive black (7.5Y3/2) colored homogeneous diatomaceous dull silt with very fine sand. Oxygenated layer is identified at ~ 1 cmbsf. Silt ~ very fine sand is observed in the whole length. Biogenic disturbance is weakly developed below about 20 cmbsf.

3.15.6 Color reflectance

(Aya Kato, Toshikatsu Sugawara, Marine Works Japan Ltd.,
and Naomi Harada, JAMSTEC)

Color reflectance was measured by using the Minolta Photospectrometer CM-2002. This is a compact and hand-held instrument, and can measure the spectral reflectance of surface sediment with a scope of 8 mm in diameter. High-speed and accuracy measurements of spectral reflectance in the range from 400 to 700 nm can be obtained by ultracompact spectral sensors, hybrid IC analog circuitry, and a 32-bit, 16-MHz microcomputer. To ensure accuracy, the CM-2002 uses a double-beam feedback system, monitoring the illumination on the specimen at the time of measurement and automatically compensating for any changes in the intensity or spectral distribution of the light.

Calibration was carried out with the zero and white calibration pieces (Minolta CM-2002 standard accessories) before the measurement of core samples. The color of working half core was measured on every 1 or 2-cm through crystal clear polyethylene wrap.

The color reflectance data are indicated as color parameters of L*, a*, and b* (L*: black and white, a*: red and green, b*: yellow and blue). Additionally, the Munsell colors (H: hue, V: value, C: chroma) and spectral data were also obtained. Spectral data can be used to estimate the abundance of certain compounds.

Results

For MC-01 multiple core, L*, a*, and b* changed in the range from 37 to 41, from 0.4 to 0.8, and from 1.5 to 3, respectively (see Fig. 5 and the chapter of 3.17.5 Visual core descriptions).

For PC-01 piston core and MC-02, L*, a*, and b* ranged from 30 to 55, from -2 to 0.5, and from 0.2 to 11.8, respectively (Fig. 6). The highest L* value, 55, was found at the depth of 3.3m and corresponded with the relatively high gamma density peak. The profiles of three parameters indicate relatively small fluctuation

throughout the whole core compared with those of the PC-02, 03 and 04.

L^* , a^* , and b^* of PC-02, 03 and MC-03 varied from 24 to 45, from -2 to 3.7, and 2 to 14, respectively (Figs.7 and 8). Variation pattern of vertical profiles between PC-02 and 03 were very similar for each color parameter. The change of L^* profile corresponded to that of the b^* , but was opposite trend of the a^* profile. The L^* indicated relatively low value (less than 30) at the depths of 0.8, 2.3, 4.4m. It seems likely that the low value of L^* occurred cyclic.

L^* , a^* , and b^* of PC-04 and MC-04 changed in the range from 30 to 44, from -3 to 0.8, and from 4 to 12.5, respectively (Fig. 9). There was no correlated variation trend among L^* , a^* , and b^* profiles.

3.15.7 Multi sensor core logging

Hiroaki Muraki, Kazue Matsuo, Toshikatsu Sugawara (Marine Works Japan Ltd.),
Sayuki Koyama (Toyama University), and Toshiya Kanamatsu (JAMSTEC)

Gamma-ray attenuation (GRA) and magnetic susceptibility (MS) were measured on whole-core section before splitting using the onboard GEOTEK multisensor core logger (MSCL). The MSCL have three sensors, which is gamma-ray attenuation, P-wave velocity (PWV), and magnetic susceptibility. However, PWV could not be measured, because there was always gap between the core liner and the core, which prevents PWV sensor transfer through the core.

The principle of GRA is based on the facts that medium-energy gamma rays (0.1- 1 MeV) interact with the formation material mainly by Compton scattering, that the elements of most rock-forming minerals have similar Compton mass attenuation coefficients, and that the electron density measured can easily be related to the material bulk density. The ^{137}Ce source used transmits gamma rays at 660 KeV. A standard NaI scintillation detector is used in conjunction with a universal counter. GRA calibration assumes a two-phase system model for sediments and rocks, where the two phases are the minerals and the interstitial water. Aluminum has an attenuation coefficient similar to common minerals and is used as the mineral phase standard. Pure water is used as the interstitial-water phase standard. The actual standard consists of a telescoping aluminum rod (five elements of varying thickness) mounted in a piece of core liner and filled with distilled water. GRA measurement was carried on every 1 or 2-cm whole-core with 10 seconds counting. GRA data provide wet bulk density and fractional porosity for core thickness is constant (multiple core: 74mm, piston core: 80mm).

MS was measured using Bartington MS2C system within the MSCL. The main unit is the widely used, versatile MS2 susceptometer for rapid measurements with a number of sensors. The unit has a measuring range of 1×10^{-5} to 9999×10^{-5} (SI, volume specific). It has five front panel controls: on-off switch, sensitivity range switch, SI or cgs unit switch, zero button, measure button, and continuous measurement switch. The unit switch should always be on SI. This loop sensor has an internal diameter of 100 mm. It operates at a frequency of 0.565 kHz and an alternating field (AF) intensity of 80 A/m (= 0.1 mT). MS data measurement was carried on every 1 or 2-cm whole-core with 1 second. MS data is used mostly as a relative proxy indicator for changes in composition that can be linked to paleoclimatic

controlled depositional processes.

General Results

Raw data of magnetic susceptibility and gamma ray attenuation are generally inversely correlated, and thus volumetric magnetic susceptibility and gamma bulk density are directly correlated to each other. Such patterns of profiles imply that high bulk density (low gamma ray attenuation) intervals are associated with high content of magnetic materials. From the core top to several ten-cm downward, drastic increasing of gamma density and magnetic susceptibility are generally observed due to quick decreasing of water contents. These pattern are recognized not only PC core but MC core. It is important information to construct composite a profile of MC and PC cores

PC-01 and MC-02 (Figs 10 and 11)

Most peaks and troughs of magnetic susceptibility correlative with that of gamma density. Several unique patterns, however, occurs in PC-1. For example, small susceptibility peaks at about 7.6 m in depth is correlated to prominent trough in the gamma ray attenuation variation. The peak corresponds to a pumiceous layer identified by visual core descriptions. Pumiceous fragment of porous texture and high contents of magnetic minerals might cause such a pattern. In the case of a glassy ash layer at the depth of 3.3 m, different pattern showing high density and low magnetic susceptibility is recognized.

PC-02, PC-03 and MC-02 (Figs 12, 13, 14 and 15)

Profiles of PC-2 and 3 show same variations in the interval up to 5 m. Both cores include three distinctive sand layers. The layers show sharp spike in magnetic susceptibility and gamma density. Magnetic susceptibility spikes show more than ten times of background value, and also grain density several times. In the second sand layer of PC-02, Spike of magnetic susceptibility in the interval of 2.5 show unique pattern, which is a sharp increasing at the bottom, and gradual decreasing in the top of the spike. This pattern suggests that the sand layer was derived by a turbidite. Visual inspection also identifies upward grading structure in this horizon.

PC-04 and MC-03 (Figs 16 and 17)

Peaks and troughs of magnetic susceptibility show good correlation with that of gamma density. These pattern of profiles imply that high bulk density (low gamma ray attenuation) intervals are associated with high content of magnetic materials. Although no large spikes in the profile such as PC-01 and 02, changes in magnetic susceptibility and gamma density show a periodical pattern.

3.15.8 Soft X-ray photographs analysis

Yutaka Matsuura and Toshikatsu Sugawara (Marine Works Japan Ltd.)

Soft X-ray photographs analysis system (Soft X), PRO-TEST 150 (SOFTEX), was used to observe the structure of sediment samples.

Sediment samples were picked up from cores using original plastic cases

(200x30x7mm). X-ray photographs of samples through the plastic cased were taken in a standard power (50kVp, 3mA, in 200 seconds). In this cruise, total 198 samples were photographed in 41 nega-films. The developer is equipped on this ship, photographed films were developed on board.

3.15.9. Future analysis

(1) Index of physical properties

Dry bulk density and water content are planning to be measured by a penta picno meter at JAMSTEC. The subsamples in U-channel containers are planning to be measured for magnetic properties by Drs. Kanamatsu and Koyama at JAMSTEC and Toyama Univ.

(2) Index of chemical properties

Total carbon, organic carbon and total nitrogen are planning to be measured by Drs. Harada and Uchida at JAMSTEC. Inorganic carbon is estimated by subtraction of the organic carbon content from the total carbon content.

(3) Others

The others are planning to be analyzed as follows;

1) ^{14}C dating, $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ of planktonic foraminifera, Cd/Ca, Ba/Ca ratio of benthic foraminifera for the reconstruction of paleo-nutrient distribution, Mg/Ca, Sr/Ca ratio of planktonic and benthic foraminifera, hydrocarbon, alkenone, and fatty acid analysis, ^{14}C age of organic compound molecules (by Drs. Ahagon, Kimoto, Harada, and Uchida at JAMSTEC)

2) Silicate and biogenic silica, radio isotopes (U, Th, Pa, Po, Pb etc.), component analysis of terrigenous materials, and analysis of particle size (by Drs Narita, Shigemitsu, and Sakamoto at Hokkaido Univ.),

3) Paleo magne, (by Dr. Kanamatsu at JAMSTEC and Ms. Koyama at Toyama Univ.)

Table 1. Summary of cored materials during the Cruise MR00-K03 (R/V Mirai)

Core	Date	Hit time (JST)	Equipment	Latitude	Longitude	Water Depth	Cored length excluding follow-in	Core depth below sea floor
						(m)	(cm)	(cmbsf)
MC-01	18-May-00	-	multiple corer	45-52.77'N	151-33.15'E	1121	6.5	0-6.5
MC-02	21-May-00	-	multiple corer	46-18.65'N	152-32.16'E	2796	27.5	0-27.5
MC-03	30-May-00	-	multiple corer	48-14.96'N	151-59.94'E	3245	35.5	0-35.5
MC-04	31-May-00	-	multiple corer	49-22.02'N	153-00.64'E	1822	37	0-37
PC-01	21-May-00	-	piston corer-10m	46-18.61'N	152-32.23'E	2793	865.9	-
PC-02	30-May-00	-	piston corer-20m	48-15.00'N	151-59.95'E	3244	482.5	-
PC-03	30-May-00	-	piston corer-20m	48-15.00'N	151-59.89'E	3244	461.5	-
PC-04	31-May-00	-	piston corer-20m	49-22.03'N	153-00.63'E	1821	2060	-

*The core location (latitude and longitude) is a hitting point of corer.

*Positioning system: WGS84

Table 2 Summary of section length and core depth.

Core	Subcore/ Section	Length (cm)	Core depth (cm)			Cube No	Remarks
			Top		Bottom		
MC-01	Hand1	0	0	-	0		Two small rocks were obtained
MC-01	Hand2	0	0	-	0		
MC-01	Hand3	6.5	0	-	6.5		Toyama Univ. for paleo-magne
MC-01	Hand4	4.2	0	-	4.2		Archive
MC-01	Hand5	6.5	0	-	6.5		Visual description, Hokkaido Univ. for analysis of size distribution of particles
MC-01	Hand6	6.5	0	-	6.5		Hokkaido Univ. for radio isotopes
MC-01	Hand7	5.5	0	-	5.5		Archives
MC-01	Hand8	0	0	-	0		One rock was obtained
MC-02	Hand1	27.4	0	-	27.4		Koyama (Toyama Univ.) for paleo-magne
MC-02	Hand2	27.5	0	-	27.5		Visual description, Kimoto (JAMSTEC) for trace elements analysis of benthic foraminifera
MC-02	Hand3	27	0	-	27		Shigemitsu (Hokkaido Univ.) for radio isotopes
MC-02	Hand4	27.3	0	-	27.3		Harada (JAMSTEC) for organic materials
MC-02	Hand5	25	0	-	25		Sakamoto (Hokkaido Univ.) for size distribution of particles
MC-02	Hand6	26	0	-	26		Ahagon (JAMSTEC) for $\delta^{18}\text{O}$ of planktonic foraminifera
MC-02	Hand7	27.5	0	-	27.5		Uchida (JAMSTEC) for ^{14}C of organic molecules
MC-02	Hand8	27	0	-	27		Uchida (JAMSTEC) for ^{14}C of organic molecules
MC-03	Hand1	33.0	0	-	33		Harada (JAMSTEC)
MC-03	Hand2	31.5	0	-	31.5		Shigemitsu (Hokkaido Univ.)
MC-03	Hand3	33.5	0	-	33.5		Uchida (JAMSTEC)
MC-03	Hand4	31.0	0	-	31		Sakamoto (Hokkaido Univ.)
MC-03	Hand5	33.5	0	-	33.5		Ahagon (JAMSTEC)
MC-03	Hand6	34.0	0	-	34		Koyama (Toyama Univ.)
MC-03	Hand7	35.5	0	-	35.5		Visual description, Kimoto (JAMSTEC)
MC-03	Hand8	33.0	0	-	33		Uchida (JAMSTEC)
MC-04	Hand1	34.5	0	-	34.5		Ahagon (JAMSTEC)
MC-04	Hand2	34.0	0	-	34		Uchida (JAMSTEC)
MC-04	Hand3	36.5	0	-	36.5		Shigemitsu (JAMSTEC)

Core	Subcore/ Section	Length (cm)	Core depth (cm)			Cube No	Remarks
			Top		Bottom		
MC-04	Hand4	37.0	0	-	37		Visual description, Kimoto (JAMSTEC)
MC-04	Hand5	33.0	0	-	33		Harada (JAMSTEC)
MC-04	Hand6	36.0	0	-	36		Koyama (JAMSTEC)
MC-04	Hand7	30	0	-	30		Uchida (JAMSTEC)
MC-04	Hand8	30.5	0	-	30.5		Sakamoto (JAMSTEC)
PC-01	1	79	0	-	79	37	
PC-01	2	98.7	79	-	177.7	45	
PC-01	3	99.2	177.7	-	276.9	45	
PC-01	4	100.5	276.9	-	377.4	45	
PC-01	5	101.5	377.4	-	478.9	46	
PC-01	6	101	478.9	-	579.9	45	
PC-01	7	101.2	579.9	-	681.1	45	
PC-01	8	102.3	681.1	-	783.4	46	Cube No.46 is stuffed only half volume (It means that length of the last cube is 1cm.)
PC-01	9	82.5	783.4	-	865.9	37	
PL-01	Hand1	14.5	0	-	14.5		Pilot core of PC-01 (Ashura)
PL-01	Hand2	15	0	-	15		Pilot core of PC-01
PL-01	Hand3	25	0	-	25		Pilot core of PC-01
PC-02	1	99.2	0	-	99.2	45	
PC-02	2	97.5	99.2	-	196.7	44	
PC-02	3	101.5	196.7	-	298.2	46	
PC-02	4	99.3	298.2	-	397.5	45	
PC-02	5	85.0	397.5	-	482.5	37	
PC-02	6-20						flow in
PC-03	1	106	0	-	106	48	The cube No.48 is 1.5cm.
PC-03	2	99	106	-	205	45	
PC-03	3	100.8	205	-	305.8	46	The cube No.46 is 1.4cm.
PC-03	4	94.7	305.8	-	400.5	43	The cube No.43 is 1.5cm.
PC-03	5	61	400.5	-	461.5	28	The cube No.28 is 1.0cm.
PC-03	6-20						flow in

Core	Subcore/ Section	Length (cm)	Core depth (cm)			Cube No	Remarks
			Top		Bottom		
PC-04	1	104	0	-	104	47	
PC-04	2	105	104	-	209	48	The cube No.48 is 0.8cm.
PC-04	3	107.5	209	-	316.5	48	The cube No.48 is 1.5cm.
PC-04	4	106.5	316.5	-	423	48	
PC-04	5	106.2	423	-	529.2	48	The cube No.48 is 0.17cm.
PC-04	6	103	529.2	-	632.2	46	
PC-04	7	99.5	632.2	-	731.7	45	The cube No.45 is 1.2cm.
PC-04	8	99	731.7	-	830.7	45	The cube No.45 is 0.6cm.
PC-04	9	101	830.7	-	931.7	46	The cube No.46 is 0.4cm.
PC-04	10	99	931.7	-	1030.7	44	
PC-04	11	97.2	1030.7	-	1127.9	44	The cube No.44 is 0.8cm.
PC-04	12	98	1127.9	-	1225.9	44	The cube No.44 is 1.2cm.
PC-04	13	99.3	1225.9	-	1325.2	45	The cube No.45 is 0.7cm.
PC-04	14	99.8	1325.2	-	1425	45	The cube No.45 is 1.2cm.
PC-04	15	100.3	1425	-	1525.3	45	The cube No.45 is 1.8cm.
PC-04	16	102.5	1525.3	-	1627.8	46	The cube No.46 and No.1 are 0.95 and 1.6cm, respectively.
PC-04	17	104	1627.8	-	1731.8	47	The cube No.47 is 1.2cm.
PC-04	18	102	1731.8	-	1833.8	46	The cube No.46 is 1.0cm.
PC-04	19	103	1833.8	-	1936.8	47	The cube No.47 is 0.2cm.
PC-04	20	98.5	1936.8	-	2035.3	44	The cube No.44 is 1.1cm.
PC-04	CC	24.7	2035.3	-	2060	12	The cube No.12 is 0.8cm.

Table 3 Cube depth for PC-01, PC-02, PC-03 and PC-04.

PC-01											
Sec.	Cube No.	Top of Cube (cmbsf)	Center of Cube (cmbsf)								
1	1	0.0	1.1	2	20	121.2	122.3	3	34	251.9	253.1
1	2	2.1	3.2	2	21	123.4	124.5	3	35	254.2	255.3
1	3	4.3	5.3	2	22	125.6	126.7	3	36	256.4	257.6
1	4	6.4	7.5	2	23	127.8	129.0	3	37	258.7	259.8
1	5	8.5	9.6	2	24	130.1	131.2	3	38	260.9	262.1
1	6	10.7	11.7	2	25	132.3	133.4	3	39	263.2	264.3
1	7	12.8	13.9	2	26	134.5	135.6	3	40	265.4	266.6
1	8	14.9	16.0	2	27	136.7	137.8	3	41	267.7	268.8
1	9	17.1	18.1	2	28	139.0	140.1	3	42	269.9	271.1
1	10	19.2	20.3	2	29	141.2	142.3	3	43	272.2	273.3
1	11	21.4	22.4	2	30	143.4	144.5	3	44	274.4	275.6
1	12	23.5	24.6	2	31	145.6	146.7	3	45	276.7	276.8
1	13	25.6	26.7	2	32	147.8	148.9	4	1	276.9	278.0
1	14	27.8	28.8	2	33	150.1	151.2	4	2	279.2	280.3
1	15	29.9	31.0	2	34	152.3	153.4	4	3	281.4	282.6
1	16	32.0	33.1	2	35	154.5	155.6	4	4	283.7	284.8
1	17	34.2	35.2	2	36	156.7	157.8	4	5	285.9	287.1
1	18	36.3	37.4	2	37	158.9	160.0	4	6	288.2	289.3
1	19	38.4	39.5	2	38	161.2	162.3	4	7	290.5	291.6
1	20	40.6	41.6	2	39	163.4	164.5	4	8	292.7	293.9
1	21	42.7	43.8	2	40	165.6	166.7	4	9	295.0	296.1
1	22	44.8	45.9	2	41	167.8	168.9	4	10	297.3	298.4
1	23	47.0	48.0	2	42	170.0	171.1	4	11	299.5	300.6
1	24	49.1	50.2	2	43	172.3	173.4	4	12	301.8	302.9
1	25	51.2	52.3	2	44	174.5	175.6	4	13	304.0	305.2
1	26	53.4	54.4	2	45	176.7	177.2	4	14	306.3	307.4
1	27	55.5	56.6	3	1	177.7	178.8	4	15	308.6	309.7
1	28	57.6	58.7	3	2	179.9	181.1	4	16	310.8	312.0
1	29	59.8	60.9	3	3	182.2	183.3	4	17	313.1	314.2
1	30	61.9	63.0	3	4	184.4	185.6	4	18	315.3	316.5
1	31	64.1	65.1	3	5	186.7	187.8	4	19	317.6	318.7
1	32	66.2	67.3	3	6	188.9	190.1	4	20	319.9	321.0
1	33	68.3	69.4	3	7	191.2	192.3	4	21	322.1	323.3
1	34	70.5	71.5	3	8	193.4	194.6	4	22	324.4	325.5
1	35	72.6	73.7	3	9	195.7	196.8	4	23	326.6	327.8
1	36	74.7	75.8	3	10	197.9	199.1	4	24	328.9	330.0
1	37	76.9	77.9	3	11	200.2	201.3	4	25	331.2	332.3
2	1	79.0	80.1	3	12	202.4	203.6	4	26	333.4	334.6
2	2	81.2	82.3	3	13	204.7	205.8	4	27	335.7	336.8
2	3	83.4	84.6	3	14	206.9	208.1	4	28	338.0	339.1
2	4	85.7	86.8	3	15	209.2	210.3	4	29	340.2	341.3
2	5	87.9	89.0	3	16	211.4	212.6	4	30	342.5	343.6
2	6	90.1	91.2	3	17	213.7	214.8	4	31	344.7	345.9
2	7	92.3	93.4	3	18	215.9	217.1	4	32	347.0	348.1
2	8	94.5	95.7	3	19	218.2	219.3	4	33	349.3	350.4
2	9	96.8	97.9	3	20	220.4	221.6	4	34	351.5	352.7
2	10	99.0	100.1	3	21	222.7	223.8	4	35	353.8	354.9
2	11	101.2	102.3	3	22	224.9	226.1	4	36	356.0	357.2
2	12	103.4	104.5	3	23	227.2	228.3	4	37	358.3	359.4
2	13	105.6	106.8	3	24	229.4	230.6	4	38	360.6	361.7
2	14	107.9	109.0	3	25	231.7	232.8	4	39	362.8	364.0
2	15	110.1	111.2	3	26	233.9	235.1	4	40	365.1	366.2
2	16	112.3	113.4	3	27	236.2	237.3	4	41	367.4	368.5
2	17	114.5	115.6	3	28	238.4	239.6	4	42	369.6	370.7
2	18	116.7	117.9	3	29	240.7	241.8	4	43	371.9	373.0
2	19	119.0	120.1	3	30	242.9	244.1	4	44	374.1	375.3
				3	31	245.2	246.3	4	45	376.4	376.9
				3	32	247.4	248.6	5	1	377.4	378.5
				3	33	249.7	250.8	5	2	379.6	380.8

Table 3

5	3	381.9	383.0
5	4	384.1	385.2
5	5	386.4	387.5
5	6	388.6	389.7
5	7	390.9	392.0
5	8	393.1	394.2
5	9	395.3	396.5
5	10	397.6	398.7
5	11	399.8	400.9
5	12	402.1	403.2
5	13	404.3	405.4
5	14	406.5	407.7
5	15	408.8	409.9
5	16	411.0	412.2
5	17	413.3	414.4
5	18	415.5	416.6
5	19	417.8	418.9
5	20	420.0	421.1
5	21	422.2	423.4
5	22	424.5	425.6
5	23	426.7	427.8
5	24	429.0	430.1
5	25	431.2	432.3
5	26	433.5	434.6
5	27	435.7	436.8
5	28	437.9	439.1
5	29	440.2	441.3
5	30	442.4	443.5
5	31	444.7	445.8
5	32	446.9	448.0
5	33	449.2	450.3
5	34	451.4	452.5
5	35	453.6	454.8
5	36	455.9	457.0
5	37	458.1	459.2
5	38	460.4	461.5
5	39	462.6	463.7
5	40	464.8	466.0
5	41	467.1	468.2
5	42	469.3	470.5
5	43	471.6	472.7
5	44	473.8	474.9
5	45	476.1	477.2
5	46	478.3	478.6
6	1	478.9	480.0
6	2	481.1	482.3
6	3	483.4	484.5
6	4	485.6	486.8
6	5	487.9	489.0
6	6	490.1	491.2
6	7	492.4	493.5
6	8	494.6	495.7
6	9	496.9	498.0
6	10	499.1	500.2
6	11	501.3	502.5
6	12	503.6	504.7
6	13	505.8	507.0
6	14	508.1	509.2
6	15	510.3	511.4
6	16	512.6	513.7
6	17	514.8	515.9

6	18	517.1	518.2
6	19	519.3	520.4
6	20	521.5	522.7
6	21	523.8	524.9
6	22	526.0	527.2
6	23	528.3	529.4
6	24	530.5	531.6
6	25	532.8	533.9
6	26	535.0	536.1
6	27	537.3	538.4
6	28	539.5	540.6
6	29	541.7	542.9
6	30	544.0	545.1
6	31	546.2	547.4
6	32	548.5	549.6
6	33	550.7	551.8
6	34	553.0	554.1
6	35	555.2	556.3
6	36	557.5	558.6
6	37	559.7	560.8
6	38	561.9	563.1
6	39	564.2	565.3
6	40	566.4	567.6
6	41	568.7	569.8
6	42	570.9	572.0
6	43	573.2	574.3
6	44	575.4	576.5
6	45	577.7	578.8
7	1	579.9	581.0
7	2	582.1	583.3
7	3	584.4	585.5
7	4	586.6	587.8
7	5	588.9	590.0
7	6	591.1	592.3
7	7	593.4	594.5
7	8	595.6	596.8
7	9	597.9	599.0
7	10	600.1	601.3
7	11	602.4	603.5
7	12	604.6	605.8
7	13	606.9	608.0
7	14	609.1	610.3
7	15	611.4	612.5
7	16	613.6	614.8
7	17	615.9	617.0
7	18	618.1	619.3
7	19	620.4	621.5
7	20	622.6	623.8
7	21	624.9	626.0
7	22	627.1	628.3
7	23	629.4	630.5
7	24	631.6	632.7
7	25	633.9	635.0
7	26	636.1	637.2
7	27	638.4	639.5
7	28	640.6	641.7
7	29	642.9	644.0
7	30	645.1	646.2
7	31	647.4	648.5
7	32	649.6	650.7
7	33	651.9	653.0

7	34	654.1	655.2
7	35	656.4	657.5
7	36	658.6	659.7
7	37	660.9	662.0
7	38	663.1	664.2
7	39	665.4	666.5
7	40	667.6	668.7
7	41	669.9	671.0
7	42	672.1	673.2
7	43	674.4	675.5
7	44	676.6	677.7
7	45	678.9	680.0
8	1	681.1	682.2
8	2	683.4	684.5
8	3	685.6	686.7
8	4	687.9	689.0
8	5	690.1	691.2
8	6	692.4	693.5
8	7	694.6	695.8
8	8	696.9	698.0
8	9	699.1	700.3
8	10	701.4	702.5
8	11	703.7	704.8
8	12	705.9	707.0
8	13	708.2	709.3
8	14	710.4	711.5
8	15	712.7	713.8
8	16	714.9	716.1
8	17	717.2	718.3
8	18	719.4	720.6
8	19	721.7	722.8
8	20	724.0	725.1
8	21	726.2	727.3
8	22	728.5	729.6
8	23	730.7	731.8
8	24	733.0	734.1
8	25	735.2	736.4
8	26	737.5	738.6
8	27	739.7	740.9
8	28	742.0	743.1
8	29	744.3	745.4
8	30	746.5	747.6
8	31	748.8	749.9
8	32	751.0	752.1
8	33	753.3	754.4
8	34	755.5	756.7
8	35	757.8	758.9
8	36	760.0	761.2
8	37	762.3	763.4
8	38	764.6	765.7
8	39	766.8	767.9
8	40	769.1	770.2
8	41	771.3	772.4
8	42	773.6	774.7
8	43	775.8	777.0
8	44	778.1	779.2
8	45	780.3	781.5
8	46	782.6	783.7
9	1	783.4	784.5
9	2	785.6	786.7
9	3	787.9	789.0

Table 3

9	4	790.1	791.2
9	5	792.3	793.4
9	6	794.5	795.7
9	7	796.8	797.9
9	8	799.0	800.1
9	9	801.2	802.4
9	10	803.5	804.6
9	11	805.7	806.8
9	12	807.9	809.0
9	13	810.2	811.3
9	14	812.4	813.5
9	15	814.6	815.7
9	16	816.8	818.0
9	17	819.1	820.2
9	18	821.3	822.4
9	19	823.5	824.6
9	20	825.8	826.9
9	21	828.0	829.1
9	22	830.2	831.3
9	23	832.5	833.6
9	24	834.7	835.8
9	25	836.9	838.0
9	26	839.1	840.3
9	27	841.4	842.5
9	28	843.6	844.7
9	29	845.8	846.9
9	30	848.1	849.2
9	31	850.3	851.4
9	32	852.5	853.6
9	33	854.8	855.9
9	34	857.0	858.1
9	35	859.2	860.3
9	36	861.4	862.6
9	37	863.7	864.8

PC-02

Sec.	Cube No.	Top of Cube (cmbsf)	Center of Cube (cmbsf)
1	1	0.0	1.1
1	2	2.2	3.3
1	3	4.5	5.6
1	4	6.7	7.8
1	5	8.9	10.0
1	6	11.2	12.3
1	7	13.4	14.5
1	8	15.6	16.7
1	9	17.9	19.0
1	10	20.1	21.2
1	11	22.3	23.4
1	12	24.5	25.7
1	13	26.8	27.9
1	14	29.0	30.1
1	15	31.2	32.4
1	16	33.5	34.6
1	17	35.7	36.8
1	18	37.9	39.1
1	19	40.2	41.3
1	20	42.4	43.5
1	21	44.6	45.8
1	22	46.9	48.0

1	23	49.1	50.2
1	24	51.3	52.4
1	25	53.6	54.7
1	26	55.8	56.9
1	27	58.0	59.1
1	28	60.3	61.4
1	29	62.5	63.6
1	30	64.7	65.8
1	31	67.0	68.1
1	32	69.2	70.3
1	33	71.4	72.5
1	34	73.6	74.8
1	35	75.9	77.0
1	36	78.1	79.2
1	37	80.3	81.5
1	38	82.6	83.7
1	39	84.8	85.9
1	40	87.0	88.2
1	41	89.3	90.4
1	42	91.5	92.6
1	43	93.7	94.9
1	44	96.0	97.1
1	45	98.2	98.7
2	1	99.2	100.3
2	2	101.4	102.5
2	3	103.6	104.7
2	4	105.8	107.0
2	5	108.1	109.2
2	6	110.3	111.4
2	7	112.5	113.6
2	8	114.7	115.8
2	9	116.9	118.0
2	10	119.1	120.3
2	11	121.4	122.5
2	12	123.6	124.7
2	13	125.8	126.9
2	14	128.0	129.1
2	15	130.2	131.3
2	16	132.4	133.5
2	17	134.7	135.8
2	18	136.9	138.0
2	19	139.1	140.2
2	20	141.3	142.4
2	21	143.5	144.6
2	22	145.7	146.8
2	23	147.9	149.1
2	24	150.2	151.3
2	25	152.4	153.5
2	26	154.6	155.7
2	27	156.8	157.9
2	28	159.0	160.1
2	29	161.2	162.4
2	30	163.5	164.6
2	31	165.7	166.8
2	32	167.9	169.0
2	33	170.1	171.2
2	34	172.3	173.4
2	35	174.5	175.6
2	36	176.8	177.9
2	37	179.0	180.1
2	38	181.2	182.3

2	39	183.4	184.5
2	40	185.6	186.7
2	41	187.8	188.9
2	42	190.1	191.2
2	43	192.3	193.4
2	44	194.5	196.7
3	1	196.7	197.8
3	2	198.9	200.0
3	3	201.1	202.3
3	4	203.4	204.5
3	5	205.6	206.7
3	6	207.8	208.9
3	7	210.0	211.2
3	8	212.3	213.4
3	9	214.5	215.6
3	10	216.7	217.8
3	11	218.9	220.1
3	12	221.2	222.3
3	13	223.4	224.5
3	14	225.6	226.7
3	15	227.8	229.0
3	16	230.1	231.2
3	17	232.3	233.4
3	18	234.5	235.6
3	19	236.7	237.9
3	20	239.0	240.1
3	21	241.2	242.3
3	22	243.4	244.5
3	23	245.6	246.7
3	24	247.9	249.0
3	25	250.1	251.2
3	26	252.3	253.4
3	27	254.5	255.6
3	28	256.8	257.9
3	29	259.0	260.1
3	30	261.2	262.3
3	31	263.4	264.5
3	32	265.7	266.8
3	33	267.9	269.0
3	34	270.1	271.2
3	35	272.3	273.4
3	36	274.6	275.7
3	37	276.8	277.9
3	38	279.0	280.1
3	39	281.2	282.3
3	40	283.5	284.6
3	41	285.7	286.8
3	42	287.9	289.0
3	43	290.1	291.2
3	44	292.3	293.5
3	45	294.6	295.7
3	46	296.8	297.5
4	1	298.2	299.3
4	2	300.4	301.6
4	3	302.7	303.8
4	4	304.9	306.0
4	5	307.2	308.3
4	6	309.4	310.5
4	7	311.6	312.8
4	8	313.9	315.0
4	9	316.1	317.2

Table 3

4	10	318.4	319.5
4	11	320.6	321.7
4	12	322.8	324.0
4	13	325.1	326.2
4	14	327.3	328.4
4	15	329.6	330.7
4	16	331.8	332.9
4	17	334.1	335.2
4	18	336.3	337.4
4	19	338.5	339.7
4	20	340.8	341.9
4	21	343.0	344.1
4	22	345.3	346.4
4	23	347.5	348.6
4	24	349.7	350.9
4	25	352.0	353.1
4	26	354.2	355.3
4	27	356.5	357.6
4	28	358.7	359.8
4	29	360.9	362.1
4	30	363.2	364.3
4	31	365.4	366.5
4	32	367.7	368.8
4	33	369.9	371.0
4	34	372.1	373.3
4	35	374.4	375.5
4	36	376.6	377.7
4	37	378.9	380.0
4	38	381.1	382.2
4	39	383.4	384.5
4	40	385.6	386.7
4	41	387.8	389.0
4	42	390.1	391.2
4	43	392.3	393.4
4	44	394.6	395.7
4	45	396.8	397.1
5	1	397.5	398.6
5	2	399.8	400.9
5	3	402.1	403.2
5	4	404.4	405.5
5	5	406.7	407.8
5	6	409.0	410.1
5	7	411.3	412.4
5	8	413.6	414.7
5	9	415.9	417.0
5	10	418.2	419.3
5	11	420.5	421.6
5	12	422.8	423.9
5	13	425.1	426.2
5	14	427.4	428.5
5	15	429.7	430.8
5	16	432.0	433.1
5	17	434.3	435.4
5	18	436.6	437.7
5	19	438.8	440.0
5	20	441.1	442.3
5	21	443.4	444.6
5	22	445.7	446.9
5	23	448.0	449.2
5	24	450.3	451.5
5	25	452.6	453.8

5	26	454.9	456.1
5	27	457.2	458.4
5	28	459.5	460.7
5	29	461.8	463.0
5	30	464.1	465.3
5	31	466.4	467.6
5	32	468.7	469.9
5	33	471.0	472.2
5	34	473.3	474.5
5	35	475.6	476.8
5	36	477.9	479.1
5	37	480.2	481.3

PC-03

Sec.	Cube No.	Top of Cube (cmbsf)	Center of Cube (cmbsf)
1	1	0.0	1.1
1	2	2.2	3.3
1	3	4.4	5.6
1	4	6.7	7.8
1	5	8.9	10.0
1	6	11.1	12.2
1	7	13.3	14.5
1	8	15.6	16.7
1	9	17.8	18.9
1	10	20.0	21.1
1	11	22.2	23.3
1	12	24.5	25.6
1	13	26.7	27.8
1	14	28.9	30.0
1	15	31.1	32.2
1	16	33.4	34.5
1	17	35.6	36.7
1	18	37.8	38.9
1	19	40.0	41.1
1	20	42.2	43.4
1	21	44.5	45.6
1	22	46.7	47.8
1	23	48.9	50.0
1	24	51.1	52.2
1	25	53.4	54.5
1	26	55.6	56.7
1	27	57.8	58.9
1	28	60.0	61.1
1	29	62.3	63.4
1	30	64.5	65.6
1	31	66.7	67.8
1	32	68.9	70.0
1	33	71.1	72.3
1	34	73.4	74.5
1	35	75.6	76.7
1	36	77.8	78.9
1	37	80.0	81.2
1	38	82.3	83.4
1	39	84.5	85.6
1	40	86.7	87.8
1	41	88.9	90.0
1	42	91.2	92.3
1	43	93.4	94.5
1	44	95.6	96.7

1	45	97.8	98.9
1	46	100.1	101.2
1	47	102.3	103.4
1	48	104.5	105.2
2	1	106.0	108.2
2	2	108.2	110.4
2	3	110.4	112.6
2	4	112.6	114.8
2	5	114.8	117.0
2	6	117.0	119.2
2	7	119.2	121.4
2	8	121.4	123.6
2	9	123.6	125.8
2	10	125.8	128.0
2	11	128.0	130.2
2	12	130.2	132.4
2	13	132.4	134.6
2	14	134.6	136.8
2	15	136.8	139.0
2	16	139.0	141.2
2	17	141.2	143.4
2	18	143.4	145.6
2	19	145.6	147.8
2	20	147.8	150.0
2	21	150.0	152.2
2	22	152.2	154.4
2	23	154.4	156.6
2	24	156.6	158.8
2	25	158.8	161.0
2	26	161.0	163.2
2	27	163.2	165.4
2	28	165.4	167.6
2	29	167.6	169.8
2	30	169.8	172.0
2	31	172.0	174.2
2	32	174.2	176.4
2	33	176.4	178.6
2	34	178.6	180.8
2	35	180.8	183.0
2	36	183.0	185.2
2	37	185.2	187.4
2	38	187.4	189.6
2	39	189.6	191.8
2	40	191.8	194.0
2	41	194.0	196.2
2	42	196.2	198.4
2	43	198.4	200.6
2	44	200.6	202.8
2	45	202.8	205.0
3	1	205.0	206.1
3	2	207.2	208.3
3	3	209.4	210.5
3	4	211.6	212.7
3	5	213.8	214.9
3	6	216.0	217.1
3	7	218.3	219.4
3	8	220.5	221.6
3	9	222.7	223.8
3	10	224.9	226.0
3	11	227.1	228.2
3	12	229.3	230.4

Table 3

3	13	231.5	232.6
3	14	233.7	234.8
3	15	235.9	237.0
3	16	238.1	239.2
3	17	240.3	241.4
3	18	242.6	243.7
3	19	244.8	245.9
3	20	247.0	248.1
3	21	249.2	250.3
3	22	251.4	252.5
3	23	253.6	254.7
3	24	255.8	256.9
3	25	258.0	259.1
3	26	260.2	261.3
3	27	262.4	263.5
3	28	264.6	265.7
3	29	266.8	268.0
3	30	269.1	270.2
3	31	271.3	272.4
3	32	273.5	274.6
3	33	275.7	276.8
3	34	277.9	279.0
3	35	280.1	281.2
3	36	282.3	283.4
3	37	284.5	285.6
3	38	286.7	287.8
3	39	288.9	290.0
3	40	291.1	292.3
3	41	293.4	294.5
3	42	295.6	296.7
3	43	297.8	298.9
3	44	300.0	301.1
3	45	302.2	303.3
3	46	304.4	305.5
4	1	305.8	306.9
4	2	308.0	309.1
4	3	310.2	311.3
4	4	312.5	313.6
4	5	314.7	315.8
4	6	316.9	318.0
4	7	319.1	320.2
4	8	321.3	322.4
4	9	323.6	324.7
4	10	325.8	326.9
4	11	328.0	329.1
4	12	330.2	331.3
4	13	332.4	333.5
4	14	334.6	335.8
4	15	336.9	338.0
4	16	339.1	340.2
4	17	341.3	342.4
4	18	343.5	344.6
4	19	345.7	346.9
4	20	348.0	349.1
4	21	350.2	351.3
4	22	352.4	353.5
4	23	354.6	355.7
4	24	356.8	357.9
4	25	359.1	360.2
4	26	361.3	362.4
4	27	363.5	364.6

4	28	365.7	366.8
4	29	367.9	369.0
4	30	370.2	371.3
4	31	372.4	373.5
4	32	374.6	375.7
4	33	376.8	377.9
4	34	379.0	380.1
4	35	381.2	382.4
4	36	383.5	384.6
4	37	385.7	386.8
4	38	387.9	389.0
4	39	390.1	391.2
4	40	392.3	393.5
4	41	394.6	395.7
4	42	396.8	397.9
4	43	399.0	400.1
5	1	400.5	401.6
5	2	402.7	403.8
5	3	404.9	406.1
5	4	407.2	408.3
5	5	409.4	410.5
5	6	411.6	412.7
5	7	413.8	414.9
5	8	416.1	417.2
5	9	418.3	419.4
5	10	420.5	421.6
5	11	422.7	423.8
5	12	424.9	426.1
5	13	427.2	428.3
5	14	429.4	430.5
5	15	431.6	432.7
5	16	433.8	434.9
5	17	436.1	437.2
5	18	438.3	439.4
5	19	440.5	441.6
5	20	442.7	443.8
5	21	444.9	446.1
5	22	447.2	448.3
5	23	449.4	450.5
5	24	451.6	452.7
5	25	453.8	454.9
5	26	456.1	457.2
5	27	458.3	459.4
5	28	460.5	461.0

PC-04

Sec.	Cube No.	Top of Cube (cmbsf)	Center of Cube (cmbsf)
1	1	0.0	1.1
1	2	2.2	3.3
1	3	4.4	5.5
1	4	6.6	7.7
1	5	8.9	10.0
1	6	11.1	12.2
1	7	13.3	14.4
1	8	15.5	16.6
1	9	17.7	18.8
1	10	19.9	21.0
1	11	22.1	23.2
1	12	24.3	25.4

1	13	26.6	27.7
1	14	28.8	29.9
1	15	31.0	32.1
1	16	33.2	34.3
1	17	35.4	36.5
1	18	37.6	38.7
1	19	39.8	40.9
1	20	42.0	43.1
1	21	44.3	45.4
1	22	46.5	47.6
1	23	48.7	49.8
1	24	50.9	52.0
1	25	53.1	54.2
1	26	55.3	56.4
1	27	57.5	58.6
1	28	59.7	60.9
1	29	62.0	63.1
1	30	64.2	65.3
1	31	66.4	67.5
1	32	68.6	69.7
1	33	70.8	71.9
1	34	73.0	74.1
1	35	75.2	76.3
1	36	77.4	78.6
1	37	79.7	80.8
1	38	81.9	83.0
1	39	84.1	85.2
1	40	86.3	87.4
1	41	88.5	89.6
1	42	90.7	91.8
1	43	92.9	94.0
1	44	95.1	96.3
1	45	97.4	98.5
1	46	99.6	100.7
1	47	101.8	102.9
2	1	104.0	105.1
2	2	106.2	107.3
2	3	108.4	109.5
2	4	110.7	111.8
2	5	112.9	114.0
2	6	115.1	116.2
2	7	117.3	118.4
2	8	119.5	120.6
2	9	121.7	122.8
2	10	124.0	125.1
2	11	126.2	127.3
2	12	128.4	129.5
2	13	130.6	131.7
2	14	132.8	133.9
2	15	135.0	136.1
2	16	137.3	138.4
2	17	139.5	140.6
2	18	141.7	142.8
2	19	143.9	145.0
2	20	146.1	147.2
2	21	148.3	149.4
2	22	150.6	151.7
2	23	152.8	153.9
2	24	155.0	156.1
2	25	157.2	158.3
2	26	159.4	160.5

Table 3

2	27	161.6	162.8
2	28	163.9	165.0
2	29	166.1	167.2
2	30	168.3	169.4
2	31	170.5	171.6
2	32	172.7	173.8
2	33	174.9	176.1
2	34	177.2	178.3
2	35	179.4	180.5
2	36	181.6	182.7
2	37	183.8	184.9
2	38	186.0	187.1
2	39	188.2	189.4
2	40	190.5	191.6
2	41	192.7	193.8
2	42	194.9	196.0
2	43	197.1	198.2
2	44	199.3	200.4
2	45	201.5	202.7
2	46	203.8	204.9
2	47	206.0	207.1
2	48	208.2	208.6
3	1	209.0	210.1
3	2	211.3	212.4
3	3	213.5	214.6
3	4	215.8	216.9
3	5	218.0	219.1
3	6	220.3	221.4
3	7	222.5	223.7
3	8	224.8	225.9
3	9	227.0	228.2
3	10	229.3	230.4
3	11	231.6	232.7
3	12	233.8	234.9
3	13	236.1	237.2
3	14	238.3	239.4
3	15	240.6	241.7
3	16	242.8	244.0
3	17	245.1	246.2
3	18	247.3	248.5
3	19	249.6	250.7
3	20	251.9	253.0
3	21	254.1	255.2
3	22	256.4	257.5
3	23	258.6	259.7
3	24	260.9	262.0
3	25	263.1	264.3
3	26	265.4	266.5
3	27	267.6	268.8
3	28	269.9	271.0
3	29	272.1	273.3
3	30	274.4	275.5
3	31	276.7	277.8
3	32	278.9	280.0
3	33	281.2	282.3
3	34	283.4	284.6
3	35	285.7	286.8
3	36	287.9	289.1
3	37	290.2	291.3
3	38	292.4	293.6
3	39	294.7	295.8

3	40	297.0	298.1
3	41	299.2	300.3
3	42	301.5	302.6
3	43	303.7	304.9
3	44	306.0	307.1
3	45	308.2	309.4
3	46	310.5	311.6
3	47	312.7	313.9
3	48	315.0	316.1
4	1	316.5	317.6
4	2	318.7	319.8
4	3	320.9	322.0
4	4	323.2	324.3
4	5	325.4	326.5
4	6	327.6	328.7
4	7	329.8	330.9
4	8	332.0	333.1
4	9	334.3	335.4
4	10	336.5	337.6
4	11	338.7	339.8
4	12	340.9	342.0
4	13	343.1	344.2
4	14	345.3	346.5
4	15	347.6	348.7
4	16	349.8	350.9
4	17	352.0	353.1
4	18	354.2	355.3
4	19	356.4	357.5
4	20	358.7	359.8
4	21	360.9	362.0
4	22	363.1	364.2
4	23	365.3	366.4
4	24	367.5	368.6
4	25	369.8	370.9
4	26	372.0	373.1
4	27	374.2	375.3
4	28	376.4	377.5
4	29	378.6	379.7
4	30	380.8	382.0
4	31	383.1	384.2
4	32	385.3	386.4
4	33	387.5	388.6
4	34	389.7	390.8
4	35	391.9	393.0
4	36	394.2	395.3
4	37	396.4	397.5
4	38	398.6	399.7
4	39	400.8	401.9
4	40	403.0	404.1
4	41	405.2	406.4
4	42	407.5	408.6
4	43	409.7	410.8
4	44	411.9	413.0
4	45	414.1	415.2
4	46	416.3	417.5
4	47	418.6	419.7
4	48	420.8	421.9
5	1	423.0	424.1
5	2	425.3	426.4
5	3	427.5	428.6
5	4	429.8	430.9

5	5	432.0	433.2
5	6	434.3	435.4
5	7	436.5	437.7
5	8	438.8	439.9
5	9	441.0	442.2
5	10	443.3	444.4
5	11	445.6	446.7
5	12	447.8	448.9
5	13	450.1	451.2
5	14	452.3	453.5
5	15	454.6	455.7
5	16	456.8	458.0
5	17	459.1	460.2
5	18	461.4	462.5
5	19	463.6	464.7
5	20	465.9	467.0
5	21	468.1	469.2
5	22	470.4	471.5
5	23	472.6	473.8
5	24	474.9	476.0
5	25	477.1	478.3
5	26	479.4	480.5
5	27	481.7	482.8
5	28	483.9	485.0
5	29	486.2	487.3
5	30	488.4	489.6
5	31	490.7	491.8
5	32	492.9	494.1
5	33	495.2	496.3
5	34	497.4	498.6
5	35	499.7	500.8
5	36	502.0	503.1
5	37	504.2	505.3
5	38	506.5	507.6
5	39	508.7	509.9
5	40	511.0	512.1
5	41	513.2	514.4
5	42	515.5	516.6
5	43	517.8	518.9
5	44	520.0	521.1
5	45	522.3	523.4
5	46	524.5	525.6
5	47	526.8	527.9
5	48	529.0	529.1
6	1	529.2	530.3
6	2	531.4	532.6
6	3	533.7	534.8
6	4	535.9	537.0
6	5	538.2	539.3
6	6	540.4	541.5
6	7	542.6	543.8
6	8	544.9	546.0
6	9	547.1	548.2
6	10	549.4	550.5
6	11	551.6	552.7
6	12	553.8	555.0
6	13	556.1	557.2
6	14	558.3	559.4
6	15	560.5	561.7
6	16	562.8	563.9
6	17	565.0	566.1

Table 3

6	18	567.3	568.4
6	19	569.5	570.6
6	20	571.7	572.9
6	21	574.0	575.1
6	22	576.2	577.3
6	23	578.5	579.6
6	24	580.7	581.8
6	25	582.9	584.1
6	26	585.2	586.3
6	27	587.4	588.5
6	28	589.7	590.8
6	29	591.9	593.0
6	30	594.1	595.3
6	31	596.4	597.5
6	32	598.6	599.7
6	33	600.9	602.0
6	34	603.1	604.2
6	35	605.3	606.5
6	36	607.6	608.7
6	37	609.8	610.9
6	38	612.0	613.2
6	39	614.3	615.4
6	40	616.5	617.6
6	41	618.8	619.9
6	42	621.0	622.1
6	43	623.2	624.4
6	44	625.5	626.6
6	45	627.7	628.8
6	46	630.0	631.1
7	1	632.2	633.3
7	2	634.4	635.6
7	3	636.7	637.8
7	4	638.9	640.0
7	5	641.1	642.3
7	6	643.4	644.5
7	7	645.6	646.7
7	8	647.8	649.0
7	9	650.1	651.2
7	10	652.3	653.4
7	11	654.5	655.7
7	12	656.8	657.9
7	13	659.0	660.1
7	14	661.2	662.4
7	15	663.5	664.6
7	16	665.7	666.8
7	17	667.9	669.1
7	18	670.2	671.3
7	19	672.4	673.5
7	20	674.6	675.8
7	21	676.9	678.0
7	22	679.1	680.2
7	23	681.4	682.5
7	24	683.6	684.7
7	25	685.8	686.9
7	26	688.1	689.2
7	27	690.3	691.4
7	28	692.5	693.6
7	29	694.8	695.9
7	30	697.0	698.1
7	31	699.2	700.3
7	32	701.5	702.6

7	33	703.7	704.8
7	34	705.9	707.0
7	35	708.2	709.3
7	36	710.4	711.5
7	37	712.6	713.7
7	38	714.9	716.0
7	39	717.1	718.2
7	40	719.3	720.4
7	41	721.6	722.7
7	42	723.8	724.9
7	43	726.0	727.2
7	44	728.3	729.4
7	45	730.5	731.1
8	1	731.7	732.8
8	2	733.9	735.1
8	3	736.2	737.3
8	4	738.4	739.5
8	5	740.6	741.8
8	6	742.9	744.0
8	7	745.1	746.2
8	8	747.4	748.5
8	9	749.6	750.7
8	10	751.8	752.9
8	11	754.1	755.2
8	12	756.3	757.4
8	13	758.5	759.7
8	14	760.8	761.9
8	15	763.0	764.1
8	16	765.2	766.4
8	17	767.5	768.6
8	18	769.7	770.8
8	19	772.0	773.1
8	20	774.2	775.3
8	21	776.4	777.5
8	22	778.7	779.8
8	23	780.9	782.0
8	24	783.1	784.3
8	25	785.4	786.5
8	26	787.6	788.7
8	27	789.8	791.0
8	28	792.1	793.2
8	29	794.3	795.4
8	30	796.6	797.7
8	31	798.8	799.9
8	32	801.0	802.1
8	33	803.3	804.4
8	34	805.5	806.6
8	35	807.7	808.9
8	36	810.0	811.1
8	37	812.2	813.3
8	38	814.4	815.6
8	39	816.7	817.8
8	40	818.9	820.0
8	41	821.2	822.3
8	42	823.4	824.5
8	43	825.6	826.7
8	44	827.9	829.0
8	45	830.1	830.4
9	1	830.7	831.8
9	2	832.9	834.1
9	3	835.2	836.3

9	4	837.4	838.5
9	5	839.6	840.8
9	6	841.9	843.0
9	7	844.1	845.2
9	8	846.4	847.5
9	9	848.6	849.7
9	10	850.8	851.9
9	11	853.1	854.2
9	12	855.3	856.4
9	13	857.5	858.6
9	14	859.8	860.9
9	15	862.0	863.1
9	16	864.2	865.4
9	17	866.5	867.6
9	18	868.7	869.8
9	19	870.9	872.1
9	20	873.2	874.3
9	21	875.4	876.5
9	22	877.6	878.8
9	23	879.9	881.0
9	24	882.1	883.2
9	25	884.4	885.5
9	26	886.6	887.7
9	27	888.8	889.9
9	28	891.1	892.2
9	29	893.3	894.4
9	30	895.5	896.7
9	31	897.8	898.9
9	32	900.0	901.1
9	33	902.2	903.4
9	34	904.5	905.6
9	35	906.7	907.8
9	36	908.9	910.1
9	37	911.2	912.3
9	38	913.4	914.5
9	39	915.7	916.8
9	40	917.9	919.0
9	41	920.1	921.2
9	42	922.4	923.5
9	43	924.6	925.7
9	44	926.8	927.9
9	45	929.1	930.2
9	46	931.3	931.5
10	1	931.7	932.8
10	2	934.0	935.1
10	3	936.2	937.3
10	4	938.5	939.6
10	5	940.7	941.8
10	6	943.0	944.1
10	7	945.2	946.3
10	8	947.5	948.6
10	9	949.7	950.8
10	10	952.0	953.1
10	11	954.2	955.3
10	12	956.5	957.6
10	13	958.7	959.8
10	14	961.0	962.1
10	15	963.2	964.3
10	16	965.5	966.6
10	17	967.7	968.8
10	18	970.0	971.1

Table 3

10	19	972.2	973.3
10	20	974.5	975.6
10	21	976.7	977.8
10	22	979.0	980.1
10	23	981.2	982.3
10	24	983.5	984.6
10	25	985.7	986.8
10	26	988.0	989.1
10	27	990.2	991.3
10	28	992.5	993.6
10	29	994.7	995.8
10	30	997.0	998.1
10	31	999.2	1000.3
10	32	1001.5	1002.6
10	33	1003.7	1004.8
10	34	1006.0	1007.1
10	35	1008.2	1009.3
10	36	1010.5	1011.6
10	37	1012.7	1013.8
10	38	1015.0	1016.1
10	39	1017.2	1018.3
10	40	1019.5	1020.6
10	41	1021.7	1022.8
10	42	1024.0	1025.1
10	43	1026.2	1027.3
10	44	1028.5	1029.6
11	1	1030.7	1031.8
11	2	1032.9	1034.1
11	3	1035.2	1036.3
11	4	1037.4	1038.5
11	5	1039.7	1040.8
11	6	1041.9	1043.0
11	7	1044.2	1045.3
11	8	1046.4	1047.5
11	9	1048.6	1049.8
11	10	1050.9	1052.0
11	11	1053.1	1054.2
11	12	1055.4	1056.5
11	13	1057.6	1058.7
11	14	1059.8	1061.0
11	15	1062.1	1063.2
11	16	1064.3	1065.5
11	17	1066.6	1067.7
11	18	1068.8	1069.9
11	19	1071.1	1072.2
11	20	1073.3	1074.4
11	21	1075.5	1076.7
11	22	1077.8	1078.9
11	23	1080.0	1081.1
11	24	1082.3	1083.4
11	25	1084.5	1085.6
11	26	1086.7	1087.9
11	27	1089.0	1090.1
11	28	1091.2	1092.4
11	29	1093.5	1094.6
11	30	1095.7	1096.8
11	31	1098.0	1099.1
11	32	1100.2	1101.3
11	33	1102.4	1103.6
11	34	1104.7	1105.8
11	35	1106.9	1108.0

11	36	1109.2	1110.3
11	37	1111.4	1112.5
11	38	1113.7	1114.8
11	39	1115.9	1117.0
11	40	1118.1	1119.3
11	41	1120.4	1121.5
11	42	1122.6	1123.7
11	43	1124.9	1126.0
11	44	1127.1	1127.5
12	1	1127.9	1129.0
12	2	1130.2	1131.3
12	3	1132.4	1133.5
12	4	1134.7	1135.8
12	5	1136.9	1138.0
12	6	1139.2	1140.3
12	7	1141.4	1142.5
12	8	1143.7	1144.8
12	9	1145.9	1147.0
12	10	1148.2	1149.3
12	11	1150.4	1151.5
12	12	1152.7	1153.8
12	13	1154.9	1156.0
12	14	1157.2	1158.3
12	15	1159.4	1160.5
12	16	1161.7	1162.8
12	17	1163.9	1165.0
12	18	1166.2	1167.3
12	19	1168.4	1169.5
12	20	1170.7	1171.8
12	21	1172.9	1174.0
12	22	1175.2	1176.3
12	23	1177.4	1178.6
12	24	1179.7	1180.8
12	25	1181.9	1183.1
12	26	1184.2	1185.3
12	27	1186.4	1187.6
12	28	1188.7	1189.8
12	29	1190.9	1192.1
12	30	1193.2	1194.3
12	31	1195.4	1196.6
12	32	1197.7	1198.8
12	33	1199.9	1201.1
12	34	1202.2	1203.3
12	35	1204.4	1205.6
12	36	1206.7	1207.8
12	37	1208.9	1210.1
12	38	1211.2	1212.3
12	39	1213.4	1214.6
12	40	1215.7	1216.8
12	41	1217.9	1219.1
12	42	1220.2	1221.3
12	43	1222.4	1223.6
12	44	1224.7	1225.3
13	1	1225.9	1228.1
13	2	1228.1	1230.4
13	3	1230.4	1232.6
13	4	1232.6	1234.9
13	5	1234.9	1237.1
13	6	1237.1	1239.3
13	7	1239.3	1241.6
13	8	1241.6	1243.8

13	9	1243.8	1246.1
13	10	1246.1	1248.3
13	11	1248.3	1250.5
13	12	1250.5	1252.8
13	13	1252.8	1255.0
13	14	1255.0	1257.3
13	15	1257.3	1259.5
13	16	1259.5	1261.8
13	17	1261.8	1264.0
13	18	1264.0	1266.2
13	19	1266.2	1268.5
13	20	1268.5	1270.7
13	21	1270.7	1273.0
13	22	1273.0	1275.2
13	23	1275.2	1277.4
13	24	1277.4	1279.7
13	25	1279.7	1281.9
13	26	1281.9	1284.2
13	27	1284.2	1286.4
13	28	1286.4	1288.6
13	29	1288.6	1290.9
13	30	1290.9	1293.1
13	31	1293.1	1295.4
13	32	1295.4	1297.6
13	33	1297.6	1299.8
13	34	1299.8	1302.1
13	35	1302.1	1304.3
13	36	1304.3	1306.6
13	37	1306.6	1308.8
13	38	1308.8	1311.1
13	39	1311.1	1313.3
13	40	1313.3	1315.5
13	41	1315.5	1317.8
13	42	1317.8	1320.0
13	43	1320.0	1322.3
13	44	1322.3	1324.5
13	45	1324.5	1324.8
14	1	1325.2	1326.3
14	2	1327.4	1328.6
14	3	1329.7	1330.8
14	4	1331.9	1333.0
14	5	1334.2	1335.3
14	6	1336.4	1337.5
14	7	1338.6	1339.8
14	8	1340.9	1342.0
14	9	1343.1	1344.2
14	10	1345.4	1346.5
14	11	1347.6	1348.7
14	12	1349.8	1351.0
14	13	1352.1	1353.2
14	14	1354.3	1355.5
14	15	1356.6	1357.7
14	16	1358.8	1359.9
14	17	1361.1	1362.2
14	18	1363.3	1364.4
14	19	1365.5	1366.7
14	20	1367.8	1368.9
14	21	1370.0	1371.1
14	22	1372.3	1373.4
14	23	1374.5	1375.6
14	24	1376.7	1377.9

Table 3

14	25	1379.0	1380.1
14	26	1381.2	1382.3
14	27	1383.5	1384.6
14	28	1385.7	1386.8
14	29	1387.9	1389.1
14	30	1390.2	1391.3
14	31	1392.4	1393.5
14	32	1394.7	1395.8
14	33	1396.9	1398.0
14	34	1399.1	1400.3
14	35	1401.4	1402.5
14	36	1403.6	1404.8
14	37	1405.9	1407.0
14	38	1408.1	1409.2
14	39	1410.4	1411.5
14	40	1412.6	1413.7
14	41	1414.8	1416.0
14	42	1417.1	1418.2
14	43	1419.3	1420.4
14	44	1421.6	1422.7
14	45	1423.8	1424.4
15	1	1425.0	1426.1
15	2	1427.2	1428.4
15	3	1429.5	1430.6
15	4	1431.7	1432.8
15	5	1434.0	1435.1
15	6	1436.2	1437.3
15	7	1438.4	1439.6
15	8	1440.7	1441.8
15	9	1442.9	1444.0
15	10	1445.1	1446.3
15	11	1447.4	1448.5
15	12	1449.6	1450.7
15	13	1451.9	1453.0
15	14	1454.1	1455.2
15	15	1456.3	1457.5
15	16	1458.6	1459.7
15	17	1460.8	1461.9
15	18	1463.1	1464.2
15	19	1465.3	1466.4
15	20	1467.5	1468.7
15	21	1469.8	1470.9
15	22	1472.0	1473.1
15	23	1474.2	1475.4
15	24	1476.5	1477.6
15	25	1478.7	1479.8
15	26	1481.0	1482.1
15	27	1483.2	1484.3
15	28	1485.4	1486.6
15	29	1487.7	1488.8
15	30	1489.9	1491.0
15	31	1492.2	1493.3
15	32	1494.4	1495.5
15	33	1496.6	1497.8
15	34	1498.9	1500.0
15	35	1501.1	1502.2
15	36	1503.4	1504.5
15	37	1505.6	1506.7
15	38	1507.8	1508.9
15	39	1510.1	1511.2
15	40	1512.3	1513.4

15	41	1514.5	1515.7
15	42	1516.8	1517.9
15	43	1519.0	1520.1
15	44	1521.3	1522.4
15	45	1523.5	1524.4
16	1	1525.3	1526.4
16	2	1527.5	1528.7
16	3	1529.8	1530.9
16	4	1532.0	1533.1
16	5	1534.3	1535.4
16	6	1536.5	1537.6
16	7	1538.8	1539.9
16	8	1541.0	1542.1
16	9	1543.2	1544.4
16	10	1545.5	1546.6
16	11	1547.7	1548.8
16	12	1550.0	1551.1
16	13	1552.2	1553.3
16	14	1554.4	1555.6
16	15	1556.7	1557.8
16	16	1558.9	1560.1
16	17	1561.2	1562.3
16	18	1563.4	1564.5
16	19	1565.7	1566.8
16	20	1567.9	1569.0
16	21	1570.1	1571.3
16	22	1572.4	1573.5
16	23	1574.6	1575.7
16	24	1576.9	1578.0
16	25	1579.1	1580.2
16	26	1581.4	1582.5
16	27	1583.6	1584.7
16	28	1585.8	1587.0
16	29	1588.1	1589.2
16	30	1590.3	1591.4
16	31	1592.6	1593.7
16	32	1594.8	1595.9
16	33	1597.0	1598.2
16	34	1599.3	1600.4
16	35	1601.5	1602.7
16	36	1603.8	1604.9
16	37	1606.0	1607.1
16	38	1608.3	1609.4
16	39	1610.5	1611.6
16	40	1612.7	1613.9
16	41	1615.0	1616.1
16	42	1617.2	1618.4
16	43	1619.5	1620.6
16	44	1621.7	1622.8
16	45	1624.0	1625.1
16	46	1626.2	1627.0
17	1	1627.8	1630.0
17	2	1630.0	1632.3
17	3	1632.3	1634.5
17	4	1634.5	1636.8
17	5	1636.8	1639.0
17	6	1639.0	1641.3
17	7	1641.3	1643.5
17	8	1643.5	1645.8
17	9	1645.8	1648.0
17	10	1648.0	1650.3

17	11	1650.3	1652.5
17	12	1652.5	1654.7
17	13	1654.7	1657.0
17	14	1657.0	1659.2
17	15	1659.2	1661.5
17	16	1661.5	1663.7
17	17	1663.7	1666.0
17	18	1666.0	1668.2
17	19	1668.2	1670.5
17	20	1670.5	1672.7
17	21	1672.7	1675.0
17	22	1675.0	1677.2
17	23	1677.2	1679.4
17	24	1679.4	1681.7
17	25	1681.7	1683.9
17	26	1683.9	1686.2
17	27	1686.2	1688.4
17	28	1688.4	1690.7
17	29	1690.7	1692.9
17	30	1692.9	1695.2
17	31	1695.2	1697.4
17	32	1697.4	1699.7
17	33	1699.7	1701.9
17	34	1701.9	1704.2
17	35	1704.2	1706.4
17	36	1706.4	1708.6
17	37	1708.6	1710.9
17	38	1710.9	1713.1
17	39	1713.1	1715.4
17	40	1715.4	1717.6
17	41	1717.6	1719.9
17	42	1719.9	1722.1
17	43	1722.1	1724.4
17	44	1724.4	1726.6
17	45	1726.6	1728.9
17	46	1728.9	1731.1
17	47	1730.1	1730.7
18	1	1732.3	1733.4
18	2	1734.6	1735.7
18	3	1736.8	1737.9
18	4	1739.1	1740.2
18	5	1741.3	1742.5
18	6	1743.6	1744.7
18	7	1745.8	1747.0
18	8	1748.1	1749.2
18	9	1750.4	1751.5
18	10	1752.6	1753.7
18	11	1754.9	1756.0
18	12	1757.1	1758.2
18	13	1759.4	1760.5
18	14	1761.6	1762.8
18	15	1763.9	1765.0
18	16	1766.1	1767.3
18	17	1768.4	1769.5
18	18	1770.7	1771.8
18	19	1772.9	1774.0
18	20	1775.2	1776.3
18	21	1777.4	1778.5
18	22	1779.7	1780.8
18	23	1781.9	1783.1
18	24	1784.2	1785.3

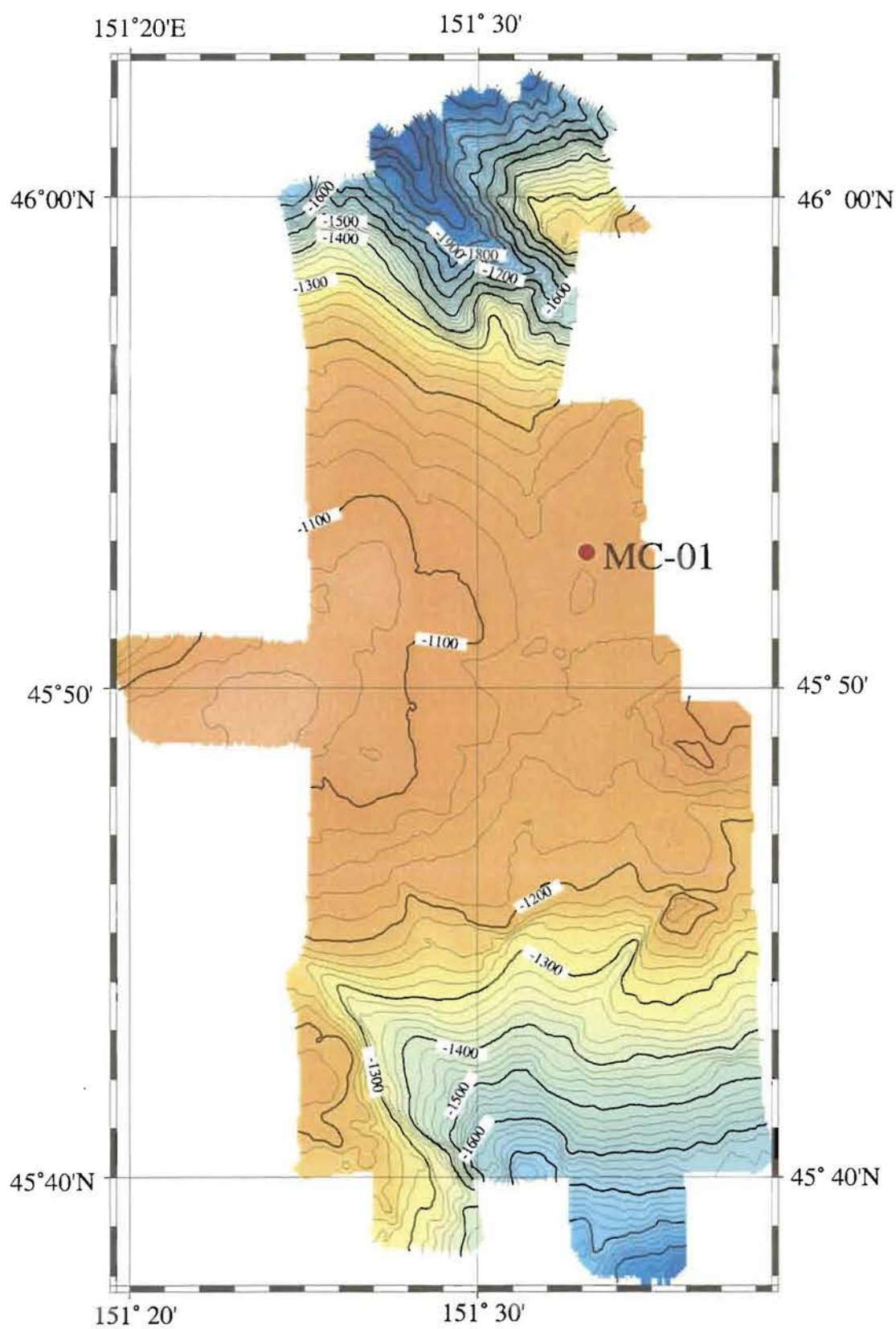
Table 3

18	25	1786.4	1787.6
18	26	1788.7	1789.8
18	27	1791.0	1792.1
18	28	1793.2	1794.3
18	29	1795.5	1796.6
18	30	1797.7	1798.8
18	31	1800.0	1801.1
18	32	1802.2	1803.4
18	33	1804.5	1805.6
18	34	1806.7	1807.9
18	35	1809.0	1810.1
18	36	1811.3	1812.4
18	37	1813.5	1814.6
18	38	1815.8	1816.9
18	39	1818.0	1819.1
18	40	1820.3	1821.4
18	41	1822.5	1823.7
18	42	1824.8	1825.9
18	43	1827.0	1828.2
18	44	1829.3	1830.4
18	45	1831.6	1832.7
18	46	1833.8	1834.3
19	1	1834.8	1837.0
19	2	1837.0	1839.3
19	3	1839.3	1841.5
19	4	1841.5	1843.7
19	5	1843.7	1846.0
19	6	1846.0	1848.2
19	7	1848.2	1850.5
19	8	1850.5	1852.7
19	9	1852.7	1854.9
19	10	1854.9	1857.2
19	11	1857.2	1859.4
19	12	1859.4	1861.6
19	13	1861.6	1863.9
19	14	1863.9	1866.1
19	15	1866.1	1868.3
19	16	1868.3	1870.6
19	17	1870.6	1872.8
19	18	1872.8	1875.0
19	19	1875.0	1877.3
19	20	1877.3	1879.5

19	21	1879.5	1881.7
19	22	1881.7	1884.0
19	23	1884.0	1886.2
19	24	1886.2	1888.4
19	25	1888.4	1890.7
19	26	1890.7	1892.9
19	27	1892.9	1895.1
19	28	1895.1	1897.4
19	29	1897.4	1899.6
19	30	1899.6	1901.9
19	31	1901.9	1904.1
19	32	1904.1	1906.3
19	33	1906.3	1908.6
19	34	1908.6	1910.8
19	35	1910.8	1913.0
19	36	1913.0	1915.3
19	37	1915.3	1917.5
19	38	1917.5	1919.7
19	39	1919.7	1922.0
19	40	1922.0	1924.2
19	41	1924.2	1926.4
19	42	1926.4	1928.7
19	43	1928.7	1930.9
19	44	1930.9	1933.1
19	45	1933.1	1935.4
19	46	1935.4	1937.6
19	47	1937.6	1937.7
20	1	1937.8	1938.9
20	2	1940.1	1941.2
20	3	1942.3	1943.5
20	4	1944.6	1945.7
20	5	1946.9	1948.0
20	6	1949.1	1950.3
20	7	1951.4	1952.5
20	8	1953.7	1954.8
20	9	1955.9	1957.1
20	10	1958.2	1959.3
20	11	1960.5	1961.6
20	12	1962.7	1963.9
20	13	1965.0	1966.1
20	14	1967.3	1968.4
20	15	1969.5	1970.7

20	16	1971.8	1972.9
20	17	1974.1	1975.2
20	18	1976.3	1977.4
20	19	1978.6	1979.7
20	20	1980.8	1982.0
20	21	1983.1	1984.2
20	22	1985.4	1986.5
20	23	1987.6	1988.8
20	24	1989.9	1991.0
20	25	1992.2	1993.3
20	26	1994.4	1995.6
20	27	1996.7	1997.8
20	28	1999.0	2000.1
20	29	2001.2	2002.4
20	30	2003.5	2004.6
20	31	2005.8	2006.9
20	32	2008.0	2009.2
20	33	2010.3	2011.4
20	34	2012.6	2013.7
20	35	2014.8	2016.0
20	36	2017.1	2018.2
20	37	2019.4	2020.5
20	38	2021.6	2022.8
20	39	2023.9	2025.0
20	40	2026.1	2027.3
20	41	2028.4	2029.5
20	42	2030.7	2031.8
20	43	2032.9	2034.1
20	44	2035.2	2035.8
cc	1	2036.3	2037.4
cc	2	2038.5	2039.6
cc	3	2040.7	2041.7
cc	4	2042.8	2043.9
cc	5	2045.0	2046.1
cc	6	2047.2	2048.3
cc	7	2049.3	2050.4
cc	8	2051.5	2052.6
cc	9	2053.7	2054.8
cc	10	2055.9	2056.9
cc	11	2058.0	2059.1
cc	12	2060.2	2060.6

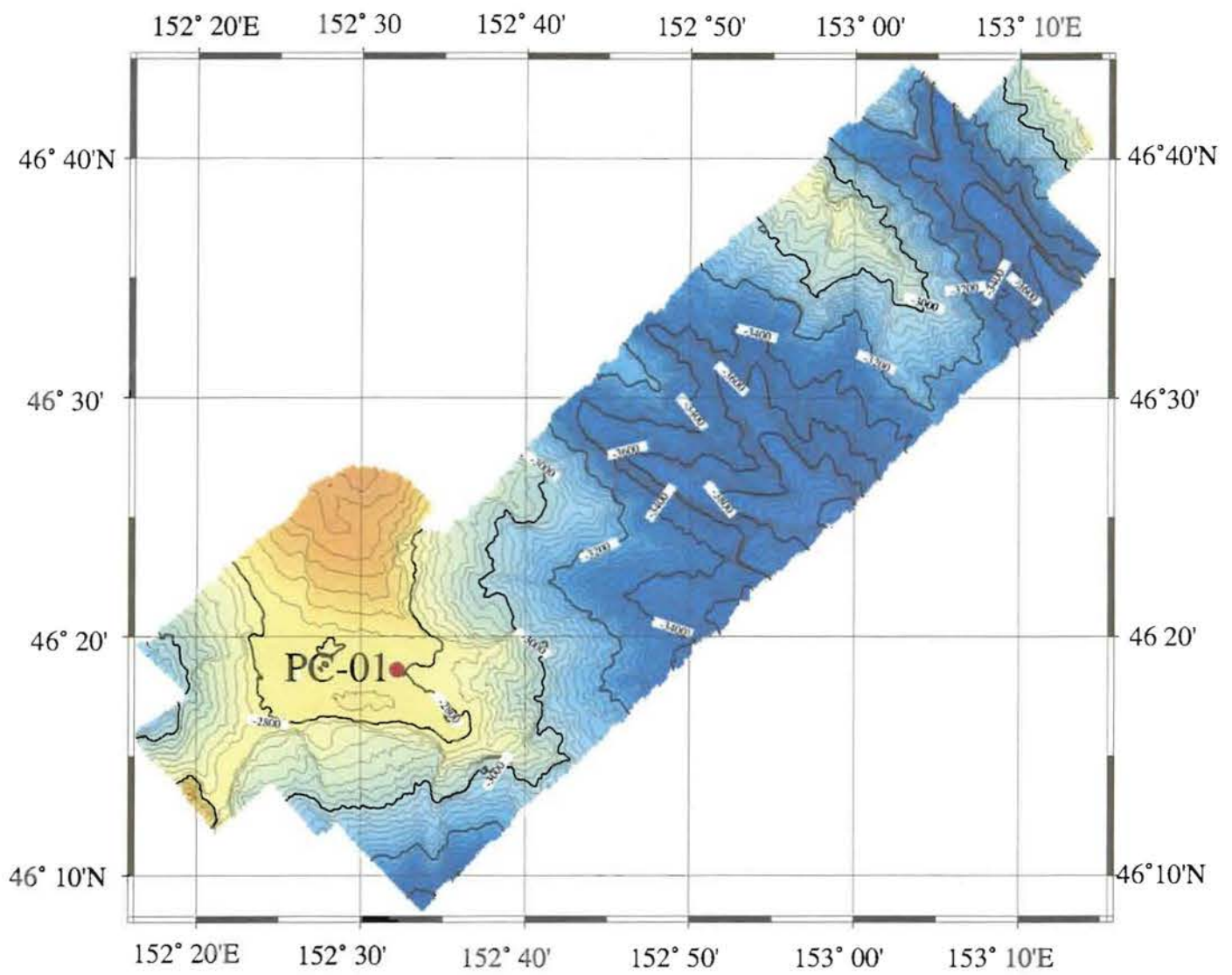
MC-01



GM May 17 12:30

Fig.1 MC-01 core sampling location

PC-01



GM May 21 03:51

Fig.2 PC-01 core sampling location

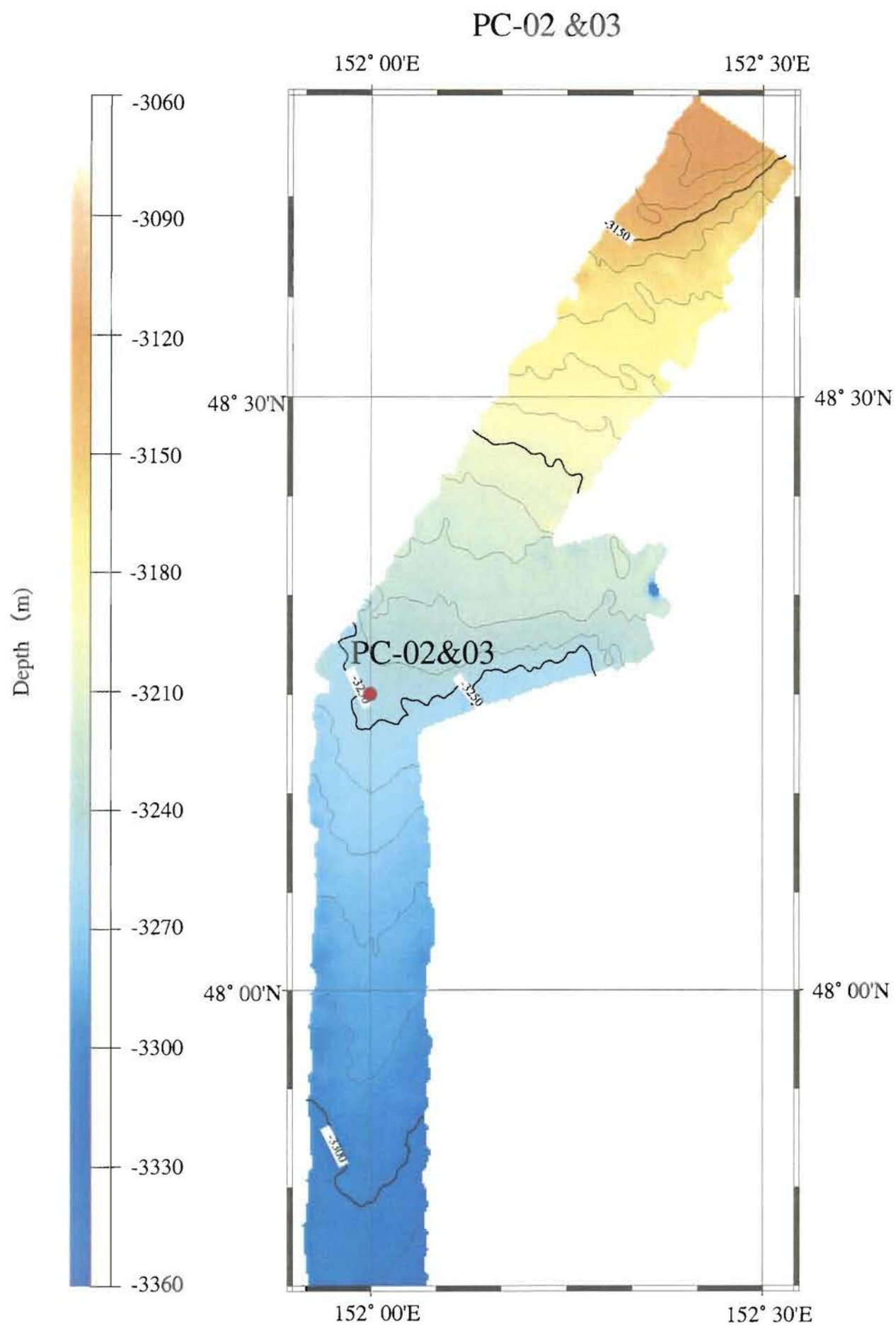
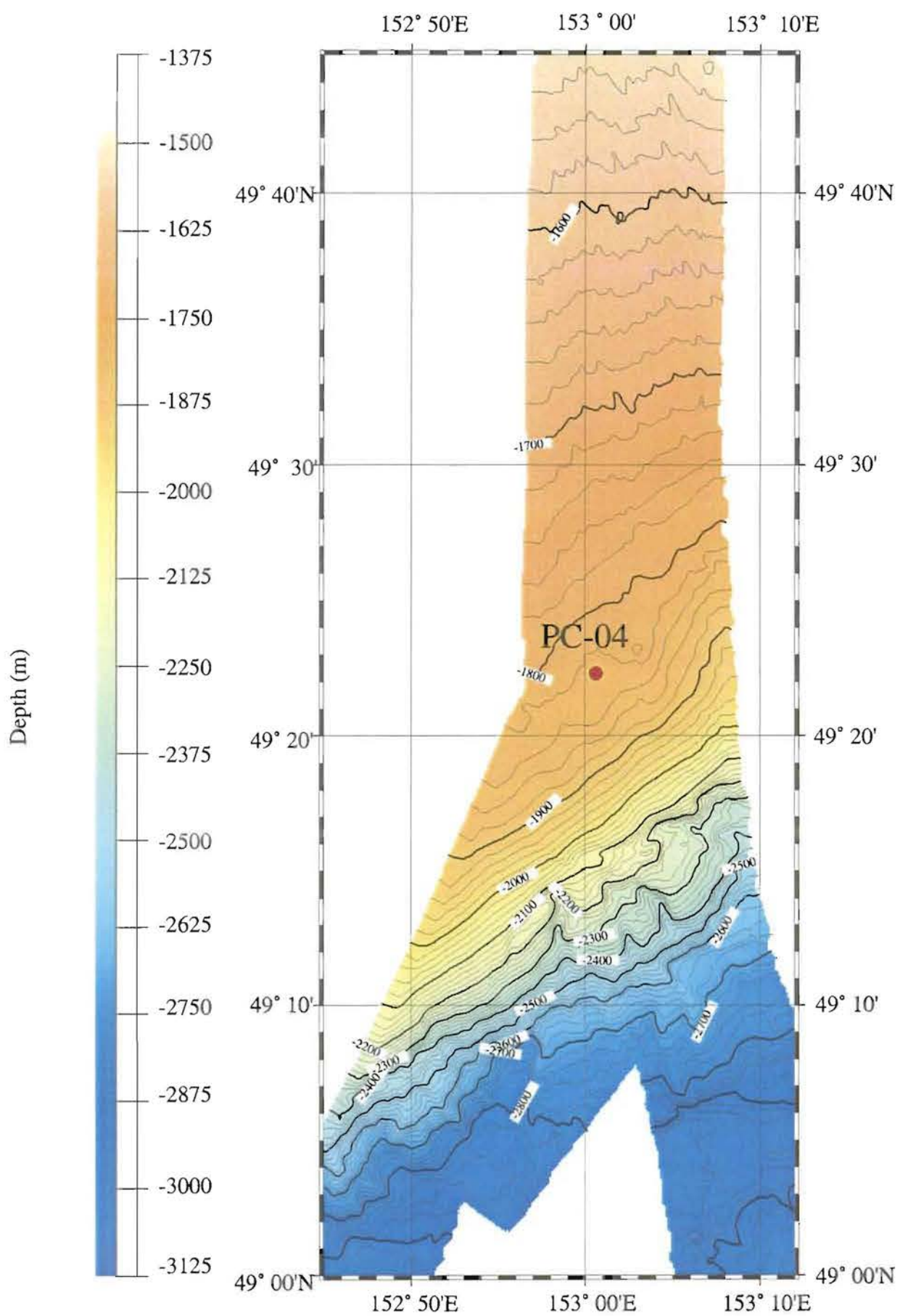


Fig.3 PC-02 and 03 cores sampling location

PC-4



GM May 28 11:06

Fig. 4 PC-04 core sampling location

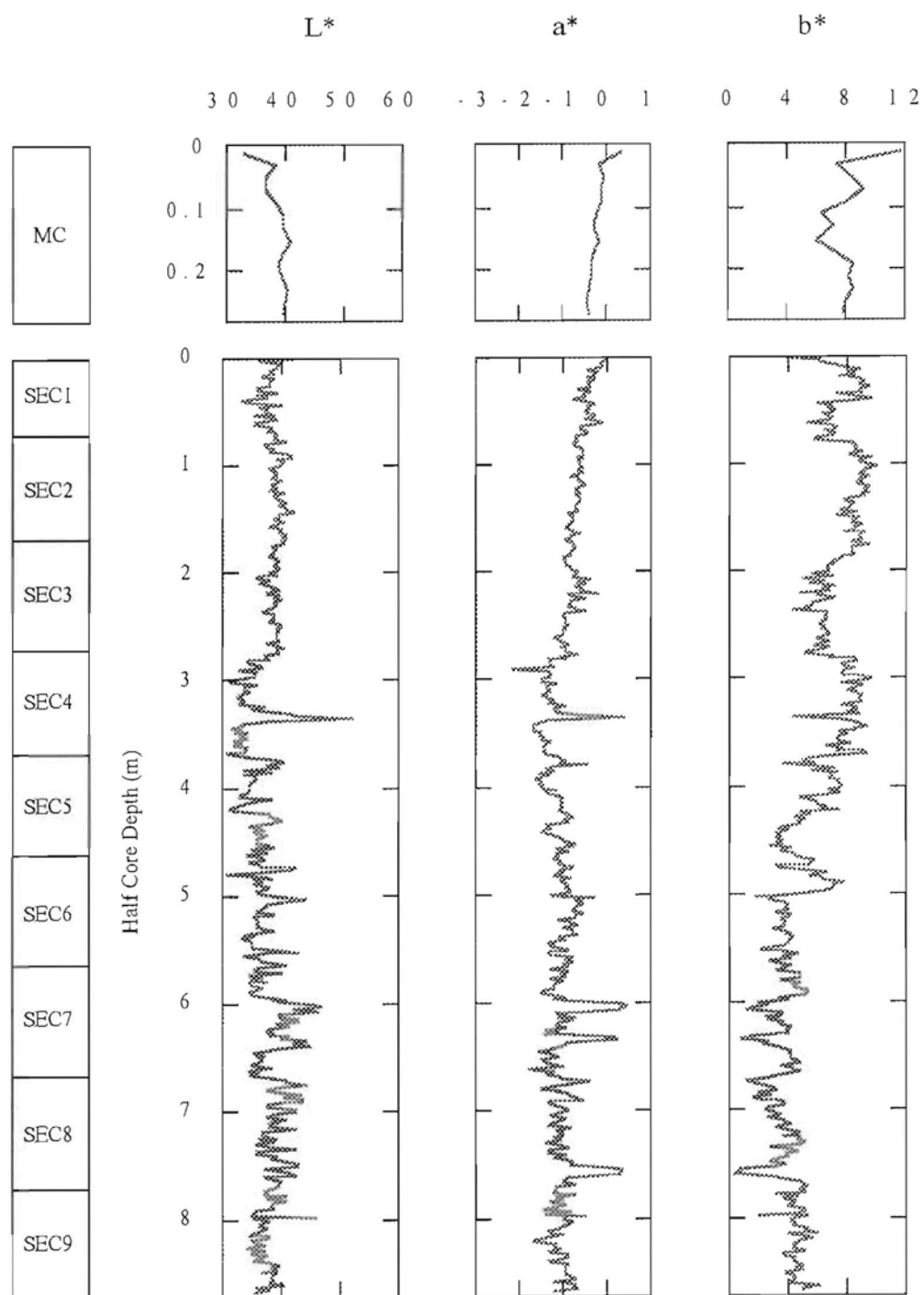


Fig. 5 MR00-K03 PC-01 & MC-02 Physical Properties (Color)

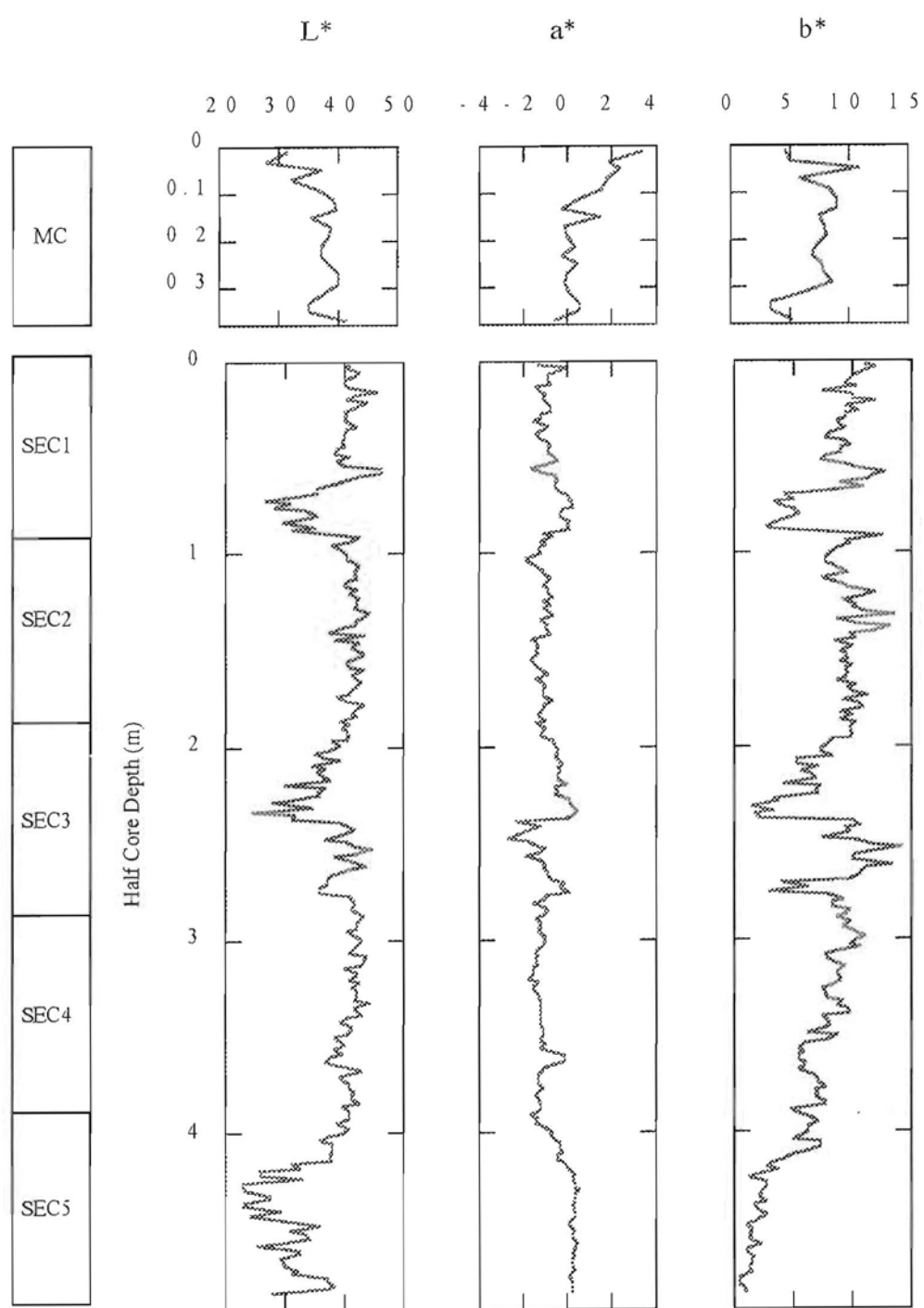


Fig. 6 MR00-K03 PC-02 & MC-03 Physical Properties (Color)

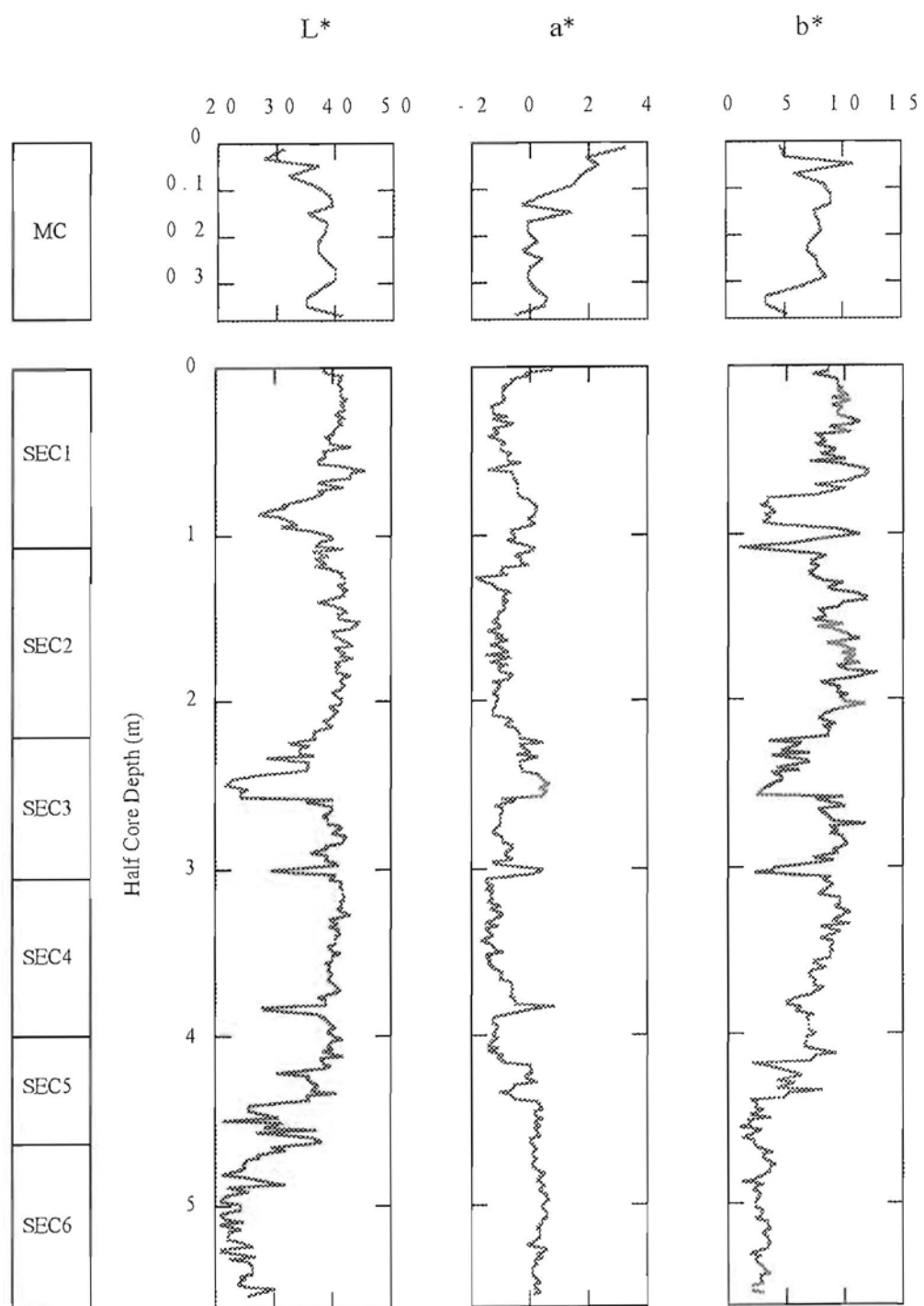


Fig. 7 MR00-K03 PC-03 & MC-03 Physical Properties (Color)

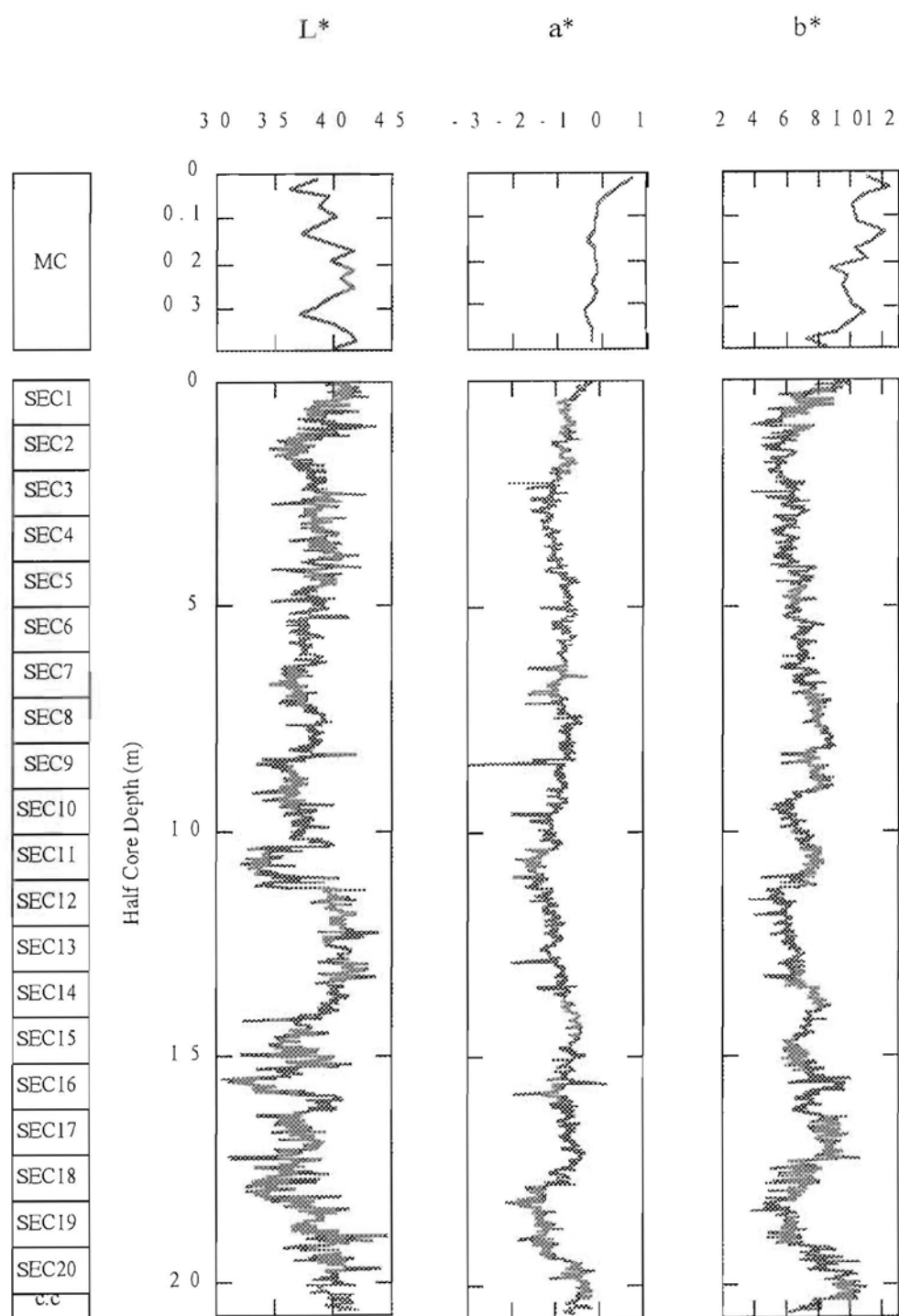


Fig. 8 MR00-K03 PC-04 & MC-04 Physical Properties (Color)

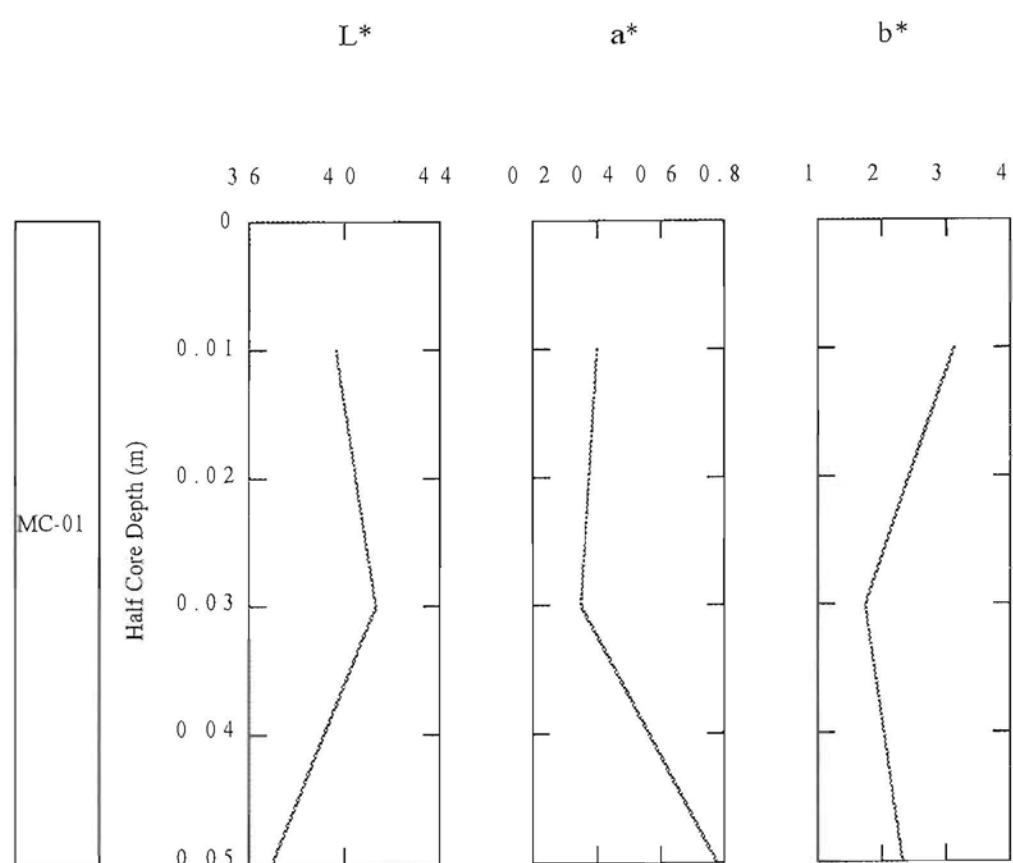


Fig. 9 MR00-K03 MC-01 Physical Properties (Color)

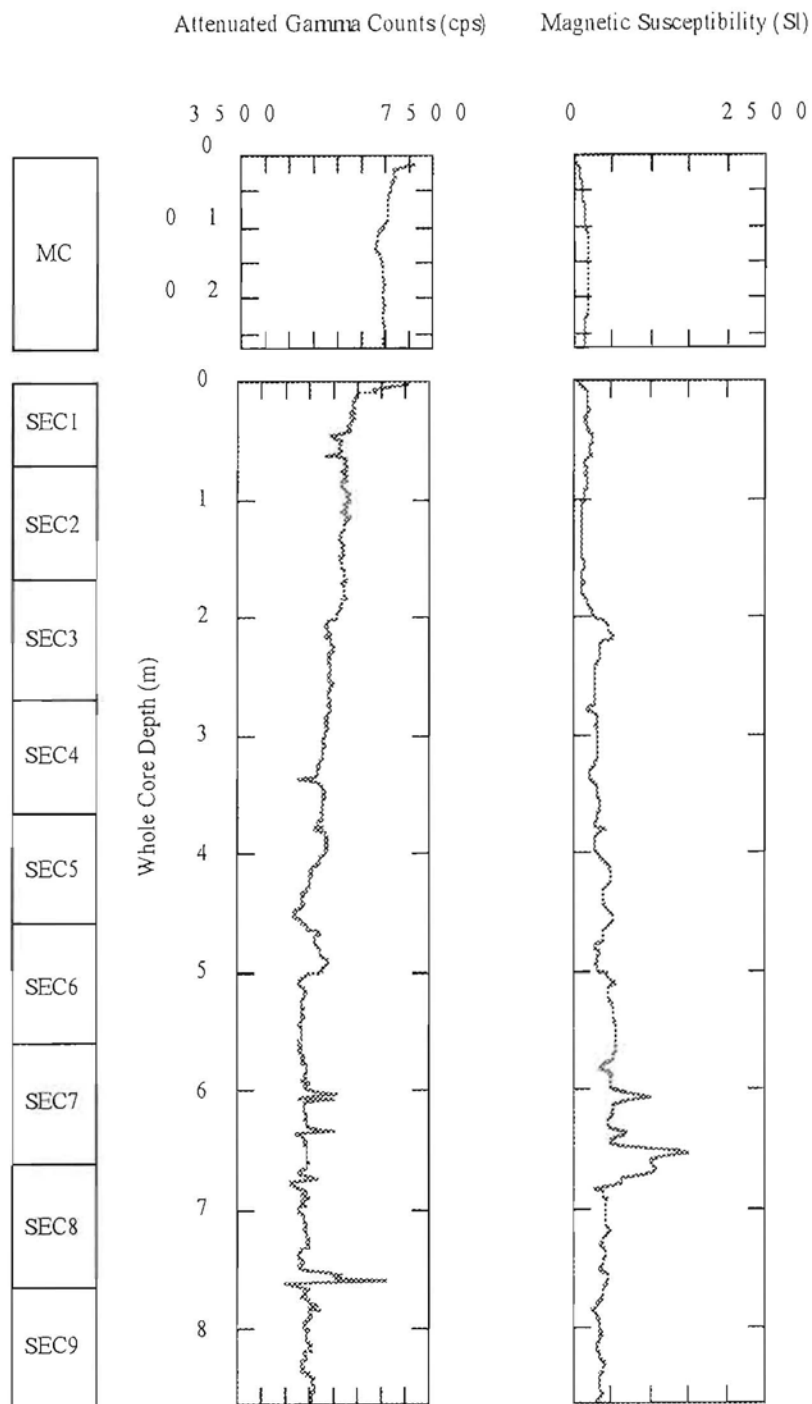


Fig.10 MR00-K03 PC-01&MC-02 Physical Properties (RAW DATA)

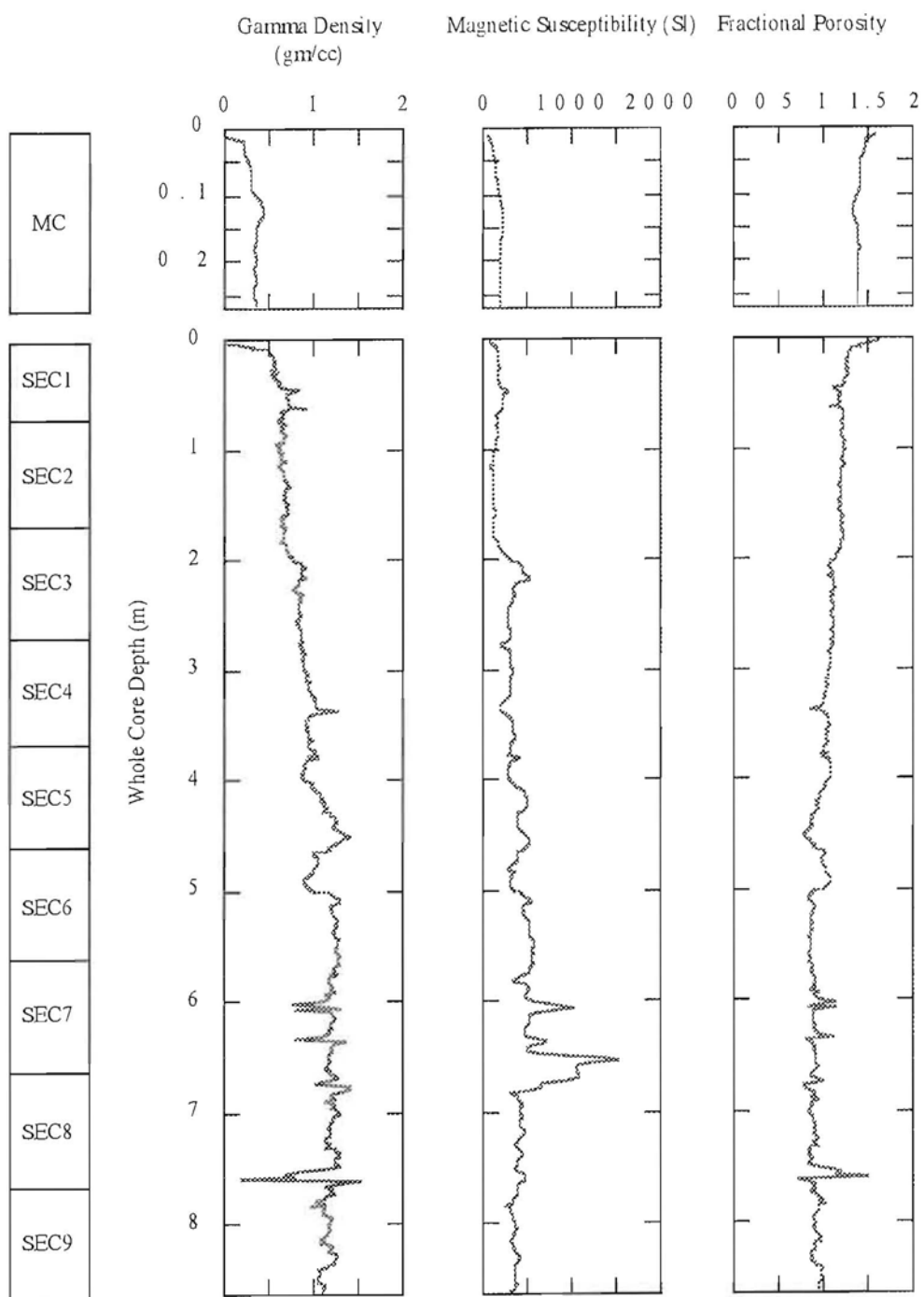


Fig.11 MR00-K03 PC-01&MC-02 Physical Properties

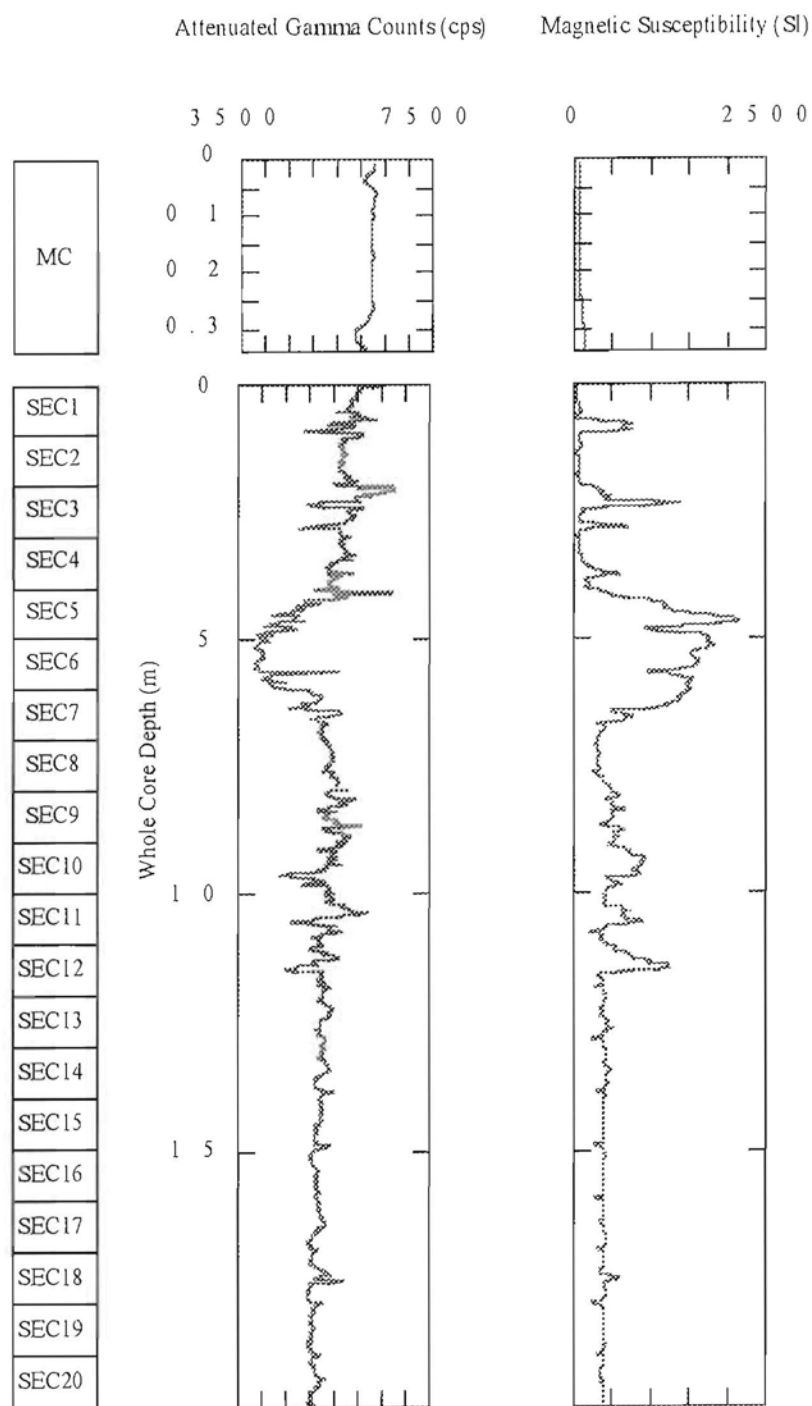


Fig.12 MR00-K03 PC-02&MC-03 Physical Properties (RAW DATA)

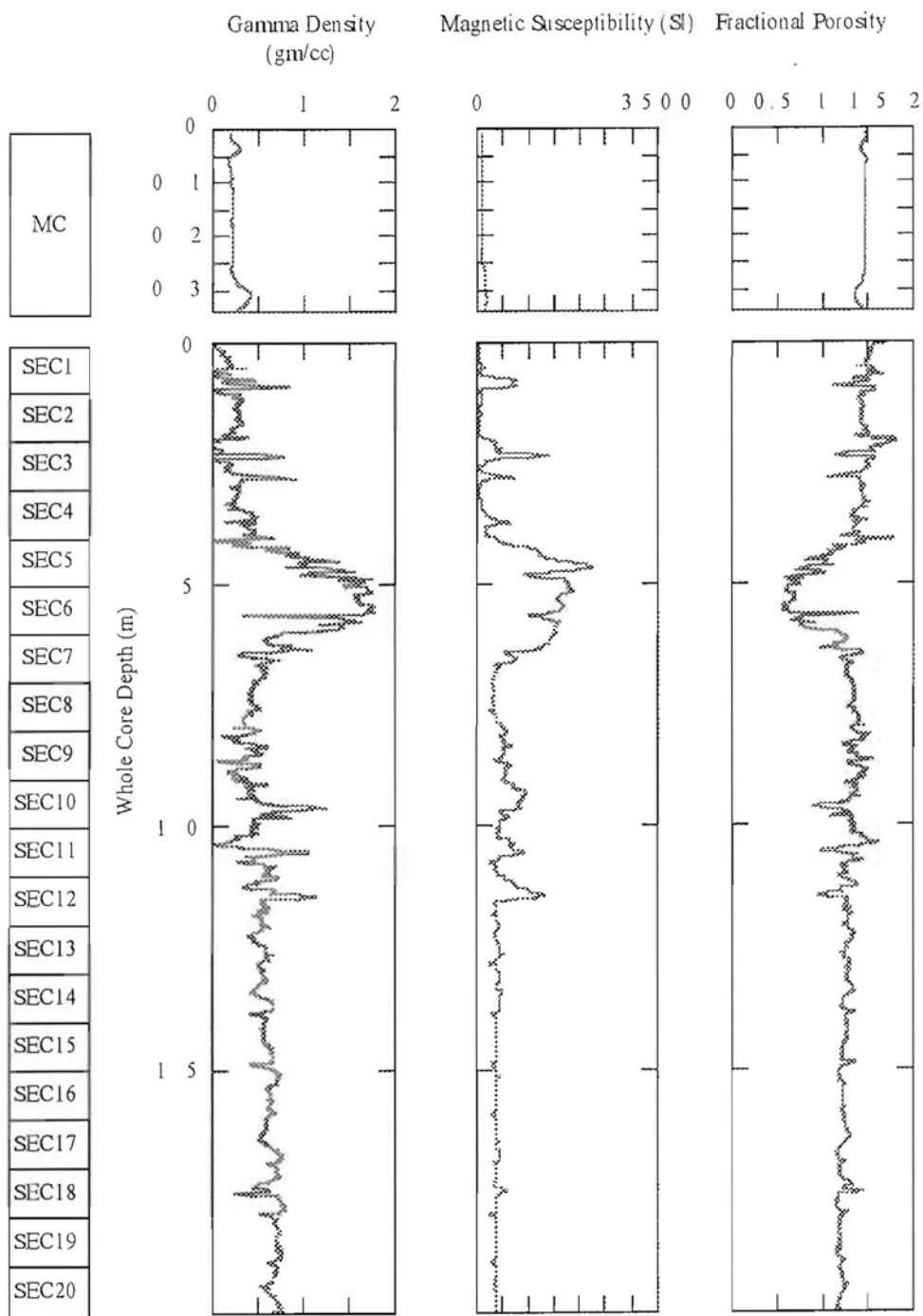


Fig.13 MR00-K03 PC-02&MC-03 Physical Properties

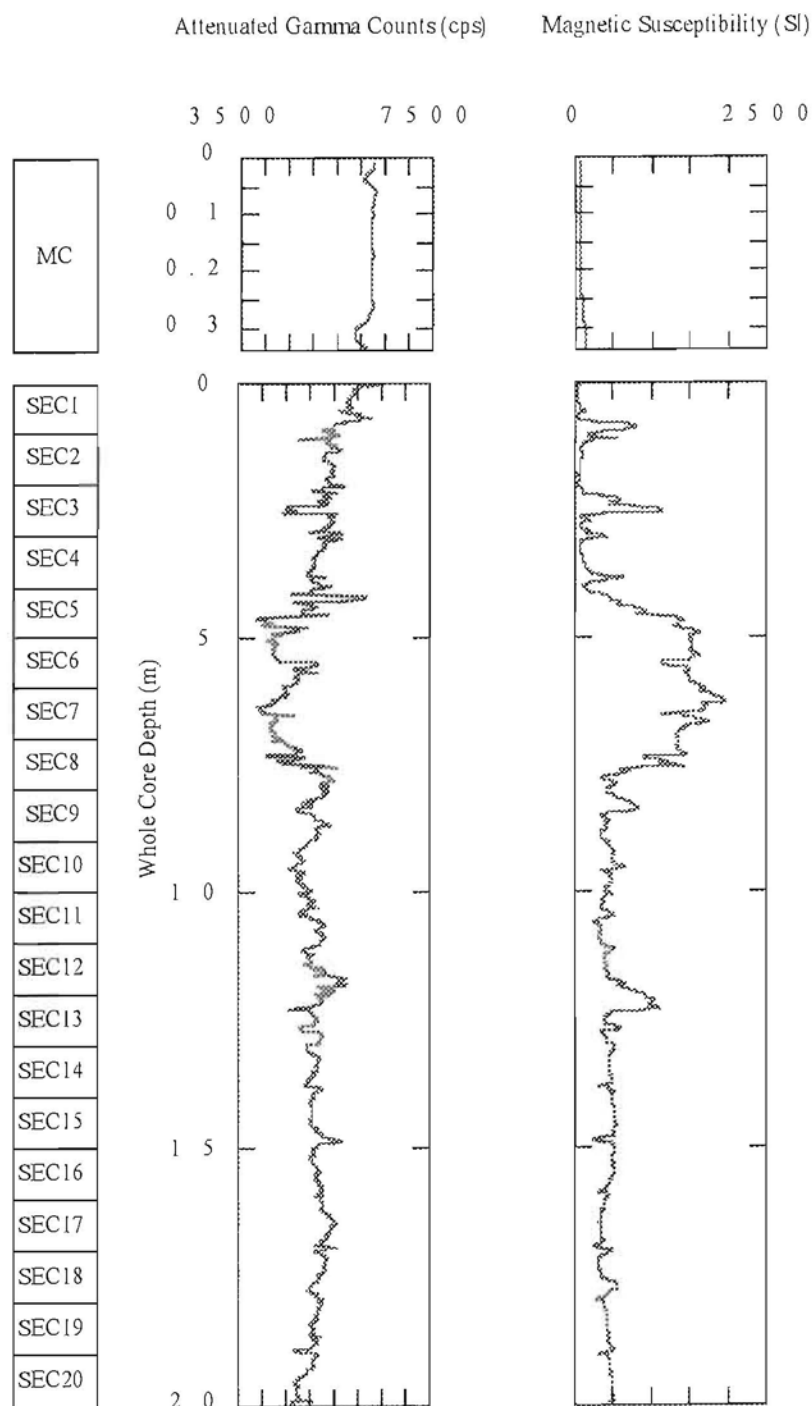


Fig.14 MR00-K03 PC-03&MC-03 Physical Properties (RAW DATA)

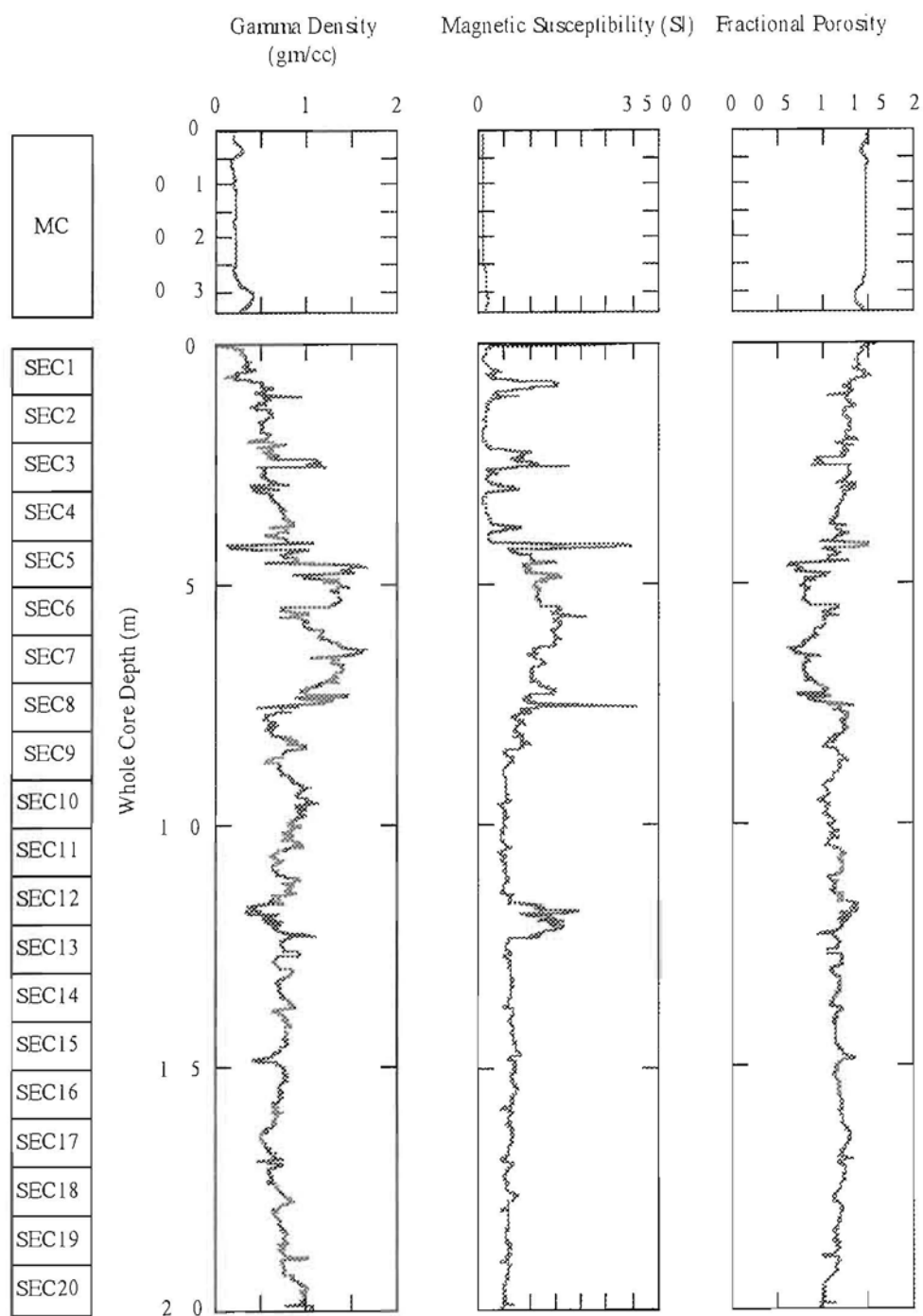


Fig.15 MR00-K03 PC-03&MC-03 Physical Properties

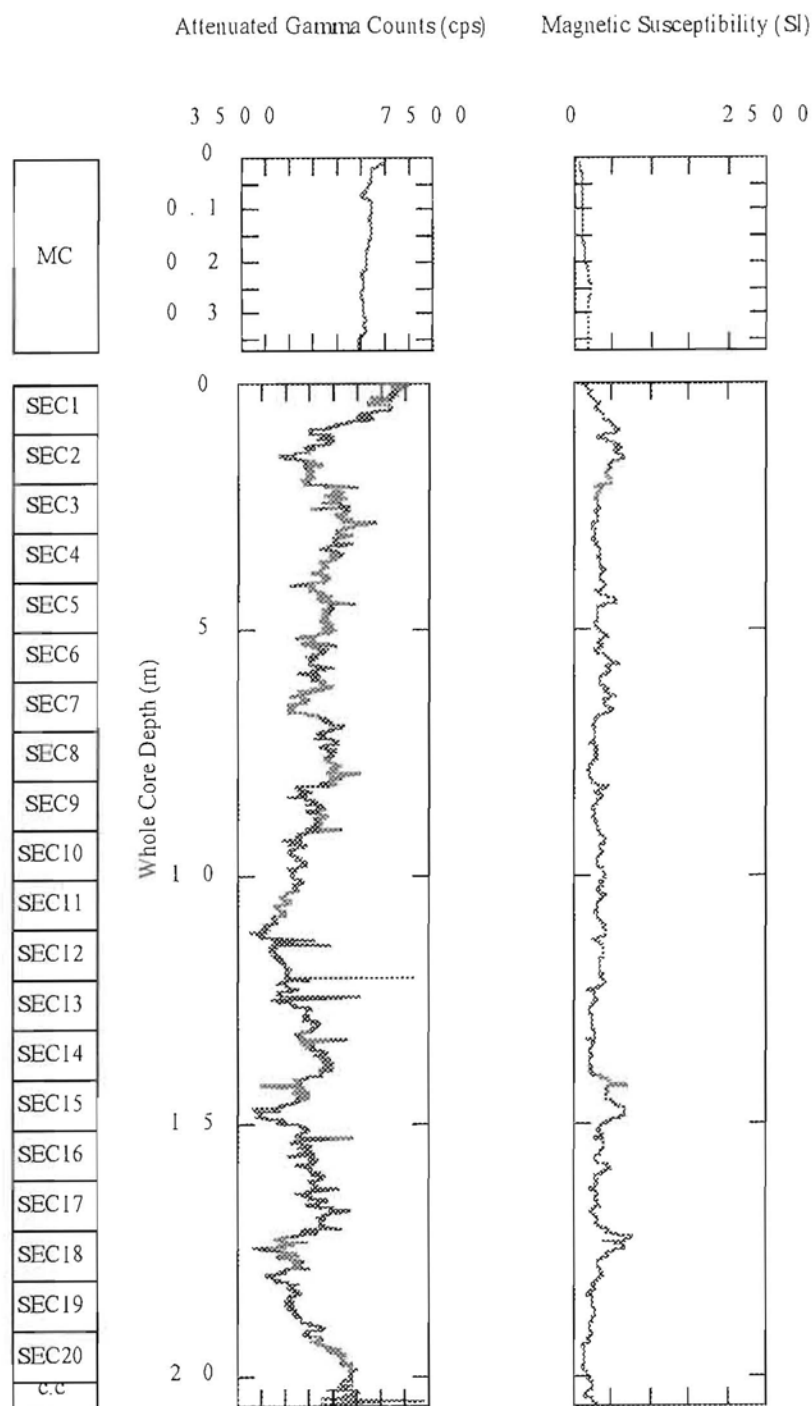


Fig.16 MR00-K03 PC-04&MC-04 Physical Properties (RAW DATA)

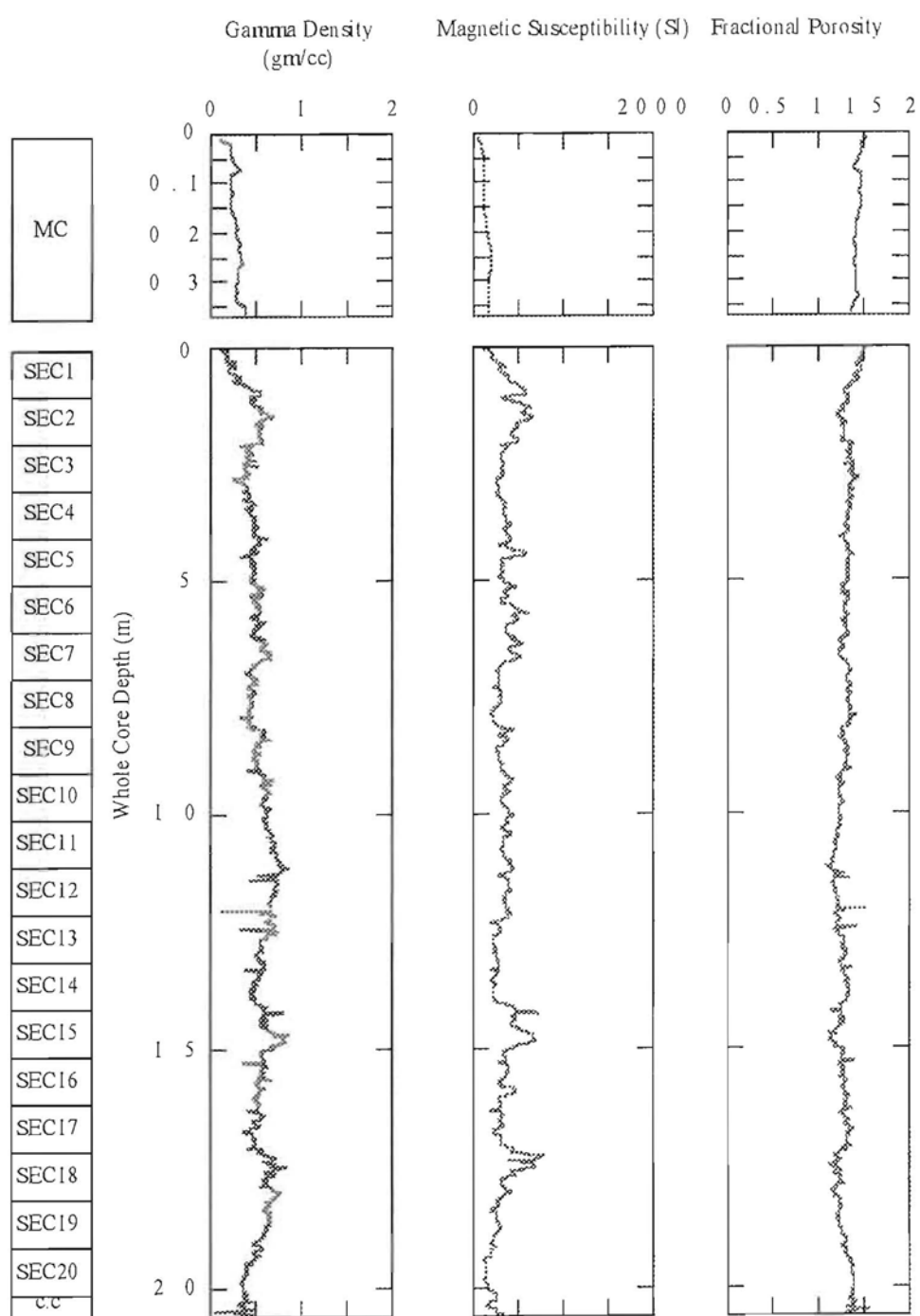
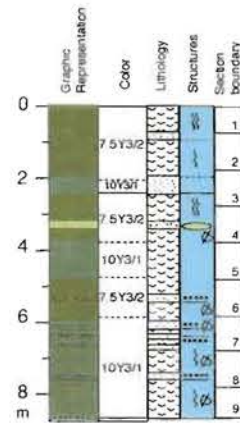


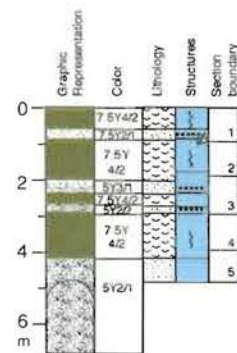
Fig.17 MR00-K03 PC-04&MC-04 Physical Properties

Visual description summary of Cores in MR00-K03 Cruise

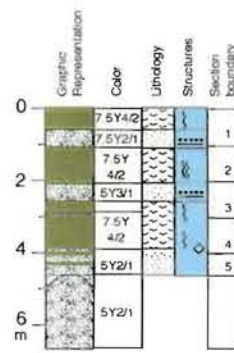
Piston Core
PC-01



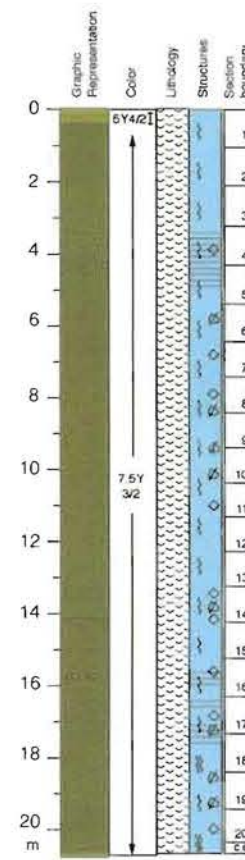
Piston Core
PC-02



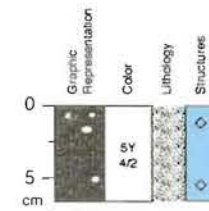
Piston Core
PC-03



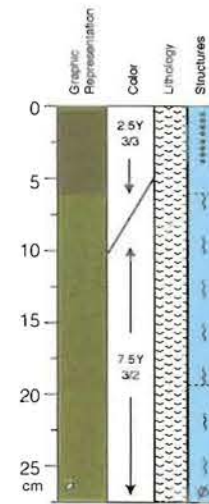
Piston Core
PC-04



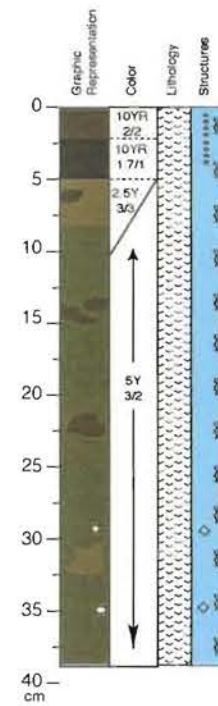
Multiple Core
MC-01



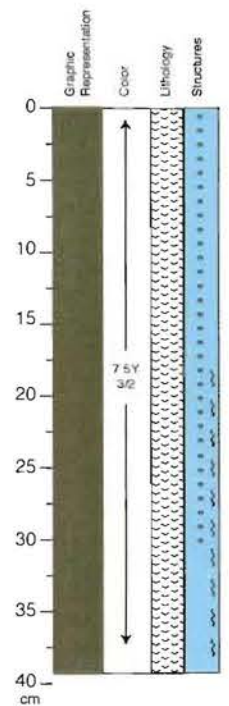
Multiple Core
MC-02



Multiple Core
MC-03



Multiple Core
MC-04



Sedimentary Structure Symbols

	Soupy sediment		Isolated pebbles
	Slightly disturbed		Shell fragment
	Planar laminae		Wood fragment
	Lenticular laminae/beds		Slightly bioturbated
	Graded bedding (normal)		Moderately bioturbated
	Graded bedding (reversed)		Diatomaceous Clay
	Sharp contact		Fine Sand
	Gradational contact		Medium Sand
			Volcanic Ash / Tuff

3.16.1. Atmospheric oxygen/nitrogen ratio measurement

Yukihiro Nojiri (CREST/NIES)

Atmospheric oxygen concentration varies by the photosynthetic/respiration activity of land biota, combustion of fossil fuel and oceanic gas exchange. It has confirmed that the atmospheric oxygen concentration (usually measured as the oxygen/nitrogen ratio) is decreasing because of the recent anthropogenic use of fossil fuel (Keeling and Shertz, 1992). If it assumes the constant oceanic role for the atmospheric oxygen concentration change, the proportion of land and oceanic uptake of anthropogenic CO₂ can be deduced.

Accordingly, US group already started the monitoring of atmospheric oxygen concentration change using their flask net work sites of various background monitoring stations in the world. The secular trend of the oxygen concentration is the key factor that deduces the land/ocean uptakes. High frequency measurement will give detailed change of the atmospheric oxygen concentration and also will give accurate data for the secular trend. The spatial atmospheric distribution will also give the detailed knowledge of the terrestrial and oceanic exchange of oxygen. The use of VOS (volunteer observation ship), like trans-ocean cargo ship, is the most feasible way to have atmospheric north/south gradient of the atmospheric component with seasonal coverage.

The newly developed method of atmospheric oxygen measurement by NIES (Tohjima, 2000) is a robust measurement system which will be applicable on board measurement. We tried the on board use of our proto-type system in this cruise, to test the feasibility of oxygen measurement by our gas chromatograph system.

Measurement System

The system consists of an automated gas chromatograph, air sampling unit, cryogenic trap (Figure 1). The atmospheric CO₂ was simultaneously monitored by a NDIR. The air was taken from bridge deck via stainless tube of 1/4' diameter. The air and standard air were injected every 5 minutes alternatively. The air and standard air were dehydrated by -50°C and -70°C traps. The total flow of the air was approximately 40 mL/min and supplied to gas chromatograph injector (8mL/min) and CO₂ measurement system (30mL/min). The gas chromatograph separates O₂+Ar and N₂. The peak area by the gas chromatograph detector (TCD) was monitored by a gas chromatographic integrator. The O₂+Ar and N₂ were separated. The calculation of O₂/ N₂ ratio assumes the constant abundance of Ar in the atmosphere. The automatic gas chromatograph system controls the injection sequence and also the logging of the data.

The O₂/ N₂ ratio have to compare with the atmospheric CO₂ concentration. A simple NDIR system with computer logging facility was devoted to the monitor of the atmospheric CO₂ concentration.

Results

Figure 2 shows the results of atmospheric O₂/N₂ ratio and CO₂ concentration. The atmospheric O₂ concentration increases during May and June because of the photosynthetic activity of land atmosphere. The increase observed late May and early June should reflect the background atmospheric trend. However, the O₂/ N₂ ratio vs. CO₂

concentration relationship showed a large contribution of oceanic emission of the oxygen, because of the high productivity of the area where we occupied in the cruise.

Generally the reproducibility of the gas chromatographic system was in satisfaction. The maritime air contains nearly saturated water vapor pressure. The initial trap of -50°C was saturated no longer than 2 days, and it was necessary to change the glass cryogenic trap every day. It was revealed the necessity of improvement of easiness of trap exchange.



Figure 1. Measurement system for atmospheric O₂/ N₂ ratio on board Mirai. The system includes an automated gas chromatograph, sample injector, cryogenic traps, and NDIR for atmospheric CO₂ measurement.

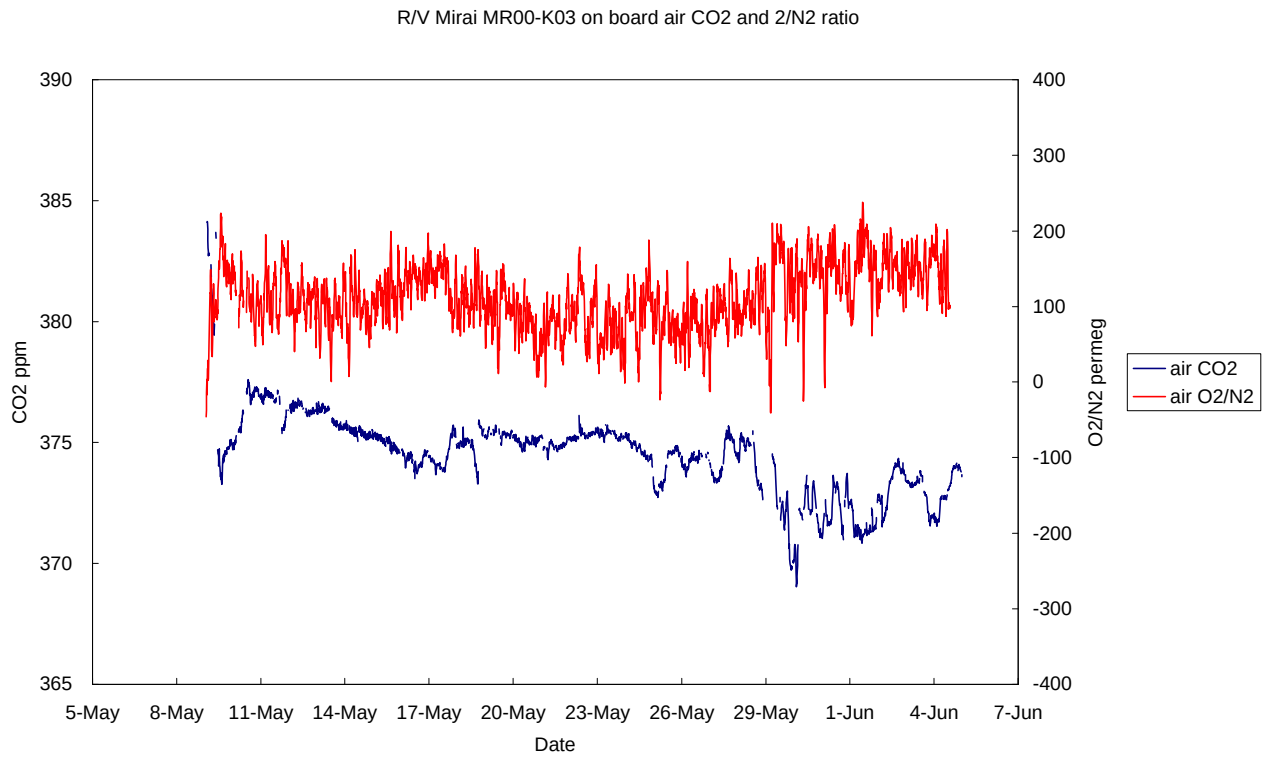


Figure 2. Atmospheric O₂/N₂ ratio (red, per meg) and CO₂ concentration (blue, ppm) observed in MR00-K03 cruise.

3.16.2 Aerosol and rain

Mitsuo Uematsu (Ocean Research Institute, The University of Tokyo)

Kazutake Ohta (Ocean Research Institute, The University of Tokyo / Japan Science and Technology Corporation)

Introduction

Tropospheric aerosols are important in the global radiation budget through reflection and absorption of solar radiation (direct forcing), and through the modification of optical properties and the lifetime of clouds (indirect forcing). Global geographical and seasonal distributions of tropospheric aerosols have attracted considerable attention during the past several decades. Especially, the importance of the western North Pacific region has been recognized in the recent studies, due to the long-range transport of anthropogenic and terrestrial aerosols from East Asia to the remote ocean.

In order to investigate the chemical and physical properties of marine aerosols over the western North Pacific Ocean, the measurements and sampling of atmospheric aerosols have been carried out. Simultaneously, the concentration of ozone, which is a good indicator of air masses in marine boundary layer, has been measured. In addition, rainwater, fog water and seawater samples were collected during this cruise.

Experimental

The concentrations of carbonaceous species in aerosols were measured for every 2 hours by using an Ambient Carbon Particulate Monitor (Rupprechet & Patashnick Co. Inc., Model 5400). The instrument can measure both the organic and elemental carbon in aerosols by a thermal analysis technique. Organic carbon was measured by combustion at 340°C, and then total carbon was measured at 750°C. The difference of the amounts of the total and organic carbon gives the amount of elemental carbon. Particle number distribution was measured with 5 size ranges (0.10, 0.15, 0.20, 0.30, 0.50 $\mu\text{m} < d$) by a particle counter (RION, model KC-18) for every 15 min. Ozone concentration was measured every 12 seconds by an ozone monitor (Dylec, model 1150). The inlets of air were located on the compass deck (about 17m above the sea surface).

To analyze chemical components in aerosols, atmospheric aerosols were collected by using aerosol samplers. Bulk aerosol samples were collected for about 24 hours periods on cellulose acetate filters (Whatman 41) by a high-volume air sampler (Kimoto Electric Co. Inc., Model SS-1003A). Size-fractionated aerosols were collected on quartz

fiber filters (Pallflex 2500QAT-UP) and on cellulose acetate filters (Whatman 41) by a high-volume virtual impactor (Kimoto Electric Co. Inc., Model AS9) and a low-volume impactor, respectively, at 2 day intervals. In order to avoid contamination from ship exhaust, all aerosol samplers were automatically controlled by a wind sector to start sampling only when the relative wind direction ranged from -90° to 90° of the bow and the relative wind speed was higher than 1.0m/s. The collections of aerosols were carried out on the compass deck. After collections, the samples collected on cellulose acetate filters were stored at 5°C and the samples collected on quartz fiber filters were stored at -20°C prior to analysis.

Rainwater samples were collected in a PTFE bottle using a PTFE-coated funnel on the compass deck. Fog water samples were collected in a polypropylene bottle using a fog sampler (Usui kogyo kenkyusho Co. Ltd., Model FWG-400) on the compass deck. After collections, the value of pH and electrical conductivity were measured, and samples were filtered to separate filtrate and residue immediately. The filtrate was stored in both polypropylene bottles (at 5°C) and glass bottles (rainwater only, at -20°C), and residue was stored with filter paper (at 5°C).

Seawater samples were collected with Niskin sampling bottles from 7 layers (10, 50, 100, 500, 1000, 2000 and 5000m) at Stn. KNOT2. Surface seawater samples were collected using plastic bucket at Stn. KNOT1-S, KNOT1, 6, 7, 8, 9, 10, 12, 13, KNOT2, 18, 17, 19, 22, 21, 16, 15 and 14). These samples were filtered by Nuclepore filter (pore size: $0.40\text{ }\mu\text{m}$) and then the residue on filters were stored at 5°C .

Results

As an example, raw concentrations of carbonaceous particles were shown in Figure 1. The data can be used for further discussions after the elimination of data during the contaminated periods.

Future plan

Aerosol samples, rainwater samples, fog water samples and seawater samples will be analyzed for major inorganic ions or organic compounds. After the determination of data quality, the separation of air masses will be attempted by the meteorological data observed on the ship. And it is interesting to compare the data obtained during this cruise with past cruise over the same region, e.g., MR98-K01 and MR99-K02. It may be possible to discuss the geographical characteristics of the chemical properties of atmospheric aerosols and the influence of air mass history and meteorological conditions to the aerosol chemistry over the western North Pacific Ocean.

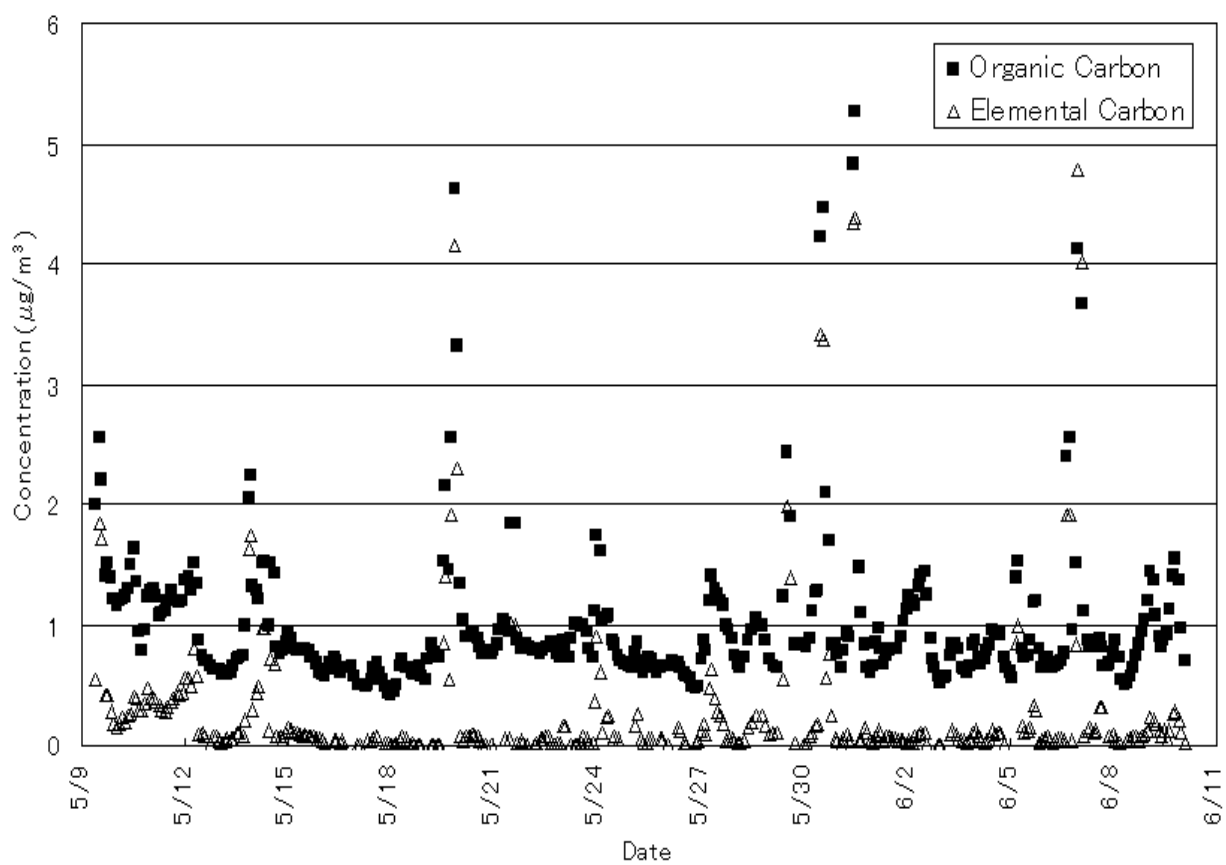


Figure 1 Temporal variation of carbonaceous aerosol concentrations.

3.17.1 Partial pressure of CO₂ (pCO₂) in the atmosphere and sea surface

Mikio Kitada (MWJ)

Akihiko Murata (JAMSTEC)

Concentrations of CO₂ in the atmosphere and the sea surface were measured continuously during the entire cruise by an automated system with a non-dispersive infrared (NDIR) analyzer (BINOSTM). It runs on one and half hour cycle during which four standards, an ambient air sample, and a headspace sample from an equilibrator were analyzed.

Ambient air sample taken from the bow is introduced into the IR through a mass flow controller which controls the air flow rate at about 0.5L/min, a cooling unit, a perma pure dryer, and a desiccant holder (Mg(ClO₄)₂).

The equilibrator has shower head space in the top through which surface water is forced at a rate of 5-8L/min. Air in the head space is circulated with an air pump at 0.5-0.8L/min in a closed loop through two cooling units, a perma pure dryer, and the desiccant holder.

For calibration, compressed gas standards with nominal mixing ratios of 270, 329, 360, 410, and 441ppmv (parts per millions by volume) were used.

3.17.2. Continuous pCO₂ measurement

Yukihiro Nojiri (CREST/NIES)

The surface seawater pCO₂ is controlled by the percentage of gaseous carbon dioxide concentration to its solubility in seawater. The four major controlling mechanisms of oceanic pCO₂ are SST (surface seawater temperature), biological activities (photosynthesis and decomposition of organic matter), vertical mixing and gas exchange.

Because the oceanic pCO₂ varies with time and space, the response time of the underway measurement on board a ship should be as short as possible. The popular types of pCO₂ systems are using showerhead type equilibrator. Because it usually has large ratio of air to water in the equilibrator, the system needs circulating pass to achieve the gas-water equilibrium to have enough contact with gas and seawater. This usually makes the response time of the pCO₂ measurement in the order of hour. The oceanic pCO₂ sometimes changes very sharply with the rapid change of SST at frontal regions. Sharp spatial change is also observed in the spring bloom season, when the patch of highest productivity is commonly observed in the subarctic and coastal regions.

In the MR00-K03 cruise, biological draw down of pCO₂ was observed in the Oyashio region and the draw down was highly patchy. Our quick response pCO₂ system revealed the detailed spatial variability of pCO₂. Additionally, we observed the degree of oxygen saturation in the surface water using gas sensor applied for the equilibrator effluent gas. The purpose of the oxygen measurement was the analysis of relationship between the biological activity, which produces dissolved oxygen, and pCO₂.

Method

The surface seawater taken from the sea chest of R/V Mirai was supplied to an air-liquid equilibrator having Tandem design, which is a combination of bubbling and mixer equilibrators. Seawater is supplied from the inlet locating the top of the equilibrator and run down. As the inlet diameter is 20 mm, it is never clogged by plankton and nekton. Cylinder air having natural CO₂ concentration is supplied from the bottom of the bubbling equilibrator at 350 ml/min flow rate and ascends in the cylindrical tube. The air is equilibrated to the CO₂ concentration in seawater at the overflow surface of the cylindrical tube. Because of the surface tension in the bubbling air makes the inside pressure of air bubble increase, the resulted pCO₂ of the bubble has slightly lower pCO₂ than the true seawater pCO₂, which is estimated about 0.8 % of the total pCO₂ in seawater. The supplied air then pass through the mixer equilibrator with a splasher inside. The air is accurately equilibrated by the second equilibrator and then flow out from the equilibrator. 200 ml/min of the air overflows at a separator, and 150 ml/min of the air is aspirated to a CO₂ measurement system with NDIR.

The NDIR is calibrated with 4 working standard gases having 270, 320, 390, and 450 ppm of CO₂ in air. The working standard gases have already been critically calibrated against NIES-95 standard gas scale. The calibration was done at 0 and 12 of GMT. The calibration takes 40 minutes and atmospheric CO₂ was measured after each calibration for 10 minutes. The NDIR output signal was logged with 10 seconds interval for standard gases and with 1 minute interval for atmosphere and seawater measurement.

Then, we had 2 series of 670 minutes (11 hour and 10 minutes) of continuous pCO₂ measurement of 1 minutes data logging in a day.

The NDIR mV output are corrected with pressure effect with pressure gage at the outlet of NDIR cell and then calibrated by the standard gas readings.

Additionally, we installed an air-oxygen monitor using paramagnetic sensor. The effluent gas from CO₂ NDIR was introduced to the sensor cell and the oxygen concentration was measured. The oxygen concentration was calibrated using the ambient air which was introduced 2 times/day.

Result

In Figure 1, the spatial distribution of pCO₂ for the all cruise was shown. It was found large pCO₂ draw down by phytoplankton blooming in adjacent area of Kuril Islands. In Sea of Okhotsk, the draw down was smaller. In early and mid May, there observed high pCO₂ region, which keeps the winter pCO₂ value.

In the cruise we visited station KNOT four times including 3 visits with hydrocast and 1 visit sailing from south to north. Figure 2 shows the pCO₂ of each visit with spatial variability. Data were extracted for 3 locations (KNOT, KNOT-north and KNOT-south). Generally pCO₂ decreased with time. In this season, the surface mixed layer stability increases with the thermocline shallowing. The surface biology, using nutrients and inorganic carbon, produces organic particulate, which sink down into the deeper layer. This reduces the surface pCO₂. The timing of the decrease was different for the three locations. The spatial variability of pCO₂ around station KNOT was far smaller than the area of phytoplankton blooming.

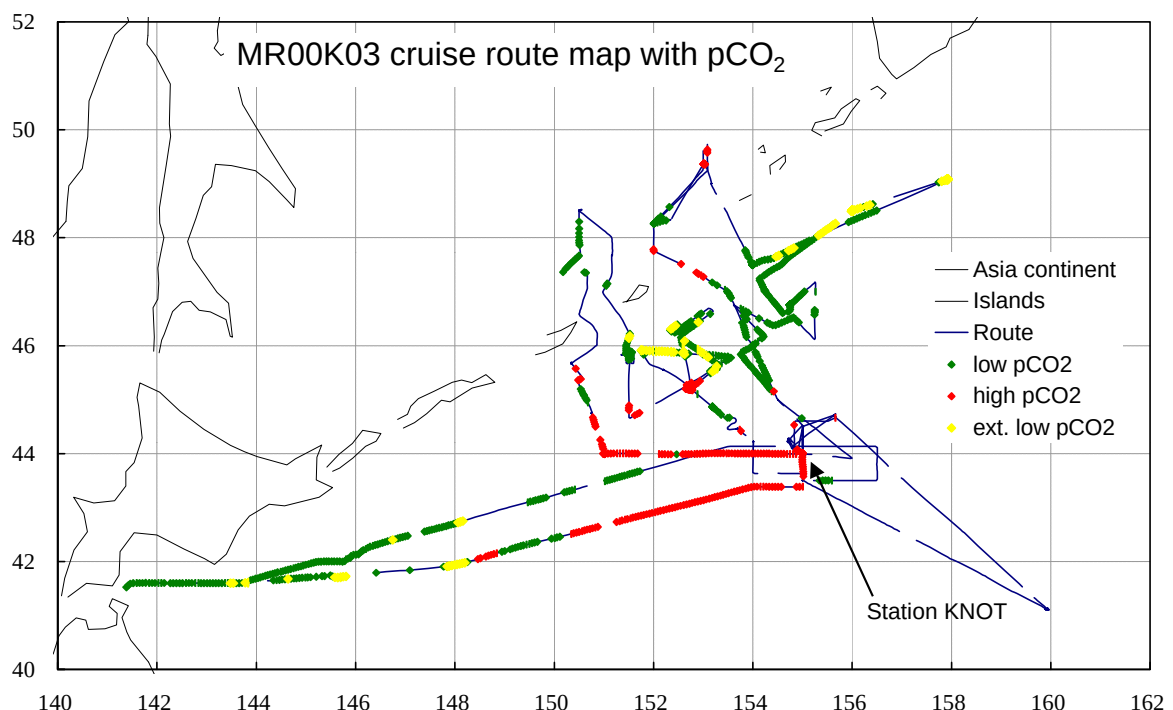


Figure 1, Distribution of pCO₂ along the MR00-K03 cruise route

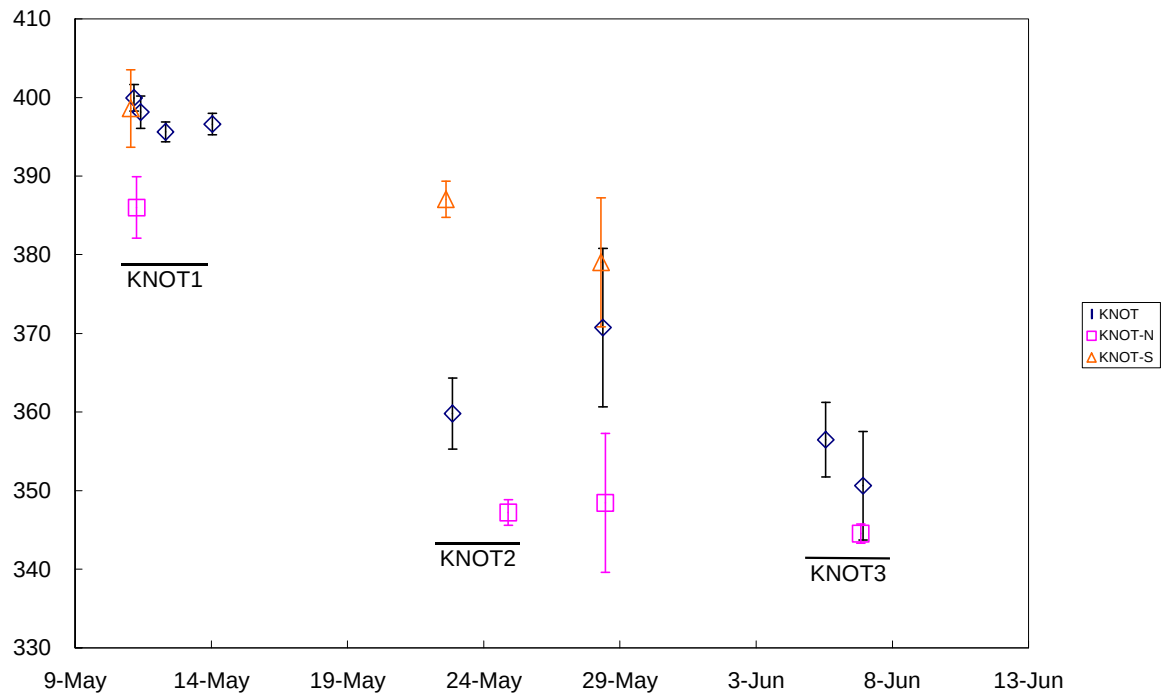


Figure 2, Observed pCO₂ and its spatial variability around station KNOT, KNOT-north and KNOT-south. Data were extracted from nearby each stations with ± 0.1 degree in longitude and latitude.

A example of relationship between pCO₂ and oxygen saturation is shown in Figure 3. The atmospheric oxygen level is the broken line, which varies mainly by the change of atmospheric pressure. The oxygen saturation can be calculated from the ratio to atmospheric oxygen, which is stable compare to the variation of seawater oxygen. The equilibrator efficiency can be calibrated by oxygen titration results.

It was clearly shown the anti-correlation between pCO₂ and oxygen saturation, which is the results of biological productivity in the surface mixed layer. Using the difference in gas exchange rates between CO₂ and oxygen, it may be possible to estimate the history of productivity in the surface mixed layer.

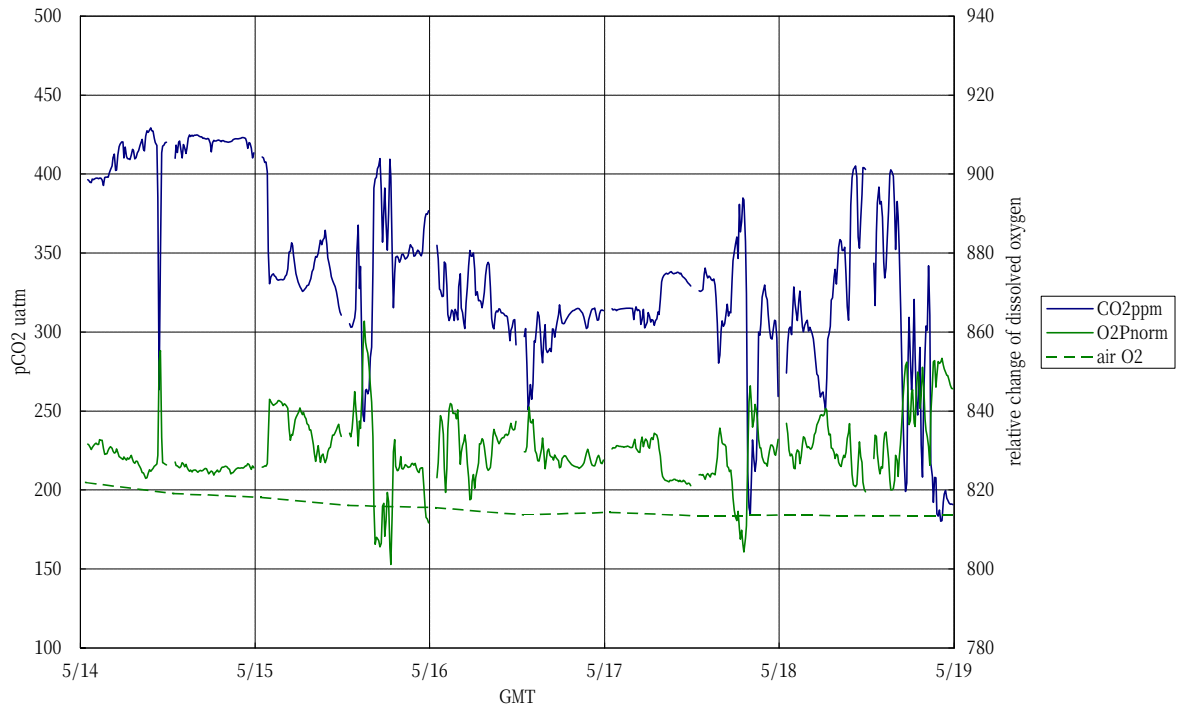


Figure 3, Example of surface seawater pCO₂ and oxygen concentration. 5 day results including station KNOT (May 14) and Sea of Okhotsuk. Oxygen concentration is relative response of gas sensor, to which seawater equilibrated air was supplied. Broken line is the sensor response by atmospheric oxygen. The equilibrated air response divided by atmospheric oxygen response can be converted to seawater oxygen saturation.

3.17.3 Salinity, temperature, DO and fluorescence

Katsunori Sagishima (Marine Works Japan LTD)

Takayoshi Seike (Marine Works Japan LTD)

(1) Introduction

Sea surface temperature, salinity, dissolved oxygen, fluorescence and plankton were measured along the ship's track with integrated monitoring system of surface seawater.

(2) Methods

This system can measure temperature, salinity, dissolved oxygen, fluorescence and particle size of surface water continuously on real time. The system was installed in the sea surface monitoring laboratory on this ship. Surface water is pumped up to the laboratory and flowed through a vinyl-chloride pipe. The flow rate is measured with two flow meters and each values were checked everyday.

The data obtained are stored in a hard disk of a computer every one minute. The measured duration was from 10 May to 9 June, 2000.

Specifications of the sensors were listed below.

a) Temperature and Salinity sensor

SEACAT THERMOSALINOGRAPH

Model: SBE-21, SEA-BIRD ELECTRONICS, INC.

Serial number: 2113117-2088

(Temperature sensor is first, Salinity is second)

Measurement range: -5 to $+35^{\circ}\text{C}$, 0 to 6.5 S m^{-1}

Accuracy: 0.01°C 6 month^{-1} , $0.001\text{ S m}^{-1}\text{ month}^{-1}$

Resolution: 0.001°C , 0.0001 S m^{-1}

b) Dissolved Oxygen sensor

Model: 2127, Oubisufair Laboratories Japan INC.

Serial number: 31757

Measurement range: 0 to 14 ppm

Accuracy: $\pm 1\%$ at 5°C of correction range

Stability: $1\%\text{ month}^{-1}$

c) Fluorometer

Model: 10-AU-005, TURNER DESIGNS

Serial number: 5562 FRXX

Detection limit: 5 ppt or less for chlorophyll a

Stability: 0.5% month⁻¹ of full scale

d) Particle Size sensor

Model: P-05, Nippon Kaiyo LTD.

Serial number: P5024

Measurement range: 0.02681 mm to 6.666 mm

Accuracy: ±10% of range

Reproducibility: ±5%

Stability: 5% week⁻¹

e) Flow meter

Model: EMARG2W, Aichi Watch Electronics LTD.

Serial number: 8672

Measurement range: 0 to 30 l min⁻¹

Accuracy: ±1%

Stability: ±1% day⁻¹

(3)Preliminary Results

The data were obtained every ten minutes while R/V Mirai was steaming. Preliminary data of salinity, temperature, fluorescence and dissolved oxygen at sea surface, when R/V Mirai passed through the Bussol Strait and the Kruzenshterna Strait, are shown in Figs.3.17.3-1 - 3.17.3-4. Figures and their corresponding sampling location and time are as follows: Fig.3.17.3-1(St.7 → St.8 on 16 May [UTC]), Fig.3.17.3-2 (St.9 → St.10 on 17 May[UTC]), Fig.3.17.3-3 (St.14 → St.17 on 28/29 May [UTC]), and Fig.3.17.3-4 (St.17 → St.19 on 31 May[UTC]).

(4)Data archive

The data were stored on a magnetic optical disk, which will be kept in Ocean Research Department, JAMSTEC.

(5)Other remarks

The instruments were in maintenance for the following periods.

File name	Time(JST)	Time(UTC)
20000531	5/31 07:43 - 20:59	5/30 22:43 - 23:02
20000601	6/2 03:32 - 03:40	6/1 18:32 - 18:40

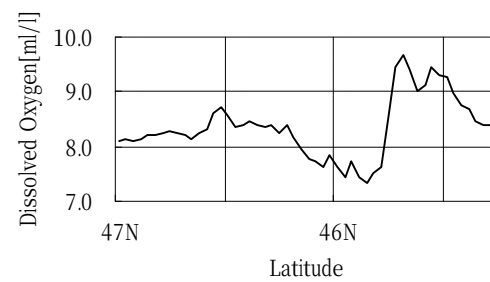
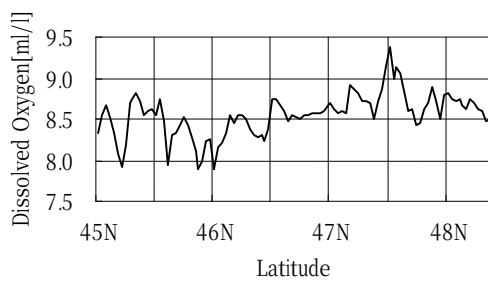
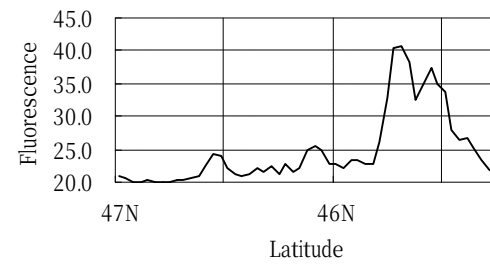
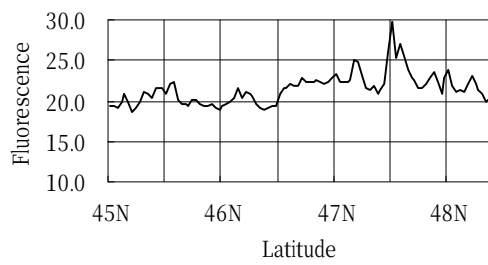
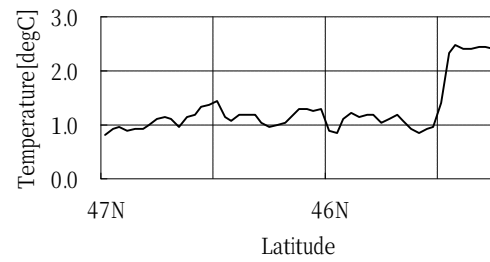
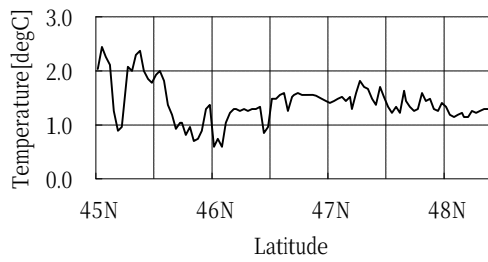
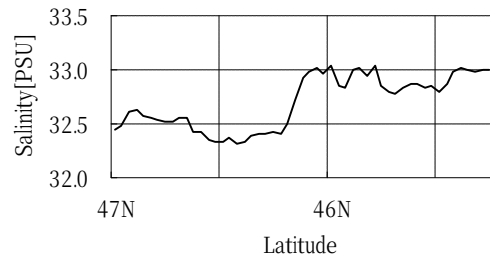
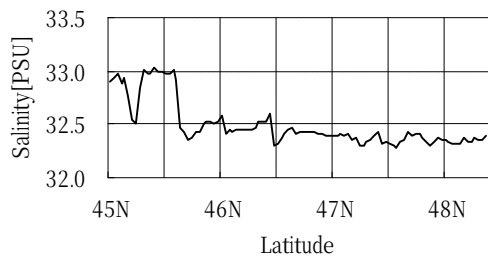


Fig3.17.3-1: Latitudinal distribution of saity, sea surface temperature, fluorescence and dissolved oxygen from St.7 to St.8. Fig3.17.3-2: Latitudinal distribution of saity, sea surface temperature, fluorescence and dissolved oxygen from St.9 to St.10.

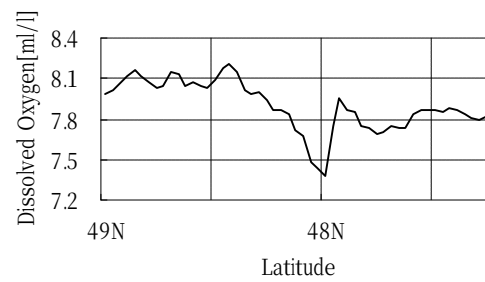
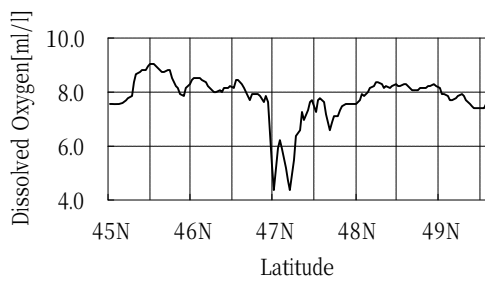
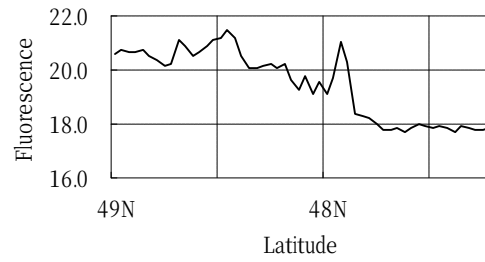
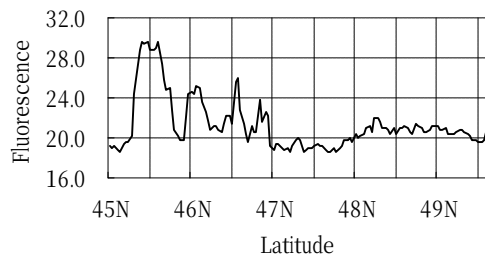
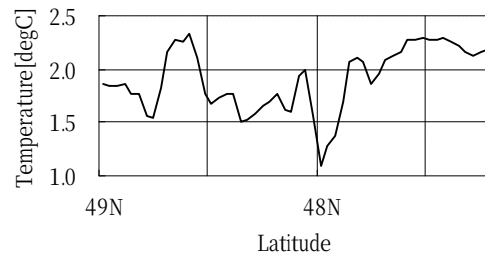
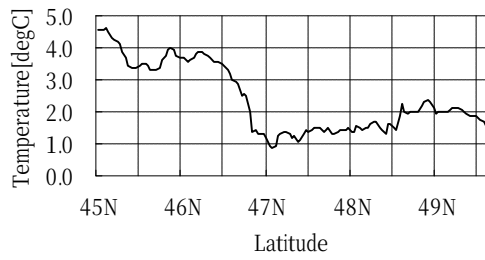
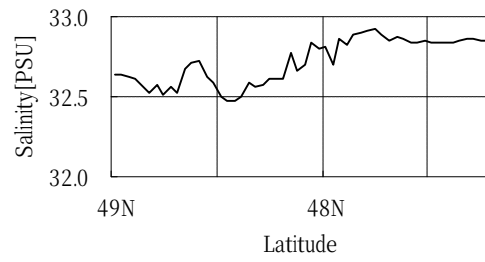
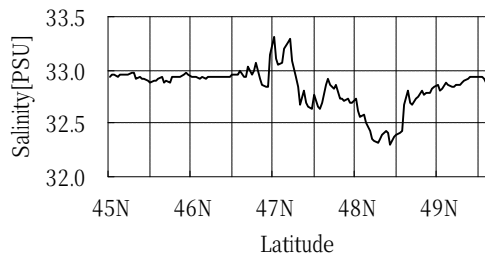


Fig3.17.3-3: Latitudinal distribution of saity, sea surface temperature, fluorescence and dissolved oxygen from St.14 to St.17.

Fig3.17.3-4: Latitudinal distribution of saity, sea surface temperature, fluorescence and dissolved oxygen from St.17 to St.19.

3.17.4 Nutrients monitoring in sea water

(1) Personnel

Shinichiro Yokogawa	(MWJ): Operation leader
Kenichiro Sato	(MWJ)
Chizuru Saito	(JAMSTEC)

(2) Objectives

To investigate the distribution of nutrients in surface seawater, we use this monitoring system during MR00-K03 cruise.

(3) Parameters

- Nitrate
- Nitrite
- Silicate
- Phosphate

(4) Methods

The nutrients monitoring system was performed on BRAN+LUEBBE continuous monitoring system Model TRAACS 800 (4 channels). It was located at the surface seawater laboratory for monitoring in R/V Mirai. The seawater of 4.5-m depth under sea surface was continuously pumped up to the laboratory inner R/V Mirai. The seawater was poured in 5 L of Pyrex glass beaker through a faucet of the laboratory. The seawater was introduced direct to monitoring system with narrow tube continuously. The methods are as follows:

Nitrate + Nitrite: Nitrate in the seawater was reduced to nitrite by reduction tube (Cd-Cu tube) and the nitrite reduced was determined by the nitrite method described to next, but the flow cell used in nitrate analysis was 3 cm length type. Nitrite initially present in the seawater was corrected after measuring.

Nitrite: Nitrite was determined by diazotizing with sulfanilamide by coupling with N-1-naphthyl-ethylenediamine (NED) to form a colored azo compound, and by being measured the absorbance of 550 nm using 3 cm length flow cell in the system.

Phosphate: Phosphate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex, and by being measured the absorbance of 800 nm using 5 cm length flow cell in the system.

Silicate: Silicate was determined by complexing with molybdate, by reducing with ascorbic acid to form a colored complex, and by being measured the absorbance of 800 nm using 3 cm length flow cell in the system.

(5) Calibration

To calibrate the monitoring nutrient data, 22 water samples were collected from the same sample line of this monitoring system and they were analyzed by TRAACS 800 (4 channels) system when we measured routine samples. We got the equations by the least squares method to minimize the difference between monitoring data and TRAACS data. The equations are as follows:

Nitrate+Nitrite: $y=0.9524x-0.4614$

Nitrite: $y=1.0071x-0.0078$

Phosphate: $y=1.0212x-0.0908$

Silicate: $y=0.9415x+0.3896$ (x: monitoring data)

.

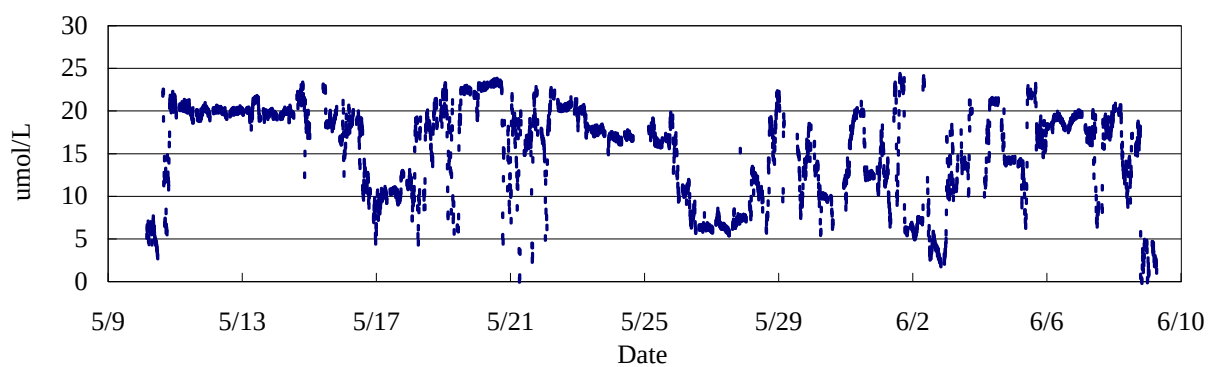
(6) Preliminary results

Sea surface nutrient concentrations were monitored during the MR00K03 cruise, from Sekinehama to Sekinehama. Monitoring data was obtained every 1 minute. Preliminary data of every 10 minutes, recalculated by the above equations, were shown in Fig. 3.17.4.

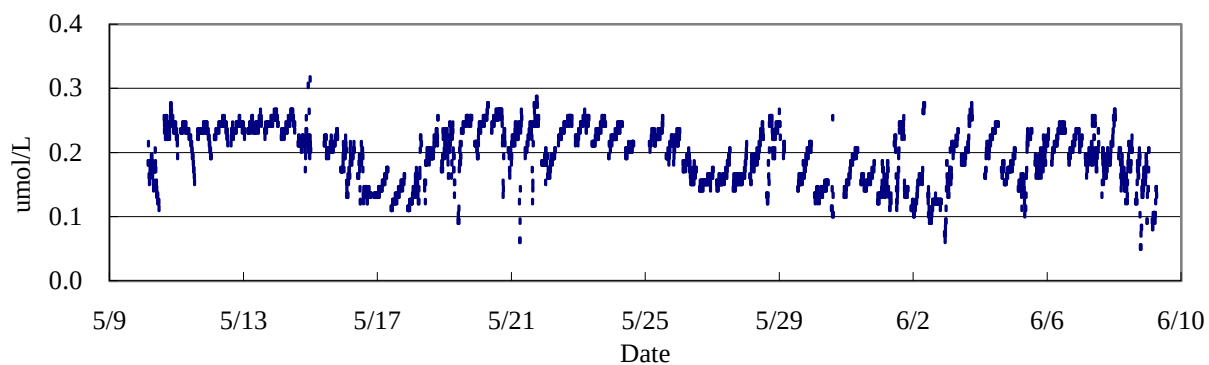
(7) Data archive

All data will be archive at JAMSTEC Data Management Office.

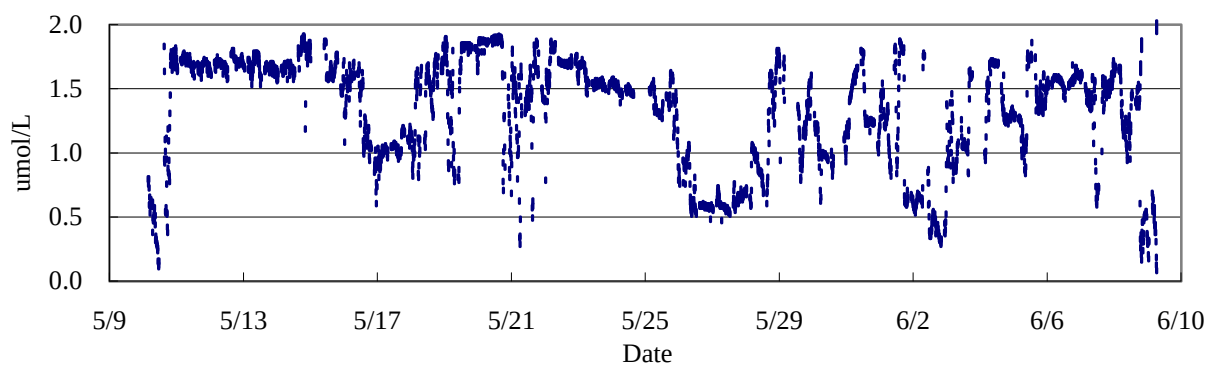
(a) nitrate + nitrite



(b) nitrite



(c) phosphate



(d) silicate

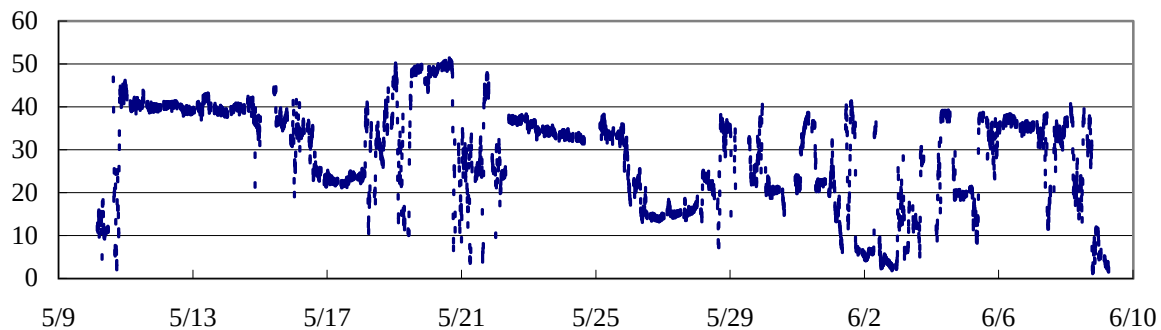


Fig.3.17.4 Seasurface nutrient concentrations

3.18 XBT and XCTD observations

Vyacheslav LOBANOV and Igor ZHABIN

(Pacific Oceanological Institute, Far Eastern Branch, Russian Academy of Sciences)

1. Introduction

The XBT and XCTD observations were implemented to obtain mesoscale structure of water masses to study process of water exchange and transformation in the Kuril area. The expandable sensors were deployed between the hydrographic stations which allow us to make a fine resolution survey to determine location of mesoscale eddies, branches of Oyashio Current and intrusions of Pacific and Okhotsk Sea water through the Kuril straits as well as filaments of Kuril and Subarctic mode water transported by the eddies off and on shore.

2. Equipment and calibration

To implement the observations we used the T.S.K.(Tsurumi-Seiki)/Sippican Expandable Bathythermographs (XBT) of T-05 and T-07 type and T.S.K. Expendable Conductivity, Temperature & Depth Profiler XCTD-1 with data registration by T.S.K. MK-30N and MK-100 digital converters. Characteristics of expandable probes are listed below.

Probe type	Depth, m	Ship speed, knots	Temperature accuracy (C)	Conductivity accuracy (mS/cm)	Coefficients for depth calculation	
					A	b
XCTD	1100	12	0.02	0.03	3.425432	-4.7026039
T-07	760	15	0.2	-	6.691	-2.25
T-07	760	20	0.2	-	6.691	-2.25
T-05	1830	6	0.2	-	6.828	-1.82

The following formula was used for depth calculation:

$$z = a*t + (10^{-3})*b*t^2$$

where z – depth (m)
 t – elapsed time (seconds)
 a, b – coefficients

For the XCTD observations the coefficients of depth, temperature and conductivity calculation were installed in the probe.

Results of the XBT, XCTD and CTD data comparison are presented at Fig. 2-5. We found pretty good accuracy of XCTD and T-07 XBT data and bad data of T-05 XBT below 300 m with the difference higher than 0.2 degrees. This may be caused by an error of the depth calculations.

3. The data

In total 63 probes were used at 61 stations. The list of observation stations is shown in Table 2 and station location chart is shown at Fig. At stations 53 and 61 the observations were not correct because of error in start time and calculation of depth.

4. Preliminary results

Our study was focused on three items related with an investigation of water exchange and transformation in the Kuril area: (a) structure and characteristics of mesoscale eddies; (b) water mixing in the area of Kuril straits and (b) penetration of Pacific water into the Okhotsk Sea in deep layer.

4.1. Mesoscale eddies

One of remarkable features of the area east of Kuril Islands are anticyclonic eddies with a diameter of 150-200 km (Bulatov and Lobanov, 1983; Lobanov and Bulatov, 1993, Rogachev et al., 1996). Analysis of satellite images over 14 years period demonstrated permanent occurrence of the eddies off Kuril Islands in a form of chain of 3-5 eddies with their centers located over the bottom trench (Lobanov, 1994). The Kuril eddies appear to have long lifetime and at least those ones located in southern and central part of the area may originate as Kuroshio warm-core rings. A case study of the Kuroshio warm-core ring A3/86B long-term evolution and its translation northward up to Bussol Strait reported by Lobanov et al. (1991), Bulatov and Lobanov (1992), Yasuda et al. (1992), Kawasaki (1993) and a similarity of structure and dynamic parameters of these two kinds of eddies confirm this suggestion. An origin of eddies observed off the northern Kuril Islands is not clear. Meantime being a permanent feature of water dynamics in the area these eddies play an important role in volume transport, water mass modification and CO₂ fluxes (Rogachev et al., 1996) as well as they affect water exchange through the Kuril straits, offshore transport of shelf water and branching of the Oyashio and East Kamchatka Current (Lobanov, 1994).

Preceding analysis of NOAA satellite infrared images before the R/V Mirai MR00K03 cruise allowed us to identify an eddy off the central Kuril Islands in early April 2000. However since that time we had no clear images because of permanent cloud cover over the region. During the cruise to confirm the eddy location and find out its center we made a section along the bottom trench with XBT (stations X20-X26) and ADCP observations on 18 May and identified position for station 12 that is supposed to be at the center of the eddy. A few days later on May 27 and 29 we received clear satellite images that proved our observations (Fig.19). Two anticyclonic eddies K00A and K00B located off Bussol Strait were manifested at the sea surface temperature as spiral structures formed by relatively cold and warm water filaments. The eddies had an elliptical shape around 110 by 170 km and their centers were located over the axis of the Kuril-Kamchatka bottom trench. Survey of the second eddy K00B was implemented on June 2-4 with XBT and CTD stations.

Horizontal distribution of water properties in the area of the eddies is shown on Fig. 20 and 21. The eddies present clear anomaly in water mass structure by deepening of the lower boundary of subsurface cold layer (2 C isotherm) from 120-130 m depth in surrounding subarctic water down to 350-400 m in the center of the eddy. In the same manner the warm intermediate layer (> 3 C) deepens from 300-400 m down to 600-900 m in eddy center (Fig.20). CTD observations prove that the eddies can be seen down to the bottom layer (Fig.

21). We have not enough deep stations to plot a chart however analysis of individual CTD profiles for bottom layer shows that down to a maximum depth of our observations (5000-6000 m) water inside the eddy is slightly warmer, fresh and lighter than surrounding subarctic water. Results of current measurements by the ADCP (Fig. 22) show anticyclonic circulation in the eddy with velocities of 60-80 cm/s. Strong currents up to 50 cm/s can be traced down to 400 m layer while maximum velocities are observed at around 100 m.

Cross-sections of temperature, salinity, density and potential vorticity are presented on Fig. 9-11 and 15. Upper 0-100 m layer of the eddies includes intrusions of relatively warm and saline subarctic water and cold and fresh water of Kuril Island zone. Off shore intrusion (streamers) of cold Kuril water from Bussol Strait into the eddy K00A is well seen at the satellite images (Fig. 19) and confirmed by sea surface monitoring of temperature, salinity, dissolved oxygen and fluorescence. High concentration of oxygen and increased fluorescence observed when the ship crossed this narrow cold water spiral intruding inside the eddy suggest high biological activity in this water.

In the layer of 100-500 m the eddies keep relatively uniform core of cold and fresh water mass of low vertical stratification. Minimum of potential vorticity corresponding to the eddy core is similar to water mass structure observed in the Okhotsk Sea (Fig.11). However these waters have different T,S characteristics. The diagram presented at Fig.16 shows that water mass of the eddy core has intermediate properties between subarctic Pacific and the Okhotsk waters. Its origin is not clear yet. We hope that comprehensive analysis of all available data including hydrochemical characteristics will help to clarify this.

Another chain of anticyclonic eddies were observed on satellite images in the area of Northern Kuril Islands and Kamchatka (Fig. 23). This phenomenon is quite typical for this area and was reported first by Solomon and Ahlnas (1978). The eddies are responsible for off shore intrusions of cold and fresh coastal water that forms their spiral structures. Station 22 was located at a cold water filament at Variability of a southern periphery of the eddy K3 to the east of Paramushir Island. It may be expected to have high biological productivity in this water in spring season.

Anticyclonic mesoscale eddies were also found at the edge of northern subarctic frontal zone (Fig. 19 and 24). In particular, rapid variability of hydrographic conditions at station KNOT was caused by evolution of one of such eddies (Eddy KNOT). XBT section through this eddy demonstrated process of mixing of subarctic and frontal (modified subtropical) types of water occurred in this eddy (Fig. 17). ADCP current measurements (Fig. 25) shows strong anticyclonic circulation.. Another eddy (Eddy X) is located just to the east. Thus, this kind of eddies are responsible for effective water mass modification at the frontal edge. This eddies pull out warm and saline water of subtropical type off the front. Then some portion of this water are mixed with the subarctic mode water inside the eddy. Some portion of the frontal water is advected northward by the eddies and then are trapped by the Kuril eddies and being transported northwestward close to Kuril Islands. This is an effective mechanism of fast water advection and mixing in the Kuril area driven by mesoscale anticyclonic eddies.

4.2. Modification of intermediate waters in the Kuril Islands area

The Kuril Islands area is important region for ventilation and modification of water masses in the North Pacific. Water exchange between the Okhotsk Sea and Pacific through Kuril Straits accompanied by enhanced vertical (diapycnal) mixing leads to intensive modification of both the Okhotsk Sea and the Subarctic Pacific water masses. Due to exchange with the Okhotsk Sea the water of the western boundary East Kamchatka Current modified into the Oyashio water which has the strong Okhotsk Sea component.

As has been noted early, outflow through Bussol' Strait is important factor of modification of water masses in the northwest Pacific. In the temperature section from st.5 to Urup Island shown (Fig. 6) that the cold Oyashio water related with outflow through Bussol Strait clearly appears in upper 350 m layer under slope of the Island. The Oyashio water (st.7) is characterized by low temperature in surface and upper part of intermediate layers in comparison with typical subarctic vertical thermohaline structure (st.6).

Because Bussol Strait appears to contain both inflow and outflow (Moroshkin, 1966) Pacific water can penetrate in the Okhotsk Sea through this passage. Vertical section of temperature and salinity (Fig. 7) in the Okhotsk Sea located to the west of Bussol' Strait shows absence of the inflow Pacific water during period of observations. Along this section a typical for the Okhotsk Sea vertical water structure characterized by subsurface temperature minimum (dichothermal layer) was found. Presence of halocline prevents penetration of winter convective mixing down to intermediate layer in the Okhotsk Sea. It is expected that depth of winter convective mixing should increase near the Kuril Islands (Bulgakov, 1975). However our observation have not confirmed these phenomena.

The intensive vertical mixing over the bank situated in central part of Bussol Strait (XCTD station X17) is reflected in temperature and salinity section (Fig. 8). Above this bank temperature and salinity are relatively homogeneous in the cold subsurface layer.

θ -S diagram demonstrates that in the intermediate layer the low temperature and salinity Okhotsk Sea waters differ considerably from subarctic Pacific waters. Water of coastal branch of the Oyashio is a mixture of the Okhotsk Sea and subarctic intermediate waters in the range of potential density 26.65-27.05 σ_θ .

Section through Rikord Strait (Fig. 12) shows a strong mixing of water masses in the area and intensive formation of modified type water. This process takes place in the upper layer including upper portion of intermediate layer down to isopycnal surface 27.0 σ_θ (Fig. 13). This indicates that relatively small straits of central part of the Kuril Islands with middle sill depth are also important for water masses modification in this area.

As it has been known the subarctic Pacific intermediate water enters in the Okhotsk Sea mainly through Kruzenshtern Strait. Fig. 14 shows potential temperature, salinity and potential density section through Kruzenshtern Strait. For this section three distinct structures of the intermediate layer (potential density range 27.2-27.4 σ_θ) are found: subarctic water with highest temperature ($>3^\circ\text{C}$), the Okhotsk Sea water with lowest temperature ($<2.5^\circ\text{C}$), and modified intermediate water with Pacific component located around Kruzenshtern Strait. The upper portion of intermediate layer in the strait consists of the Okhotsk Sea intermediate water (Fig. 14). It is shown that the Okhotsk Sea water also can penetrate in the Pacific through this strait.

Thus, our observations demonstrate that the outflow of the Okhotsk Sea water into the Pacific in the upper part of intermediate layer (and correspondingly the process of the Oyashio formation) occurs not only in the area of Bussol Strait but it takes place along wide area of central Kuril Islands. On other hand we found clear evidence of the Pacific intermediate water inflow into the Okhotsk Sea only through Kruzenshtern Strait.

4.3. Bottom water of the Kuril Basin in the Okhotsk Sea

Early observations (Moroshkin, 1966; Yasuoka, 1967 and 1968; Freeland et al., 1998) suggests that the deep water in the Kuril Basin of the Okhotsk Sea is directly connected through Bussol' Strait to water in the Pacific between 1500-2000 m. Thus Kuril Basin deep water is supplied from the Pacific Ocean. Recent data collected during the POI cruises (Salyuk et al, 2000) show that thick (a few ten meters) homogeneous bottom layer was clearly "new" in comparison with the deep water. The silicates were lower and oxygen higher indicating that this water was recently ventilated.

To clarify the bottom layer properties the detailed near-bottom measurements were made at st. 7.2 located off the Bussol Strait in the Okhotsk Sea (Fig. 18). The homogeneous bottom layer of 30 m thickness of relatively cold (potential temperature 1.607-C), saline (34.615 psu) and dense ($\sigma_\theta = 27.693$) water was found. The same bottom water was also detected at st. 9 located slightly northeastward. This water has similar properties: high salinity (34.620 psu), low potential temperature (1.585-C) and high potential density (27.699). Hypothetical mechanism by which bottom water might be formed is mixing over the Bussol' Strait sill induced by strong tidal currents in this area. In this case density of this water became higher and it sinks down to the bottom layer of deep Kuril Basin of the Okhotsk Sea. This hypothesis could be confirmed in the next Okhotsk Sea expedition.

References

- Bulatov N.V. and V.B.Lobanov (1983) Investigation of mesoscale eddies east of Kuril Islands on the base of meteorological satellite data. *Issledovanie Zemli iz Kosmosa* (Soviet J. Remote Sens.) 3, 40-47.
- Bulatov N.V. and V.B.Lobanov (1992) Influence of the Kuroshio warm-core rings on hydrographic and fishery conditions off Southern Kuril Islands. *Proc. PORSEC-92*, Okinawa, Japan, August 25-31 1992, p. 1127-1131
- Bulgakov N.P. 1975. Convection in the ocean. Nauka publishing house. Moscow, 272 p.
- Freeland H.J., Bychkov A.S., Whitney F., Taylor C., Wong C.S., Yurasov G.I. 1998. WOCE section P1W in the Sea of Okhotsk. 1. Oceanographic data description. *J. Geophys. Res.* 103, 15613-15623.
- Kawasaki Y. (1993) Modification and decay process of a Kuroshio warm-core ring 86B in the northwestern subarctic Pacific (in Japanese). *Bull. Hokkaido Natl. Fish. Res. Inst.*, 56, 43-54.
- Lobanov V.B. (1994) Statistical study of the Kuril eddies and their role in regional hydrography. *Proc. PICES III Ann. Meeting*, Nemuro, Japan, 15-24 Oct. 1994, p. 31.
- Lobanov V.B. and N.V.Bulatov (1993) Physical structure and behavior of the Kuril eddies. *Proc. Nemuro Workshop on western subarctic circulation*, 19-23 Sept. 1993, Nemuro, Japan, p.30-33.

- Lobanov V.B., K.A.Rogachev, N.V.Bulatov, A.F.Lomakin, K.P.Tolmachev (1991) Long-term evolution of the Kuroshio warm eddy. Dokl. (Transactions) USSR Ac. Sci. 317, 4, p. 984-988 (in Russian).
- Moroshkin K.V. 1966. Water masses of the Sea of Okhotsk. U.S. Department of commerce; Clearinghouse for Federal Scientific and Technical Information, Joint Publication Research service 43, 942, 98 p. Translation of Vodnyye massy Okhotskogo Morya, Nauka publishing house, Moscow.66 p.
- Rogachev K.A., Tishchenko P.Y., Pavlova G.Y., Bychkov A.S., Carmack E.C., Wong C.S. and Yurasov G.I. (1996) The influence of fresh-core rings on chemical concentrations (CO₂, PO₄, O₂, alkalinity, and pH) in the western subarctic Pacific Ocean. J.Geophys. Res., 101,999-1010.
- Salyuk A., Winckler G., Sosnin V. Renew of the bottom waters of the Kuril Basin in the Sea of Okhotsk. Proceedings of the International Symposium on Oceanography of the East Asian Marginal Seas (CREAMS-2000). May 15-16, 2000.Vladivostok, Russia (in press).
- Solomon H. and K.Ahlnas (1978) Eddies in the Kamchatka current. Deep-Sea Res., 25.
- Yasuda I., K.Okuda and M.Hirai (1992) Evolution of a Kuroshio warm-core ring: variability of the hydrographic structure. Deep-Sea Res., 39 (suppl.), S131-S161.
- Yasuoka T. 1967. Hydrography in the Okhotsk Sea (1). Oceanogr. Mag., 19, 61-67.
- Yasuoka T. 1968. Hydrography in the Okhotsk Sea (2). Oceanogr. Mag., 20, 55-63.

5. Acknowledgements

We thank Dr. Toshio Furuta and Mr. Satoshi Okumura for their valuable assistance during an implementation of the measurements and data processing, Mr. Nakabayashi and Mr. Morioka, Captain Hashimoto and the bridge officers for their cooperation on these observations.

Table 1 Location of XBT and XCTD stations

No.	St.	Lat. Deg.	Lat. Min.	Lon. Deg.	Lon. Min.	Sensor	Depth	Day, UTC	Hour, UTC	Min.
1	X1	43	30.05	155	0.19	T-5	1832	511	1	11
2	X2	44	23.04	150	52.54	T-5	8158	515	0	30
3	X3-1	44	44.34	150	45.06	T-5	5789	515	6	22
4	X3-2	44	44.44	150	44.87	T-7	5743	515	6	34
5	X4	45	3.05	150	37.02	T-5	3819	515	15	13
6	X5	45	20.99	150	28.76	T-5	663	515	16	45
7	X6	46	0.79	150	51.69	T-5	1945	516	3	17
8	X7	46	21.72	150	46.87	T-7	251	516	4	48
9	X8	46	35.39	150	30.08	XC	2970	516	5	58
10	X9	47	3.91	150	39.95	XC	3177	516	7	57
11	X10	47	21.00	150	38.70	XC	3333	516	11	40
12	X11	47	22.25	150	10.33	T-7	3338	516	13	9
13	X12	47	40.22	150	30.37	XC	3339	516	14	37
14	X13	47	59.93	150	29.86	XC	3328	516	15	58
15	X14	47	59.54	151	9.96	T-7	3314	517	6	31
16	X15	47	16.57	151	8.30	XC	3319	517	15	12
17	X16	46	44.18	151	10.22	XC	3142	517	17	31
18	X17	46	29.79	151	21.50	XC	548	517	18	35
19	X18	46	11.55	151	31.66	T-7	3627	517	19	52
20	X19	45	18.15	151	29.94	T-7	4452	518	8	42
21	X20	44	40.09	151	29.99	T-7	8326	518	11	5
22	X21	44	50.26	151	52.24	T-7	8925	518	12	28
23	X22	44	59.97	152	10.97	T-7	8348	518	13	33
24	X23	45	10.92	152	31.98	T-7	8974	518	14	46
25	X24	45	18.88	152	46.15	XC	8882	518	15	36
26	X25	45	33.98	153	11.45	T-7	8363	518	17	8
27	X26	45	46.70	153	33.83	T-7	8532	518	18	27
28	X27	45	50.03	152	59.92	T-7	6161	518	20	6
29	X28	45	53.11	152	20.00	T-7	2871	518	21	58
30	X29	45	25.03	152	27.93	XC	7301	519	14	26
31	X30	45	26.53	153	4.52	T-7	8370	520	8	8
32	X31	45	35.77	153	18.14	T-7	8759	520	9	2
33	X32	46	9.72	152	30.07	XC	3311	520	12	23
34	X33	45	2.52	152	57.21	XC	6952	521	10	5
35	X34	44	39.91	153	25.79	XC	5406	521	15	49
36	X35	45	30.32	154	14.71	XC	5473	528	15	43
37	X36	46	29.74	153	44.84	XC	5838	528	19	44
38	X37	47	12.05	153	7.72	XC	2221	528	22	57
39	X38	47	22.10	152	50.37	XC	880	529	0	2
40	X39	47	27.13	152	41.95	XC	525	529	0	35
41	X40	47	36.17	152	20.66	XC	2789	529	1	46
42	X41	48	42.83	153	19.34	XC	2457	531	12	23
43	X42	48	17.60	153	33.82	XC	1909	531	14	11
44	X43	48	0.39	153	42.73	XC	2127	531	15	24
45	X44	47	45.28	153	51.11	T-5	2391	531	16	30
46	X45	47	14.94	154	8.61	T-7	1860	602	18	25
47	X46	47	0.84	154	14.34	T-7	3999	602	21	10
48	X47	46	46.51	154	27.09	T-7	6513	602	22	26
49	X48	46	56.30	154	57.81	T-7	7446	603	6	6
50	X49	46	38.80	155	14.76	T-5	5554	603	13	12
51	X50	46	13.62	155	7.52	XC	5110	603	16	4
52	X51	46	30.31	154	46.39	T-5	6961	603	17	49
53	X52	46	22.56	154	26.85	T-7	7779	603	18	48
54	X53	46	11.19	154	12.74	T-7	8038	604	6	51

55	X53-2	46	9.78	154	12.99	T-7	7997	604	6	58
56	X54	45	52.49	153	45.94	T-7	8393	604	20	25
57	X55	44	48.93	154	44.85	T-7	4932	605	5	32
58	X56	44	37.74	155	1.48	T-7	4932	605	6	36
59	X57	44	29.56	155	13.23	T-7	5158	605	7	23
60	X58	44	18.02	155	28.23	T-7	5286	605	8	27
61	X59	44	12.24	155	35.92	T-7	5342	605	8	59
62	X60	44	4.18	155	46.72	T-7	5381	605	9	44
63	X61	43	55.32	155	59.40	T-5	5532	605	10	40

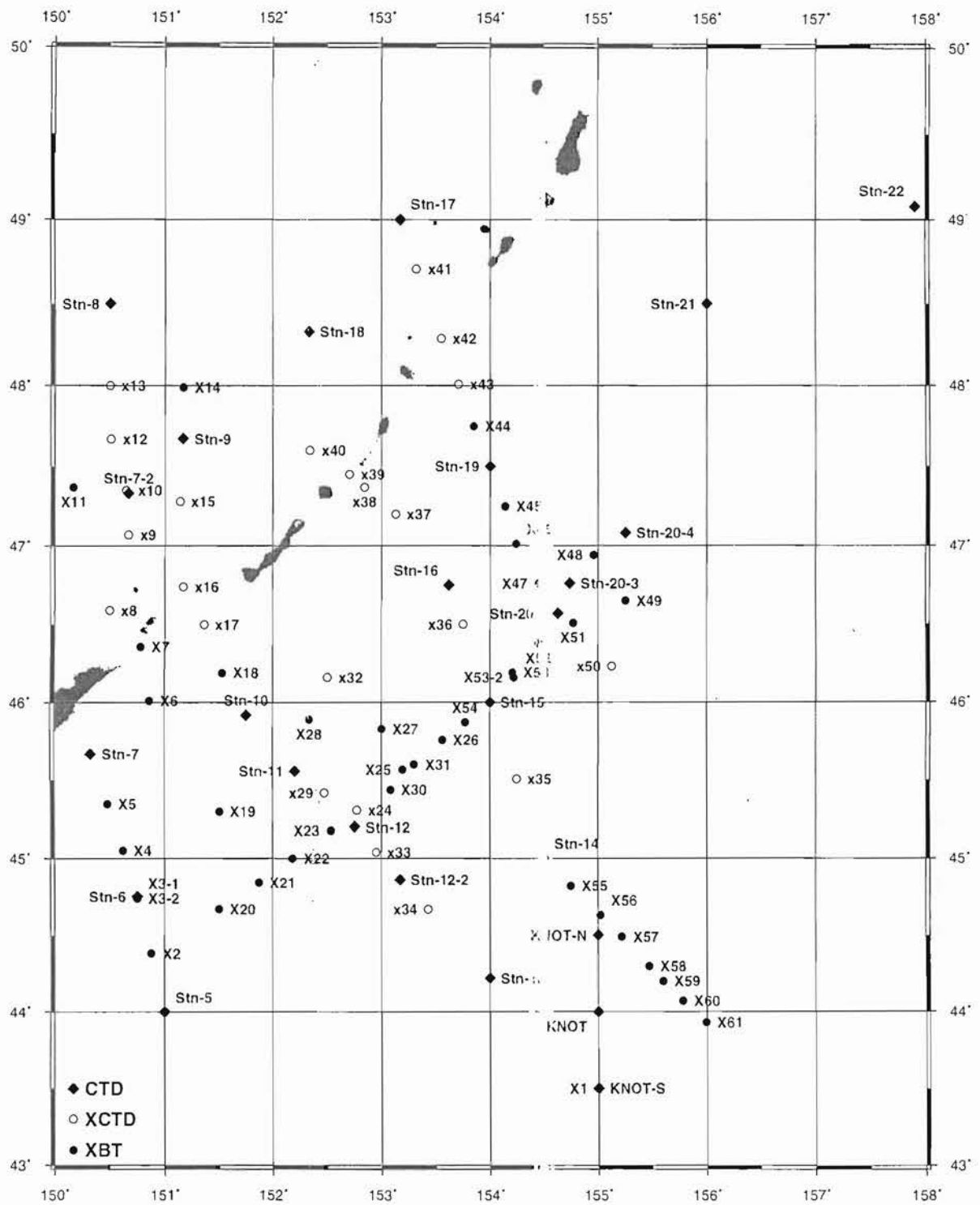


Fig. 1 XBT,XCTD & CTD Sites

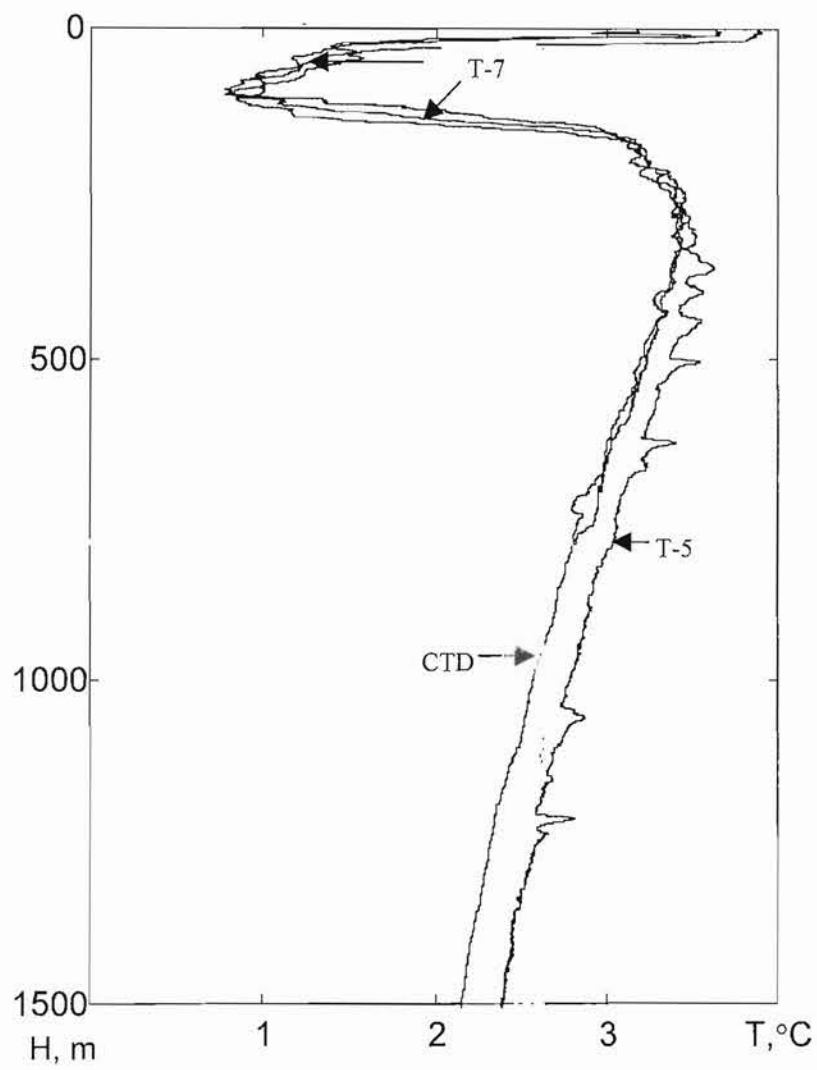


Fig. 2 Comparison of CTD and XBT data at St. 6 / X3-1 / X3-2.
Vertical profiles of temperature for St. 6 (CTD), X3-1 (T-5)
and X 3-2 (T-7).

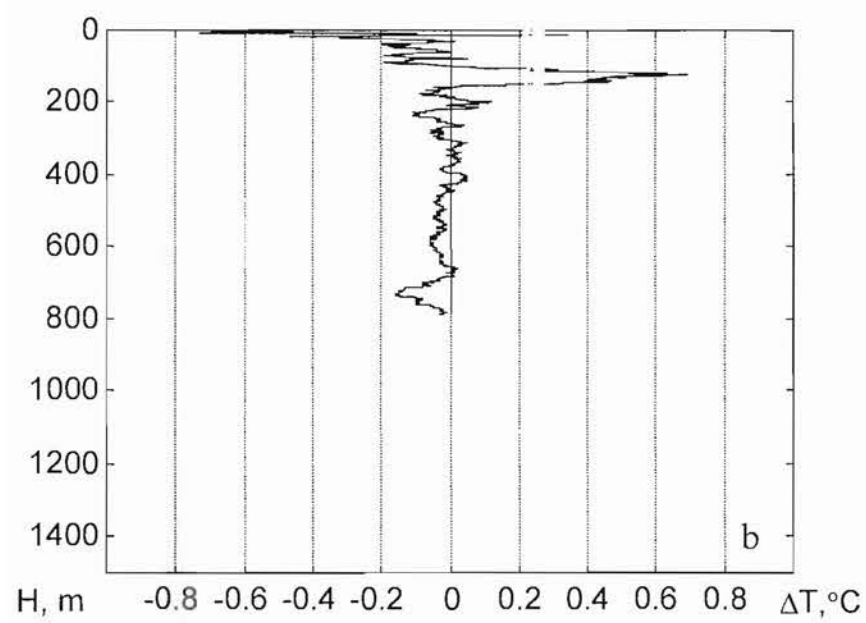
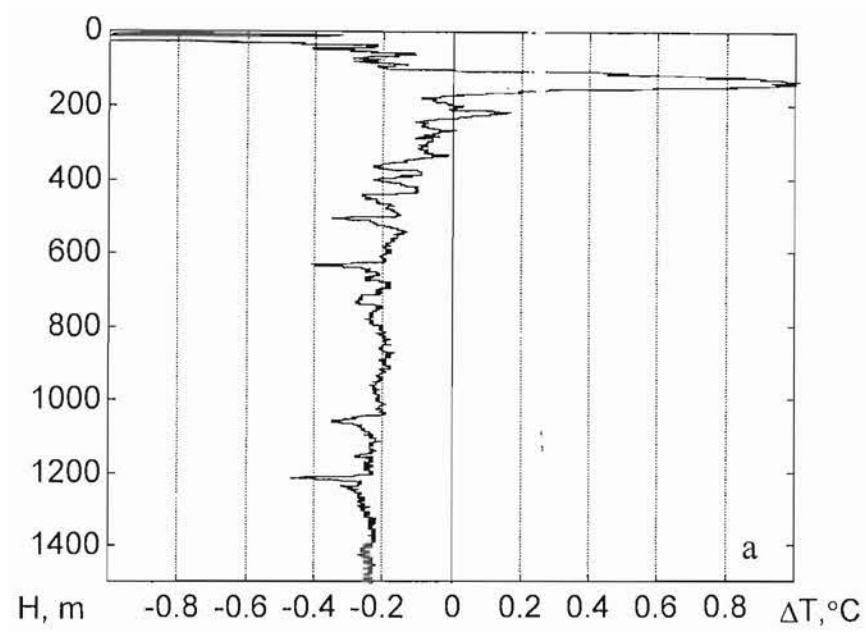


Fig.3 Comparison of CTD and XBT data at St. 6 / X3-1 / X3-2
X3-2. Differences between CTD - T5 (a) and CTD - T7 (b)
temperature sensors.

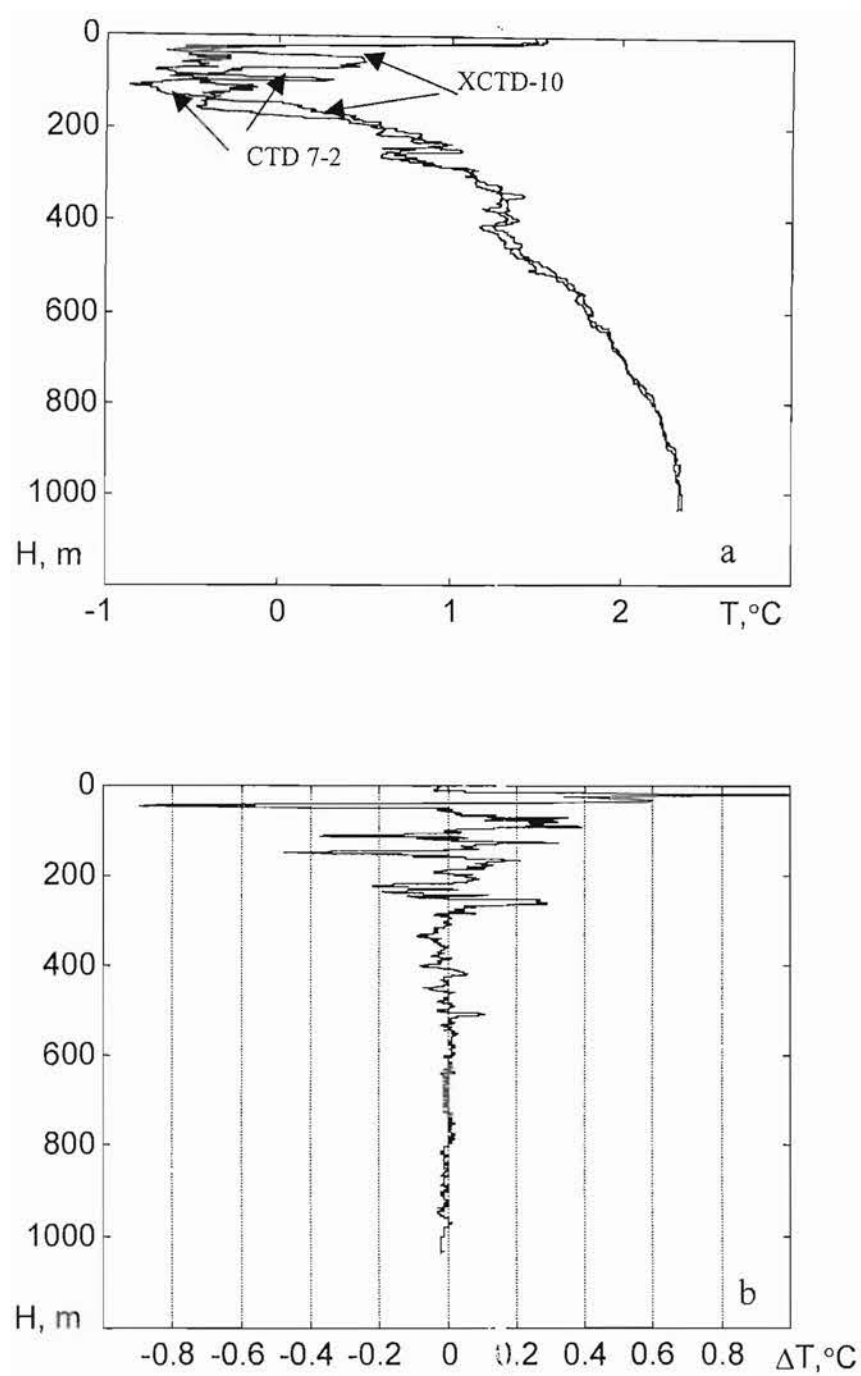


Fig. 4 Comparison of CTD and XCTD temperature data at St. 7-2 / XC10. Vertical profiles of temperature (a) and $\Delta T = T_{\text{ctd}} - T_{\text{xctd}}$ (b).

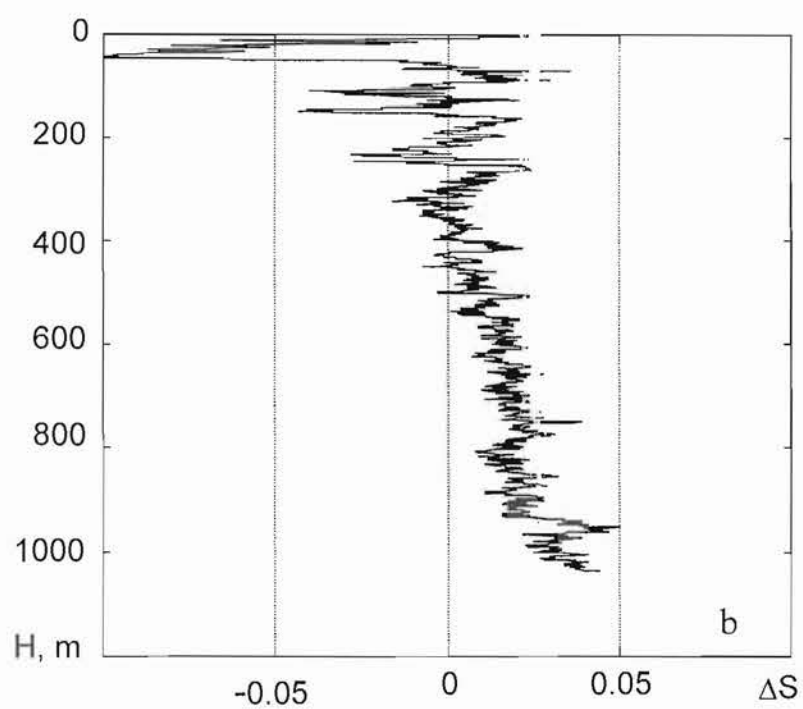
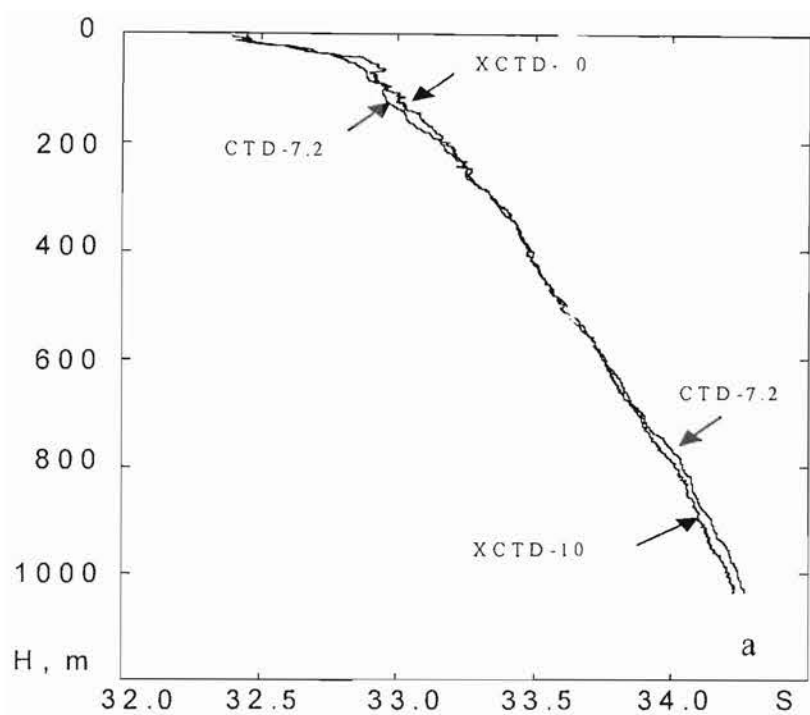


Fig. 5 Comparison of CTD and XCTD salinity data at St. 7-2 / XC10.

Vertical profiles of salinity (a) and $\Delta S = S_{\text{ctd}} - S_{\text{xctd}}$ (b).

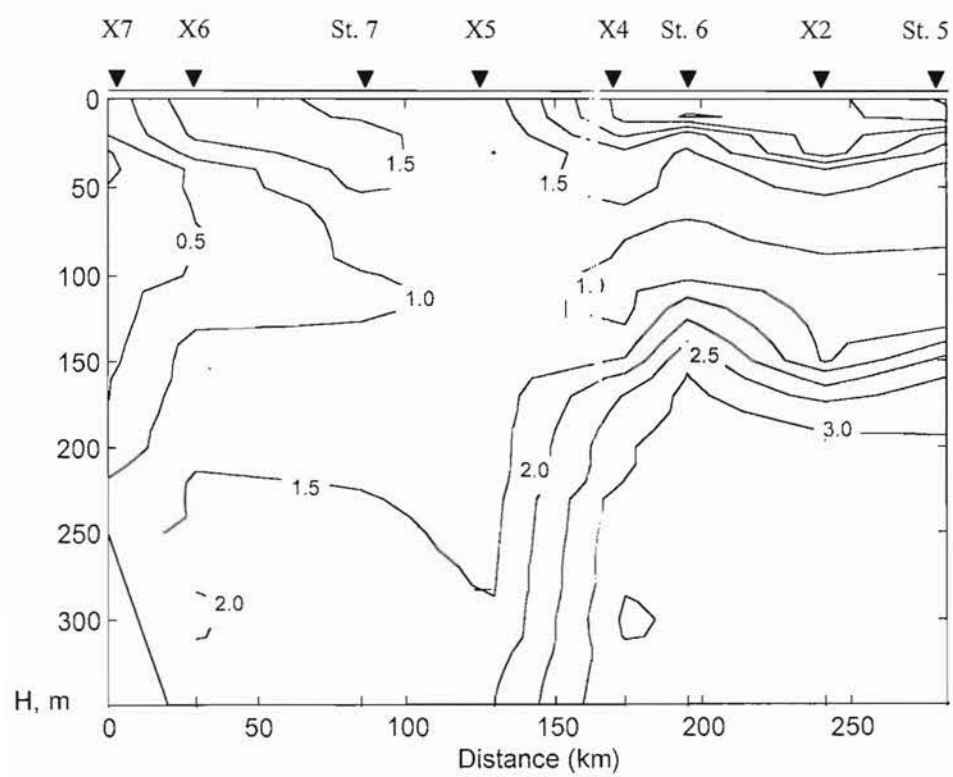


Fig. 6 Temperature section across the Oyashio coastal branch from St. 5 to Urup Strait on XBT and CTD data.

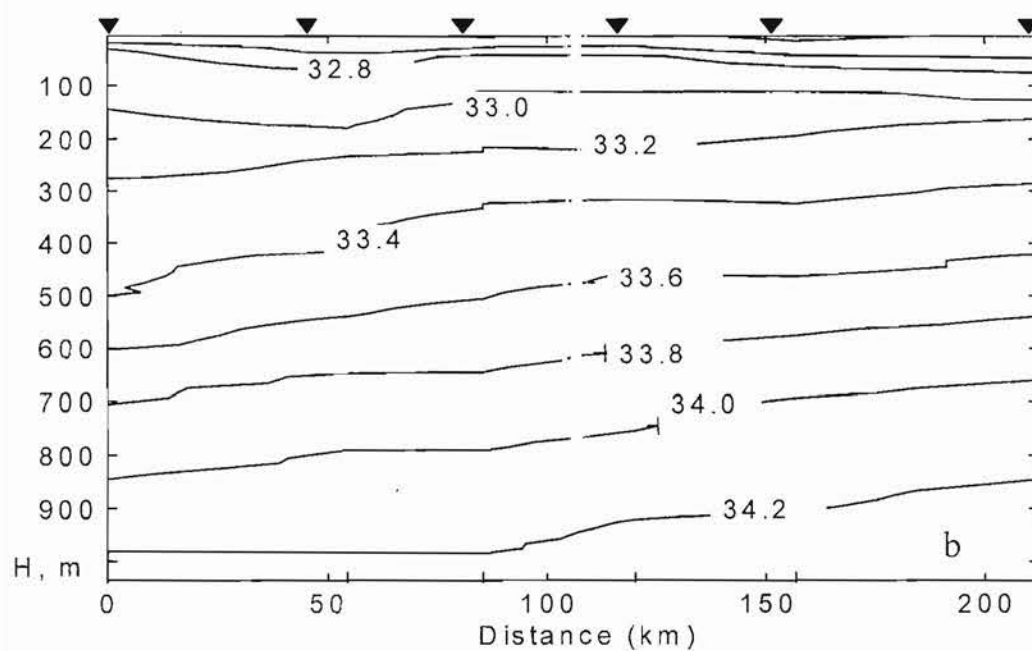
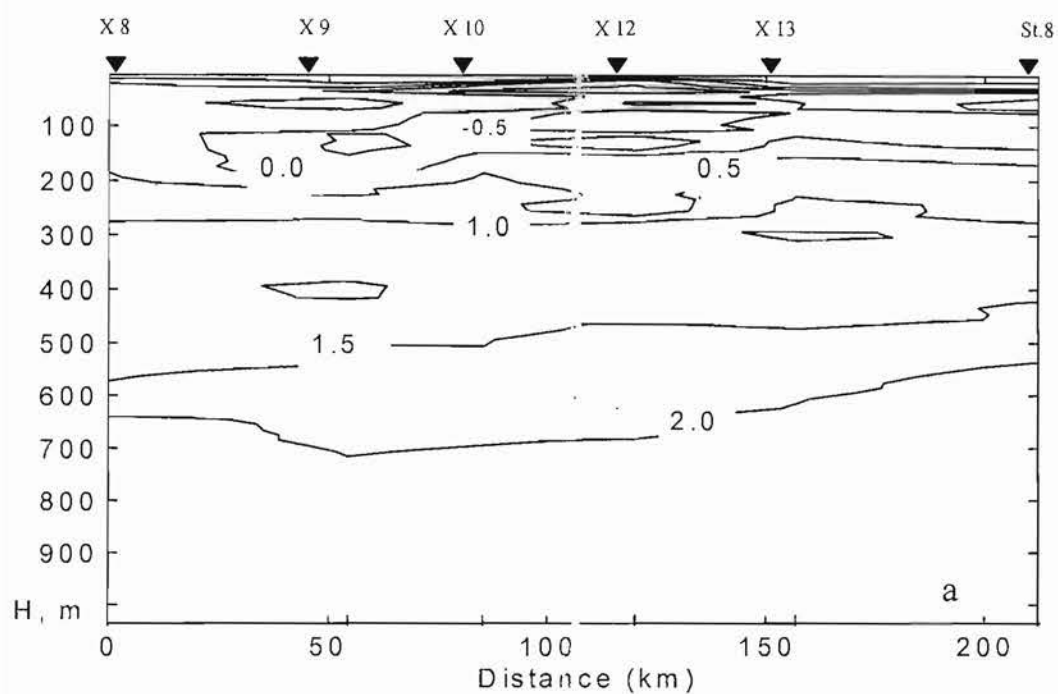


Fig. 7 Temperature (a) and salinity (b) section in the Okhotsk Sea from Urup Strait to St. 8.

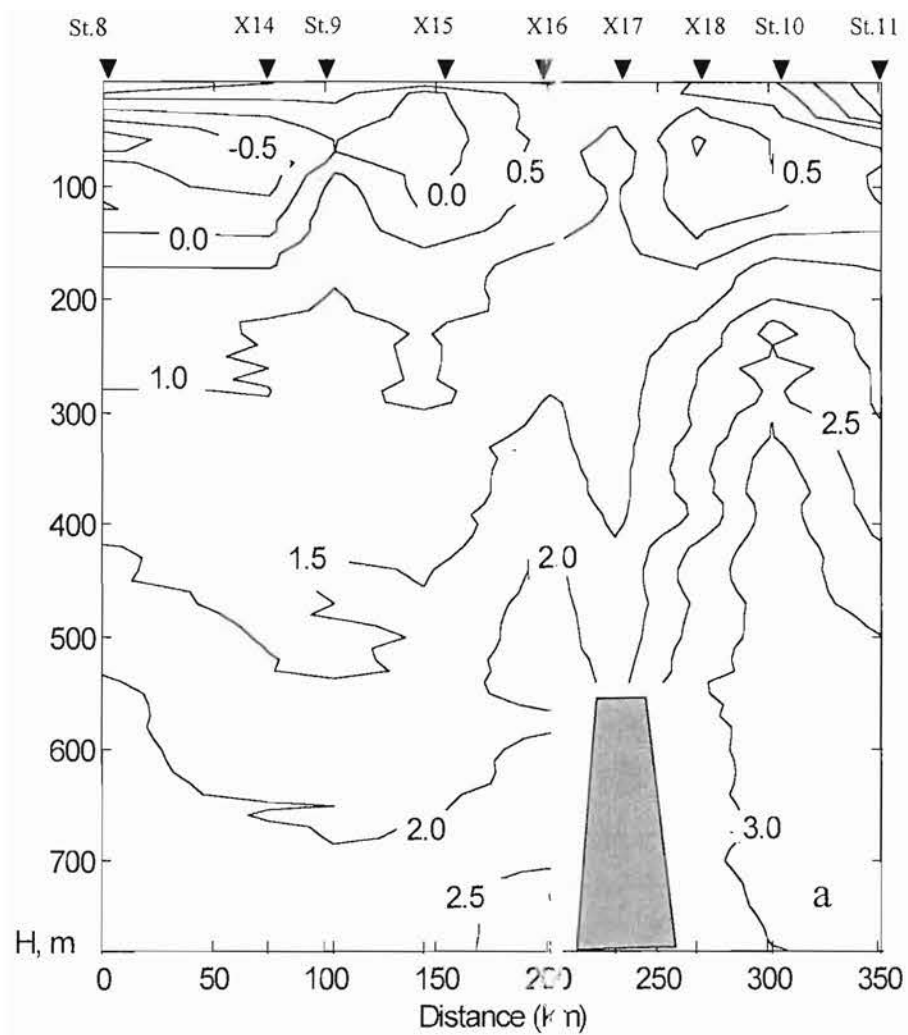


Fig. 8 Temperature (a) and salinity (b) vertical section from the Okhotsk Sea to St. 11 through Bussol Strait on VCTD, XBT and CTD data.

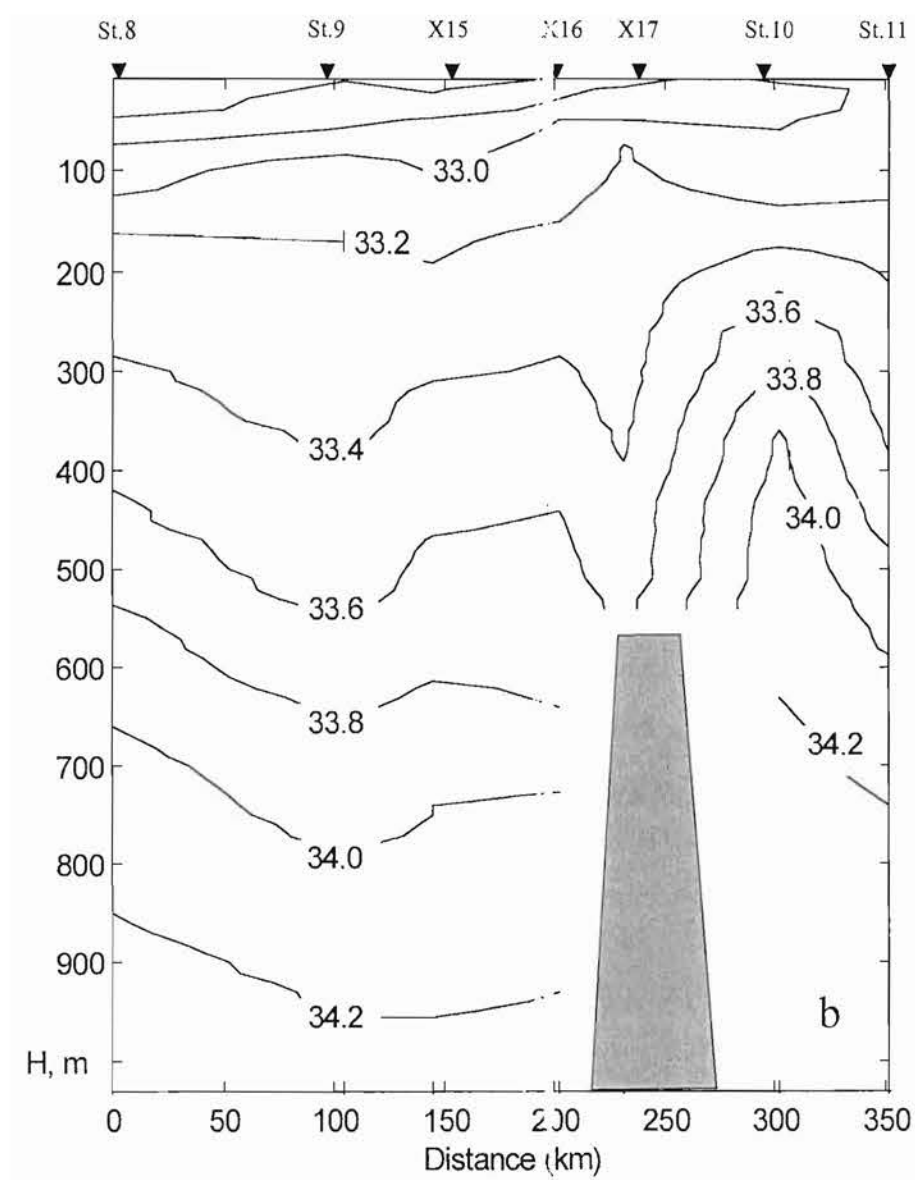


Fig. 8.b Continued.

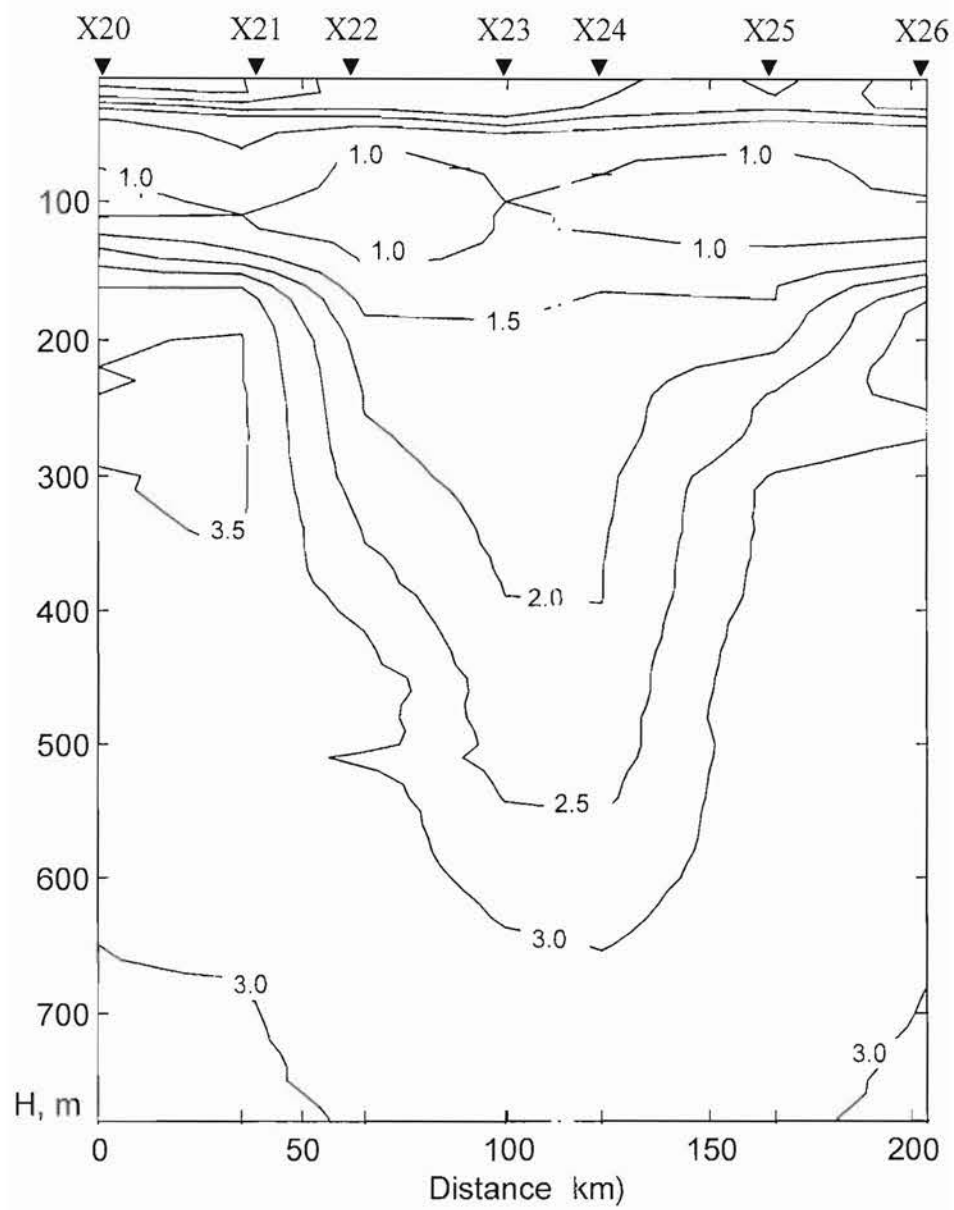


Fig. 9 Temperature vertical section across the Kuril eddy K00A from SW to NE on XBT data.

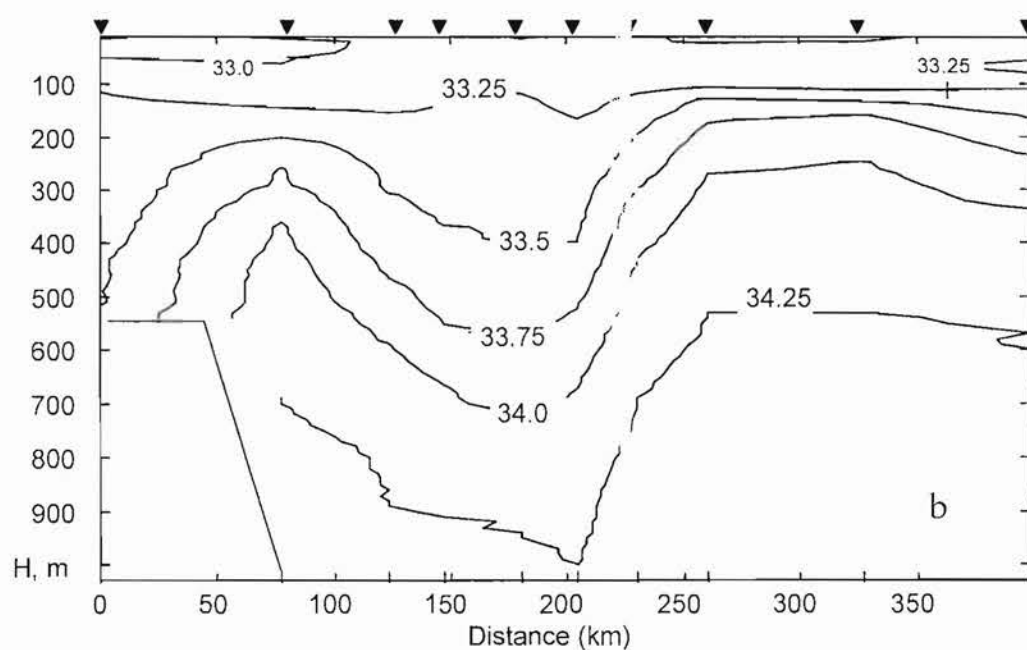
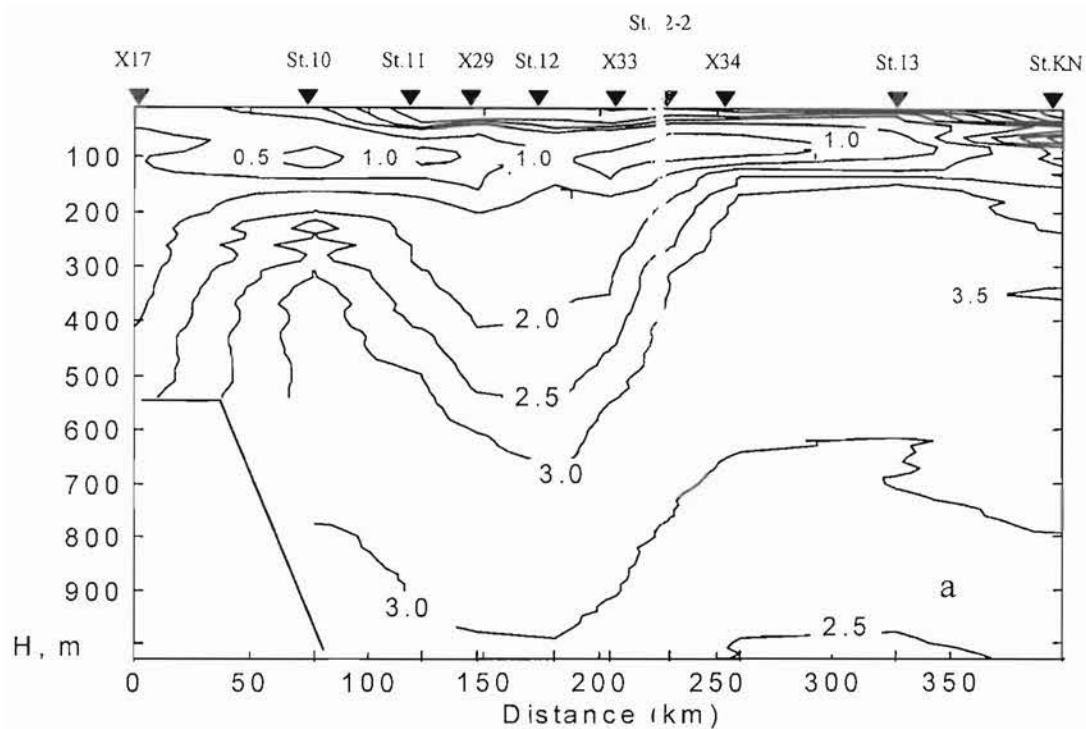


Fig.10 Vertical section of potential density (a) and salinity (b) from Bussol Strait to St. KNOT across the Kuril eddy K00A on XCTD and CTD data.

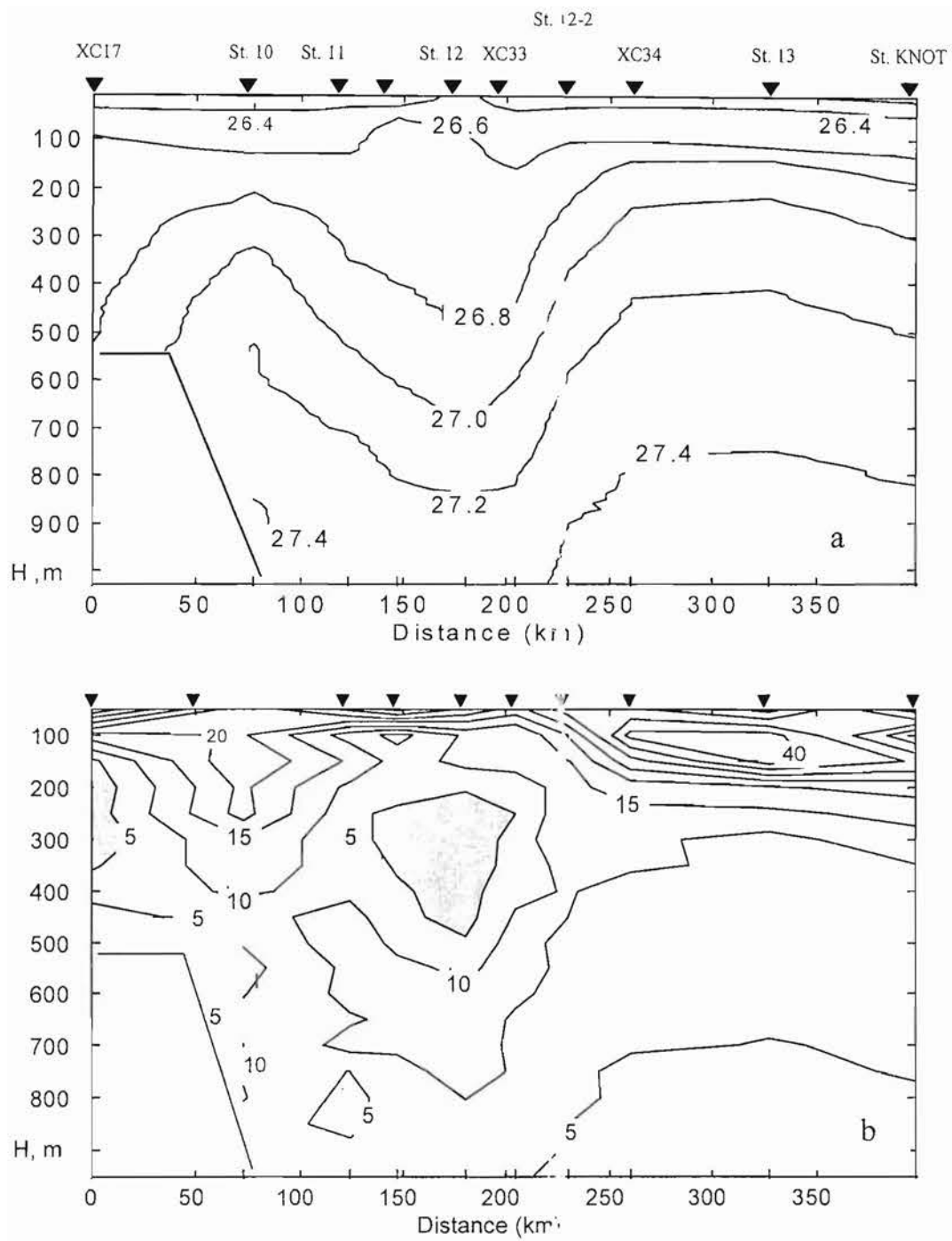


Fig. 11 Vertical section of potential density (a) and potential vorticity $Q \cdot 10^{11} \text{ m}^{-1} \text{ s}^{-1}$ (b) from Bussol Strait to St. KNOT across the Kuril eddy K00A on XCTD and CTD data.

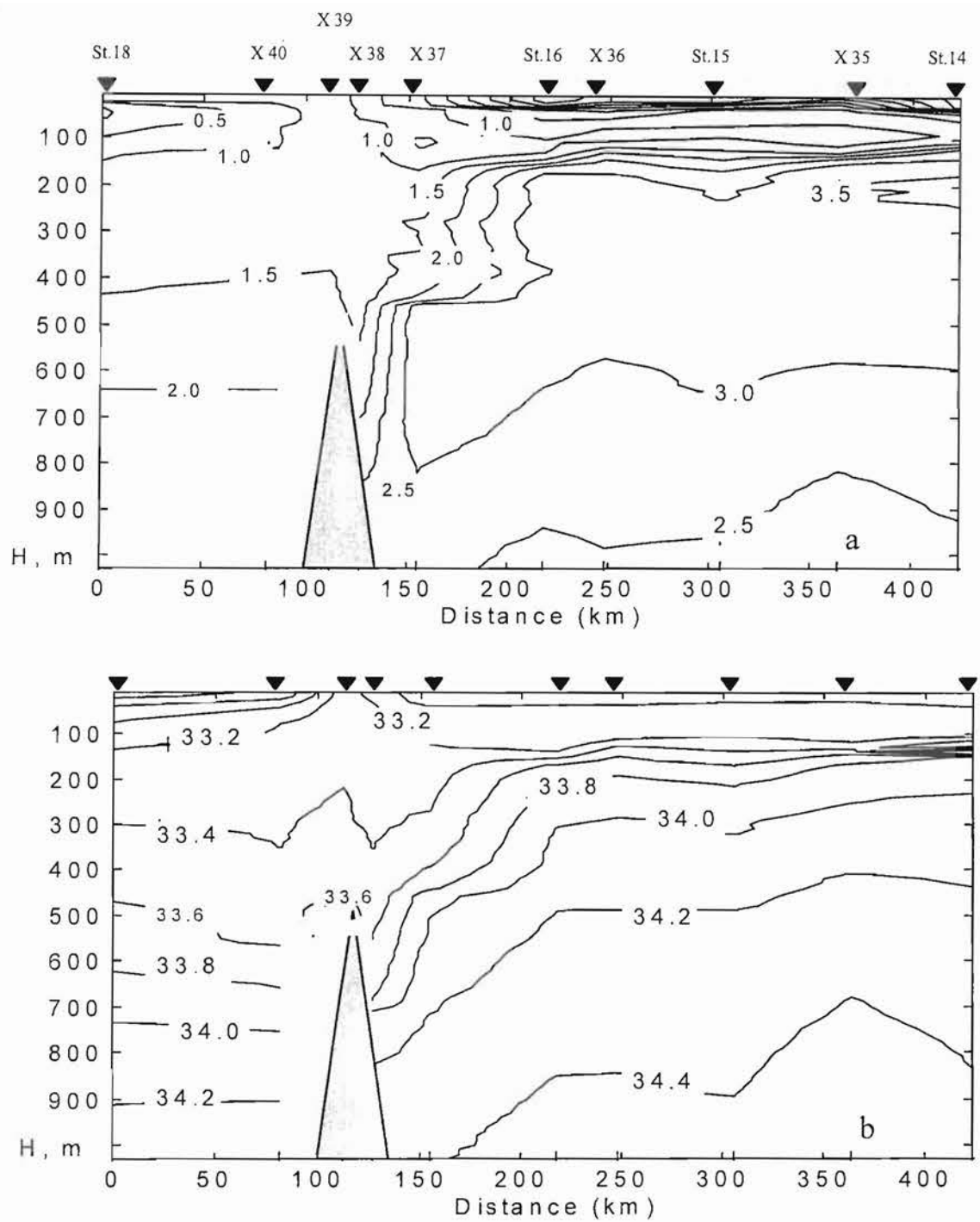


Fig.12 Potential temperature (a) and salinity (b) vertical section from St. 14 to the Okhotsk Sea (St. 18) through Rikord Strait on XCTD and CTD data.

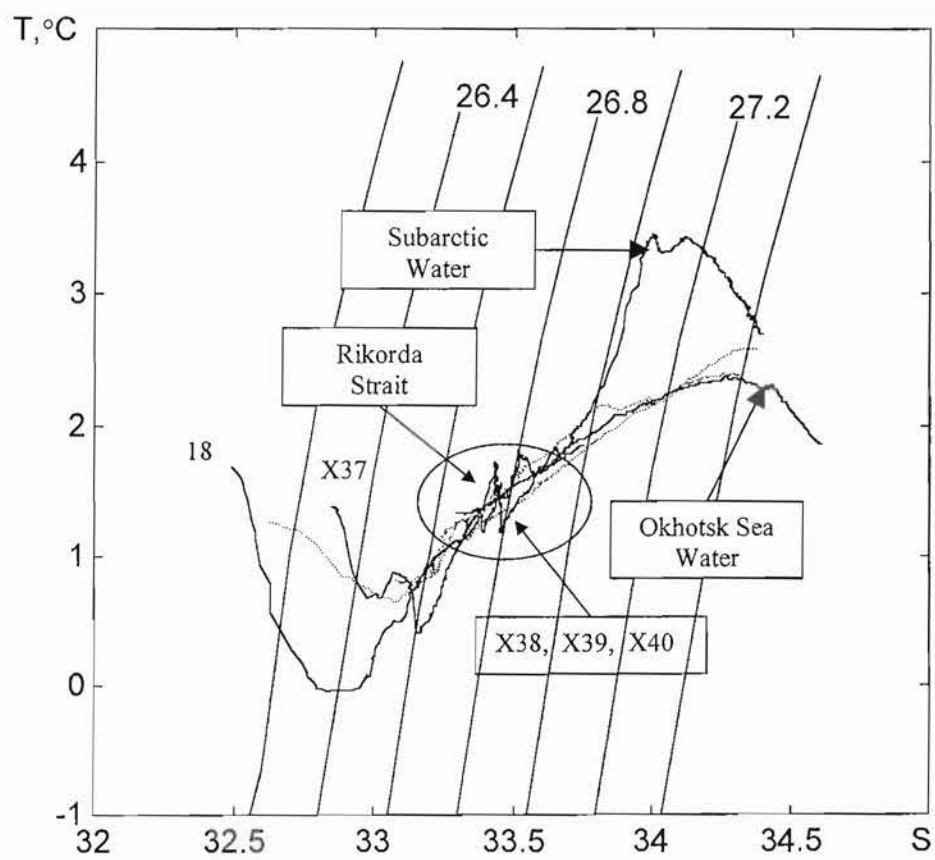


Fig.13 T,S diagram showing modification of water masses in Rikord Strait

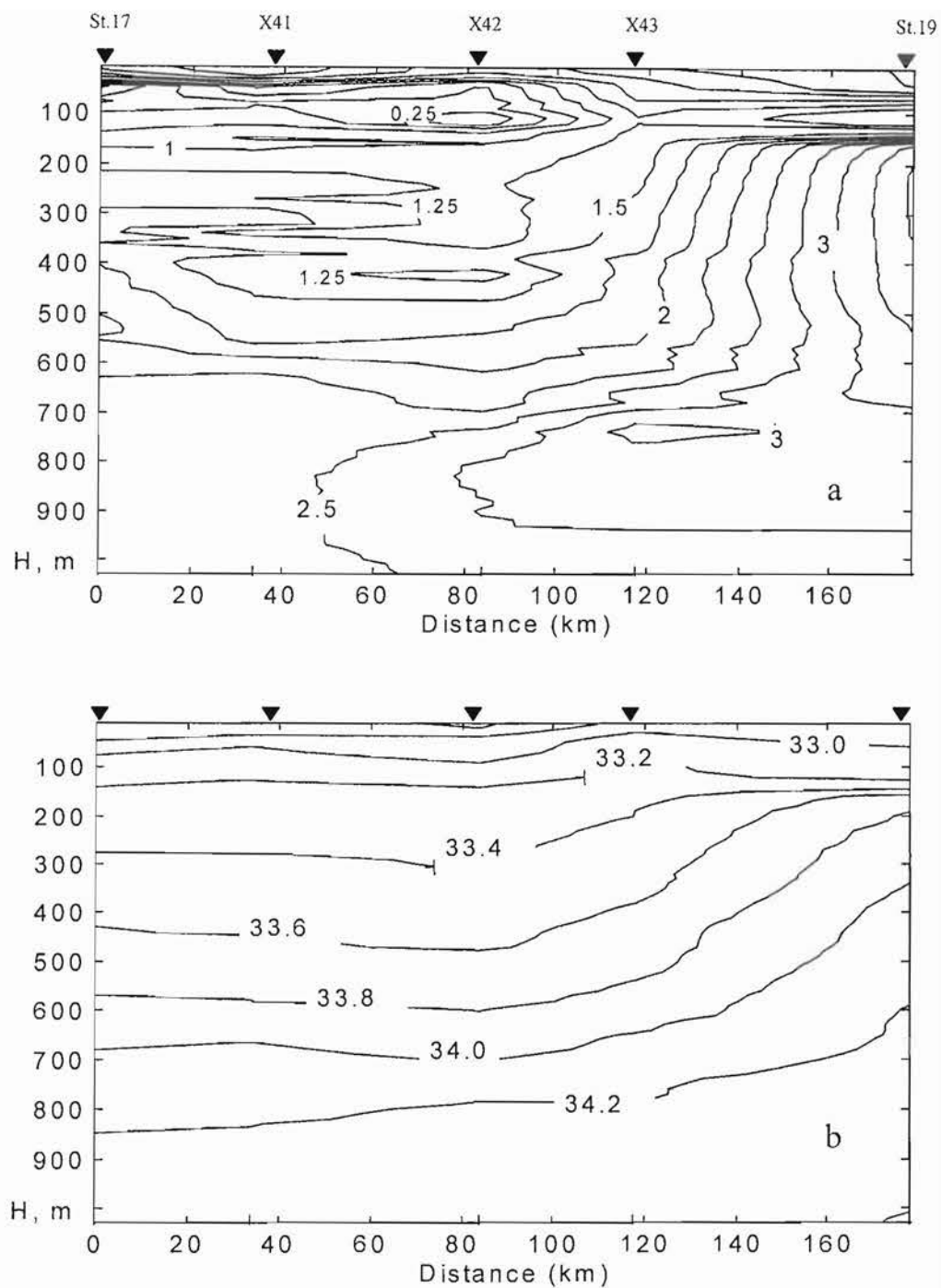


Fig.14 Vertical section of potential temperature (a), salinity (b) and potential density (c) through Kruzenshtern Strait and T,S diagram (d) for water masses in this area.

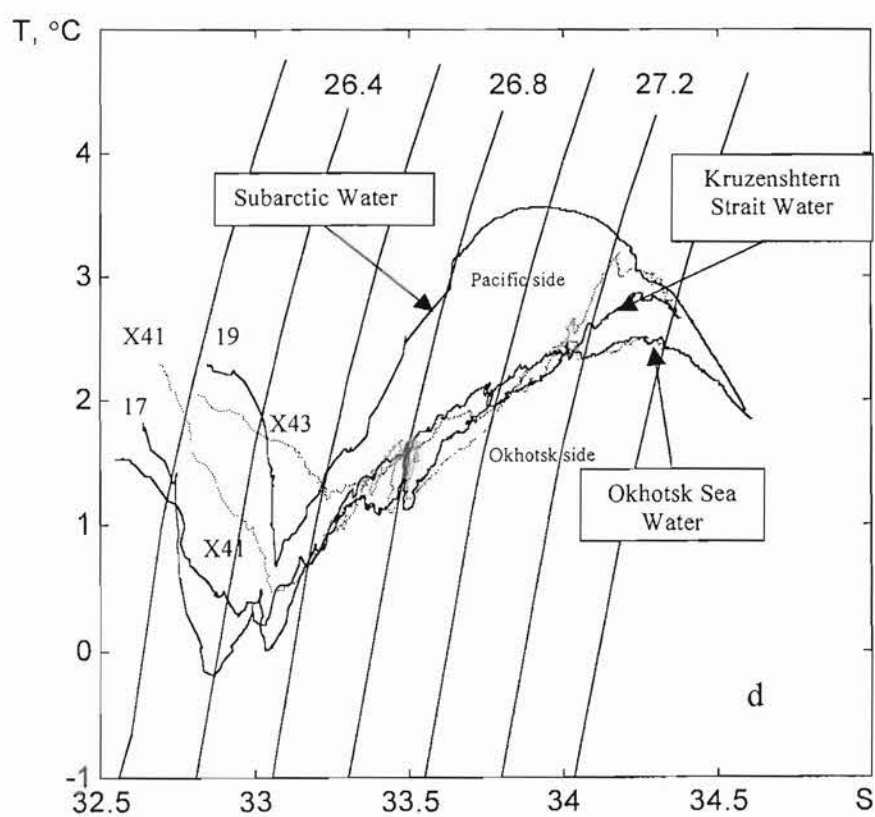
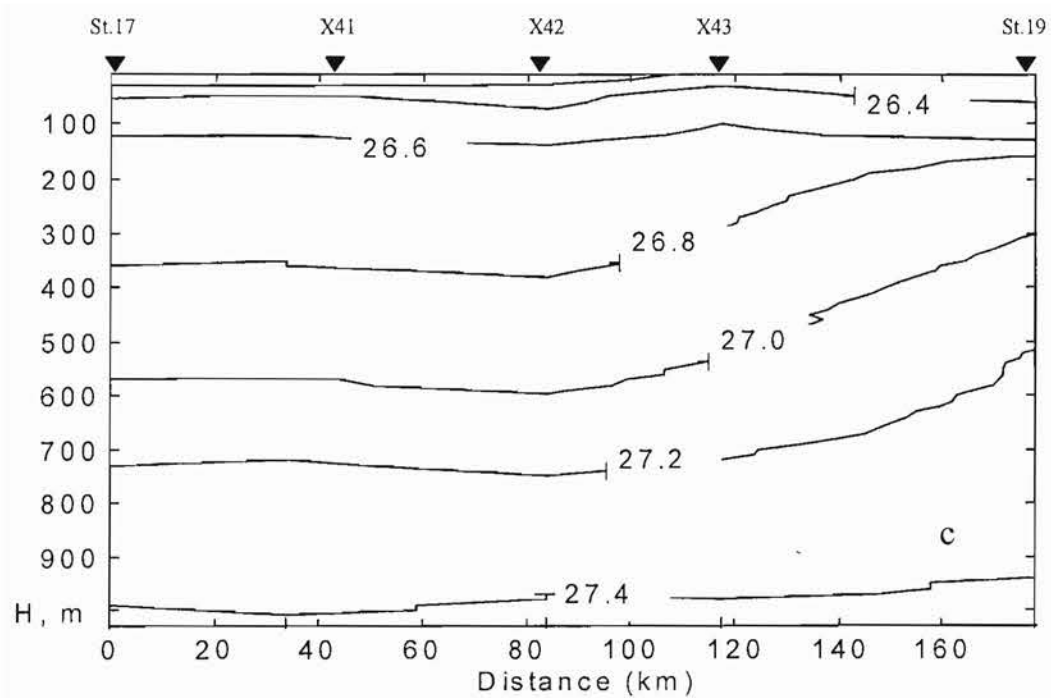


Fig. 14.c,d Continued.

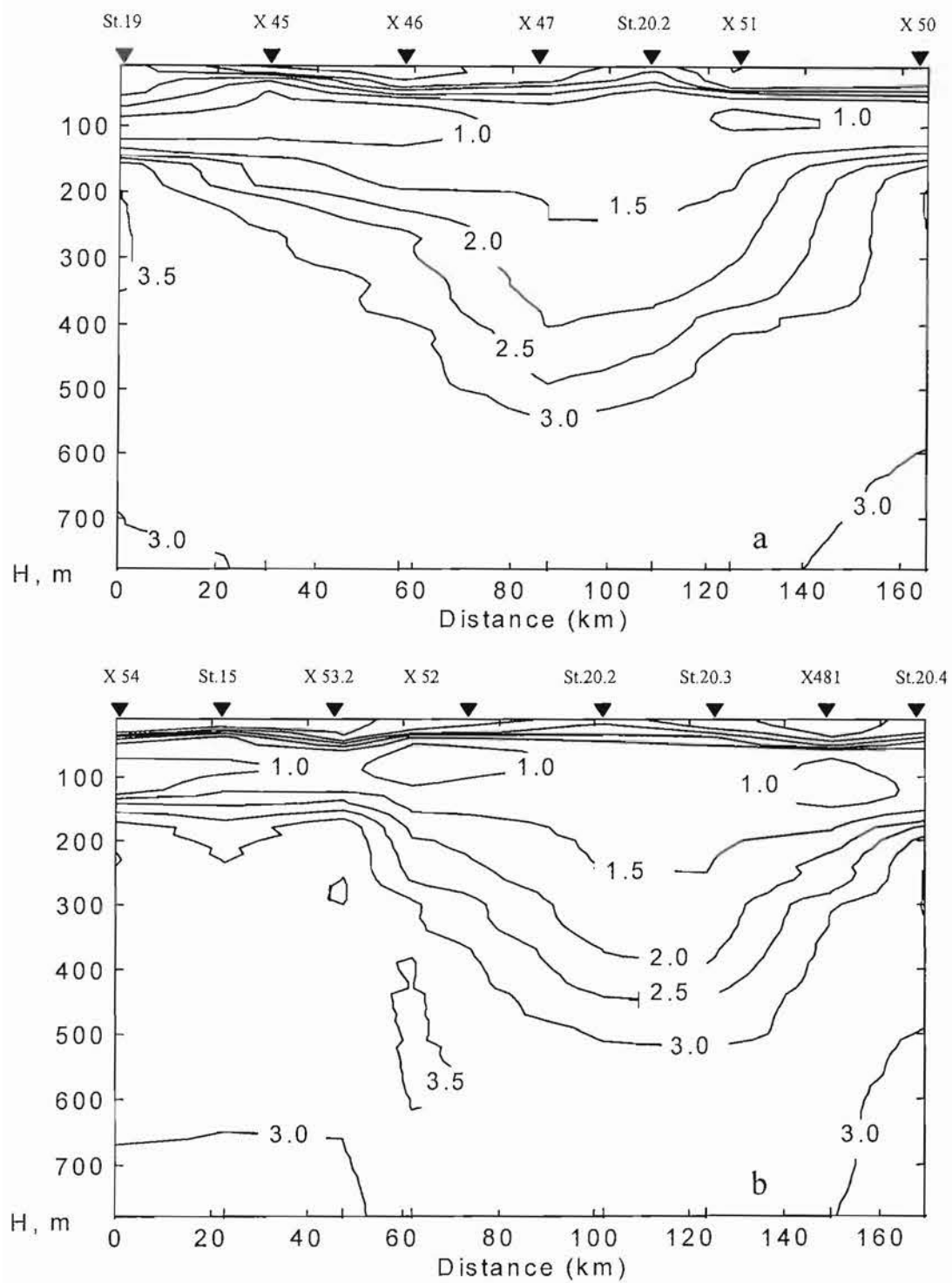


Fig.15 Vertical section of temperature across the Kuril eddy K00B along NW - SE line (a) and SW-NE line (b) on XBT and CTD data.

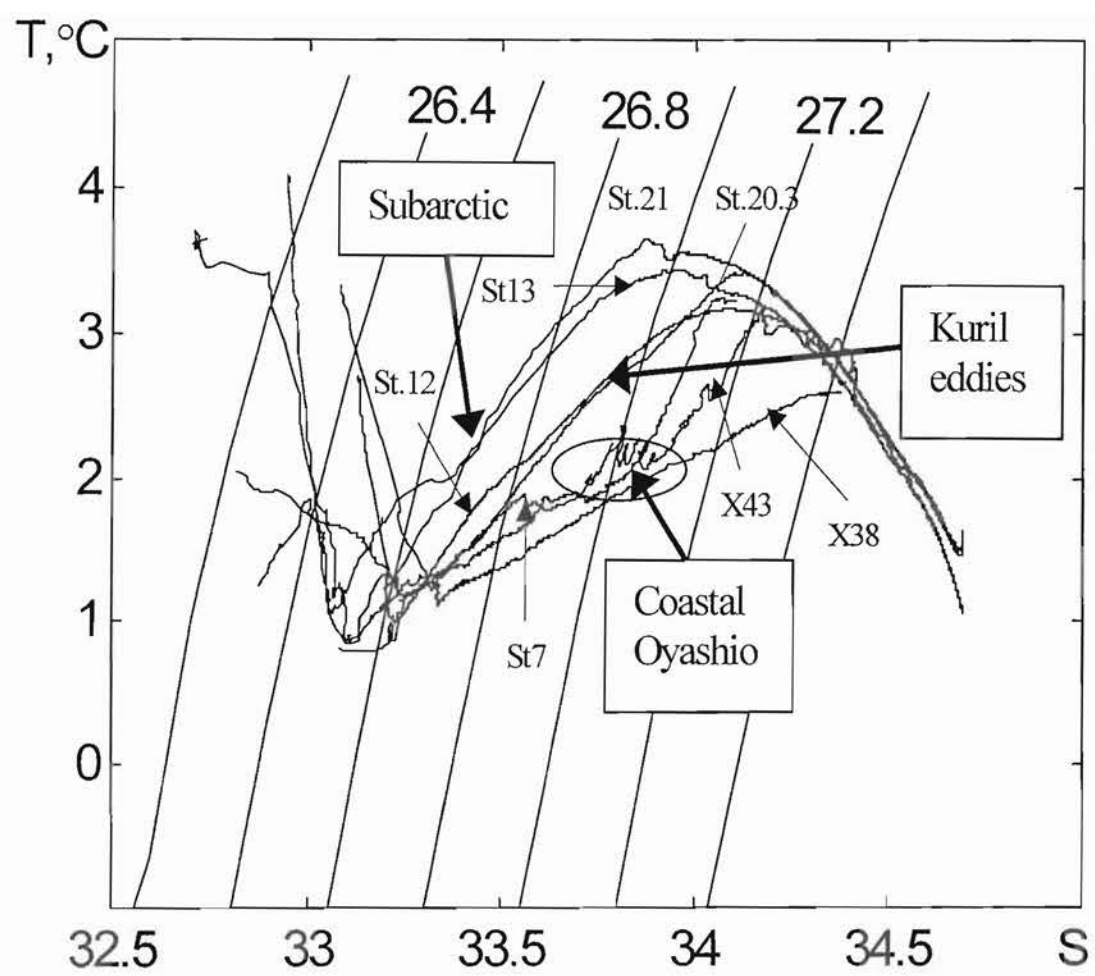


Fig.16 T,S diagramm for typical water masses in the Kuril area.

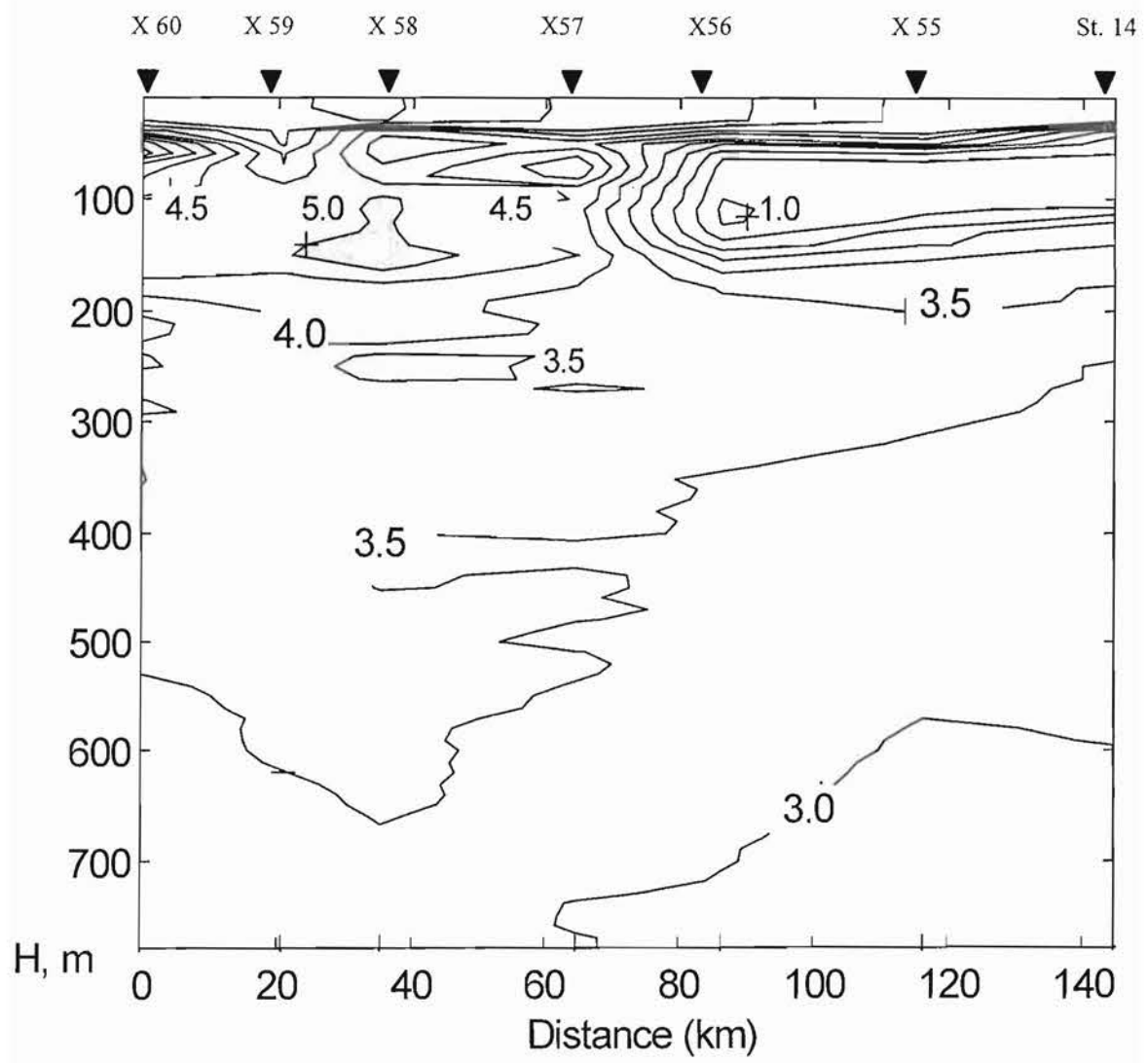


Fig.17 Temperature vertical section across the frontal eddy at station KNOT on XBT data.

St.7-2 (S01: 16 May 2000)

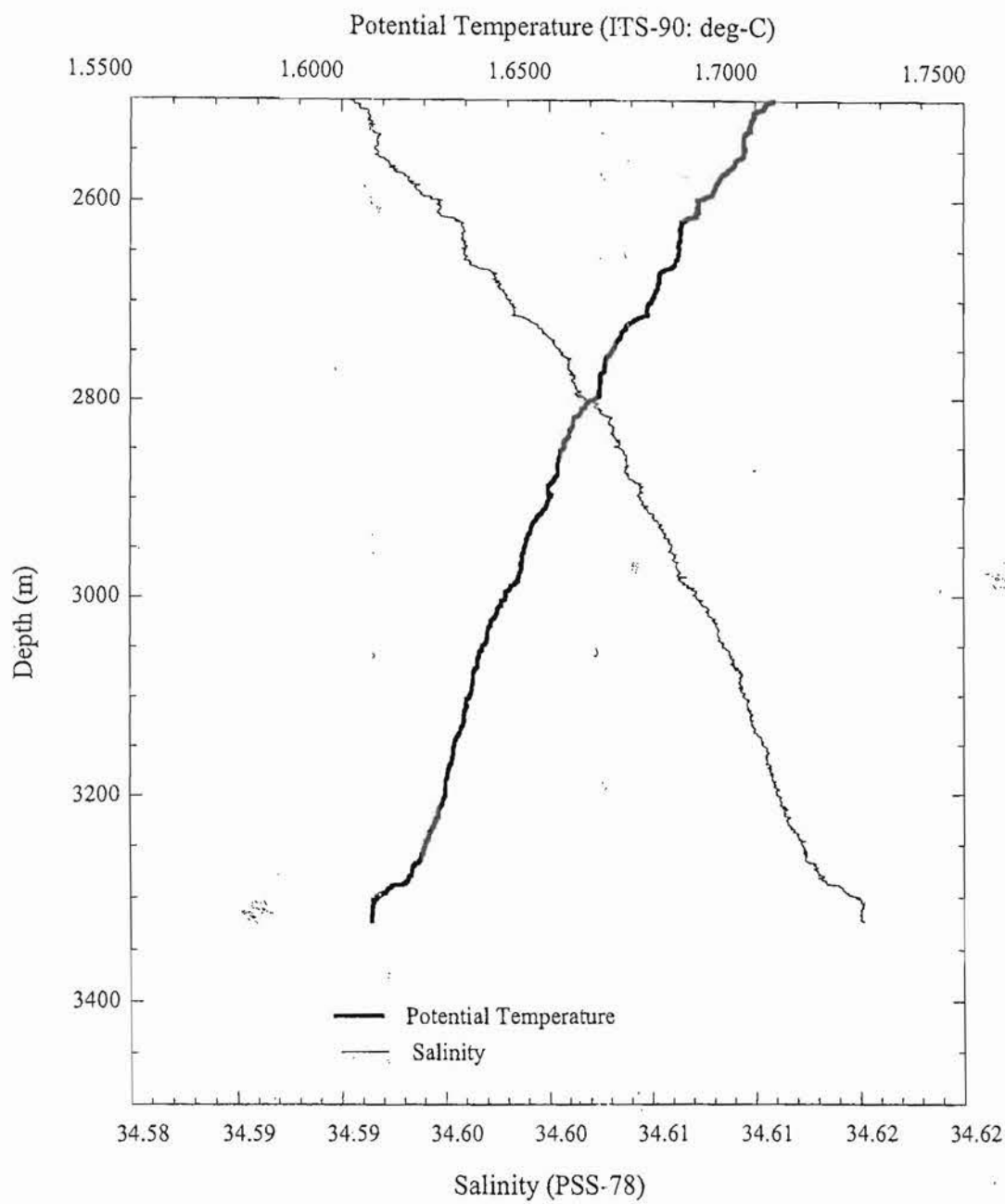


Fig.18 Cold and saline bottom layer of the Kuril Basin, the Okhotsk Sea.
Vertical profiles of potential temperature and salinity at St. 7 – 2.

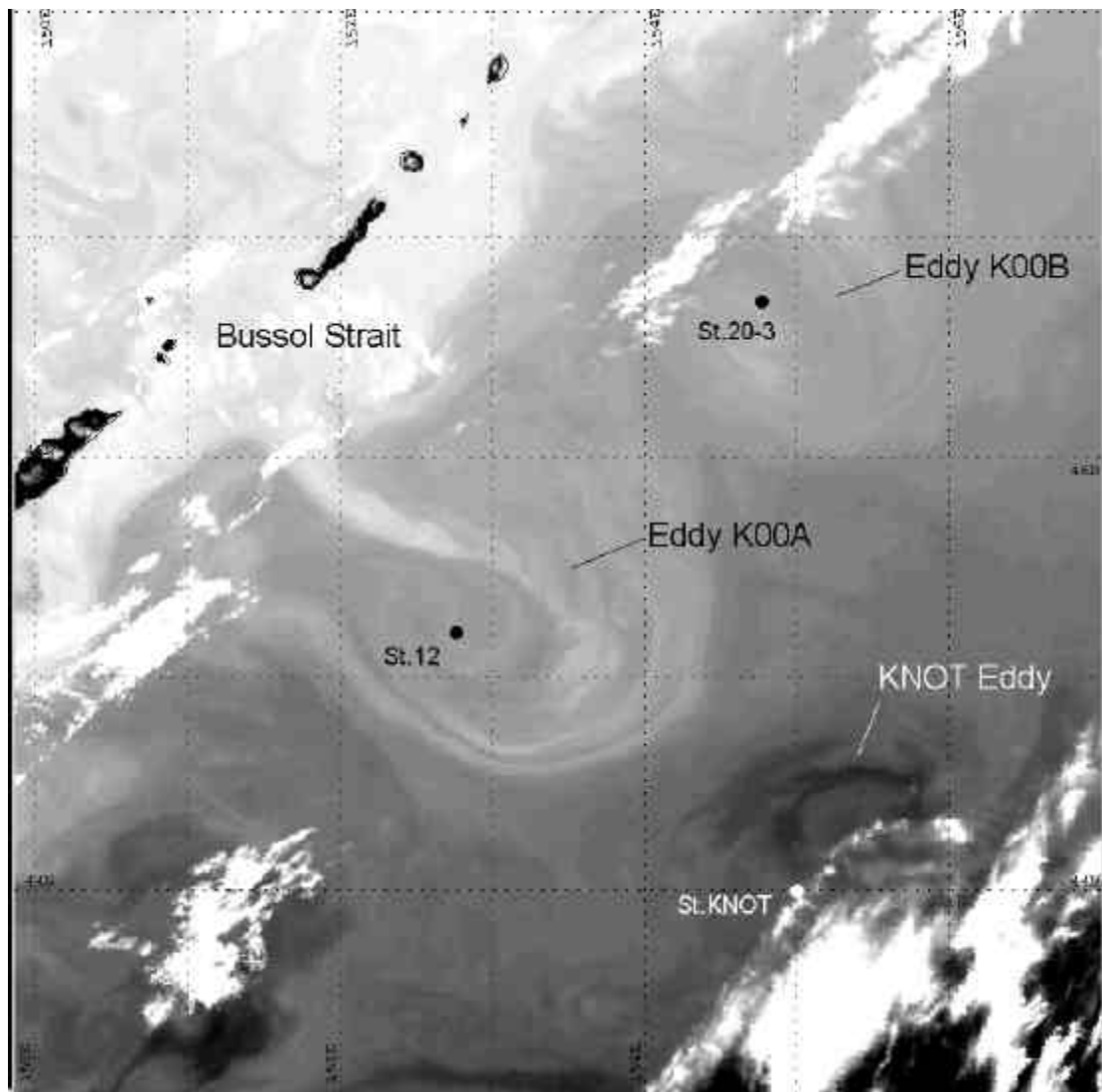


Fig. 19. Mesoscale eddies off the Kuril Islands on NOAA AVHRR infrared image for May 29, 2000 22:00 UTC. Light shades of gray color correspond to cold water, clouds are white and warm water is dark. Locations of some stations are shown by dot.

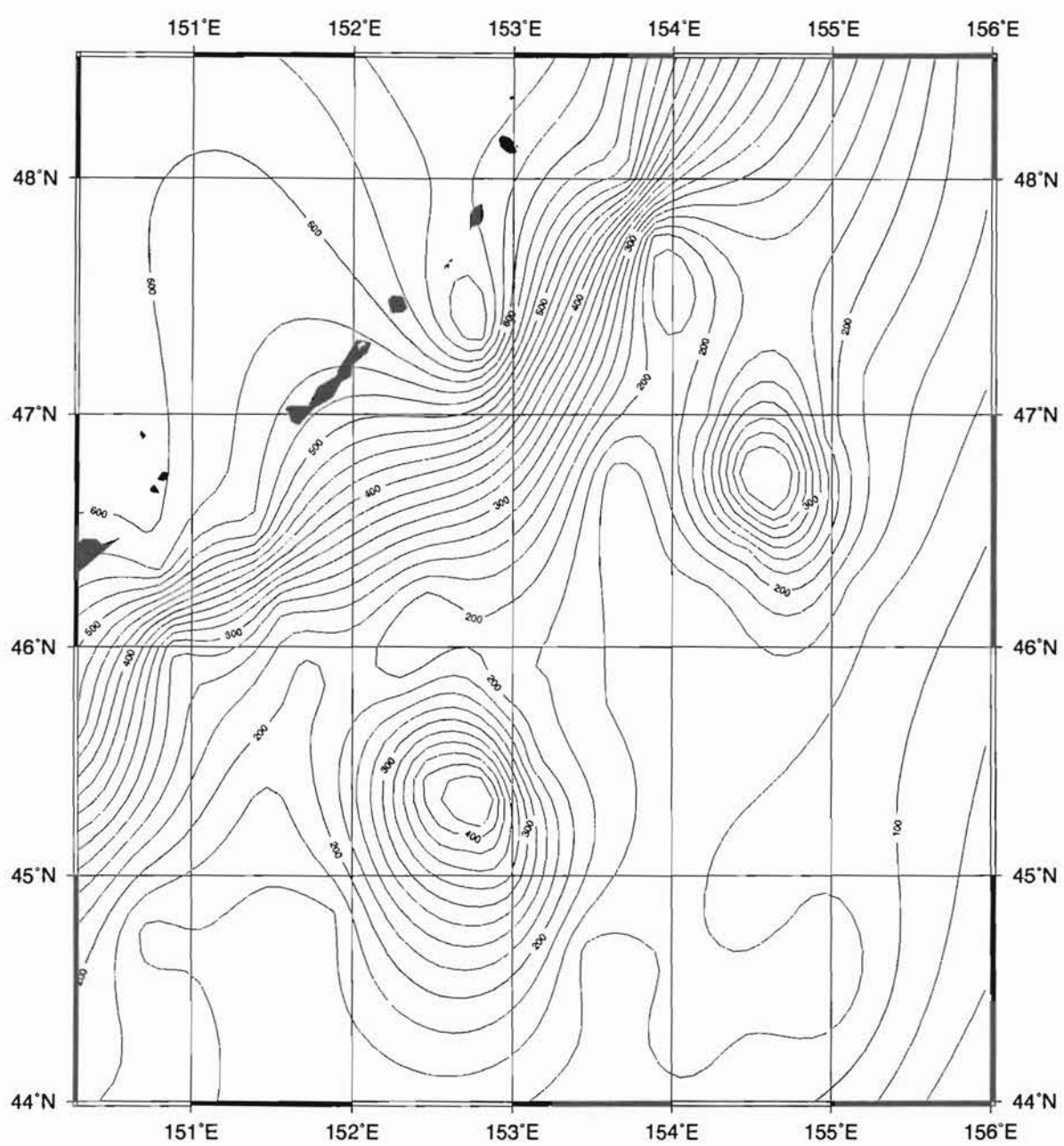


Fig. 20 Depth of isothermal surface 2 C corresponding to lower boundary of cold subsurface layer in the subarctic area.

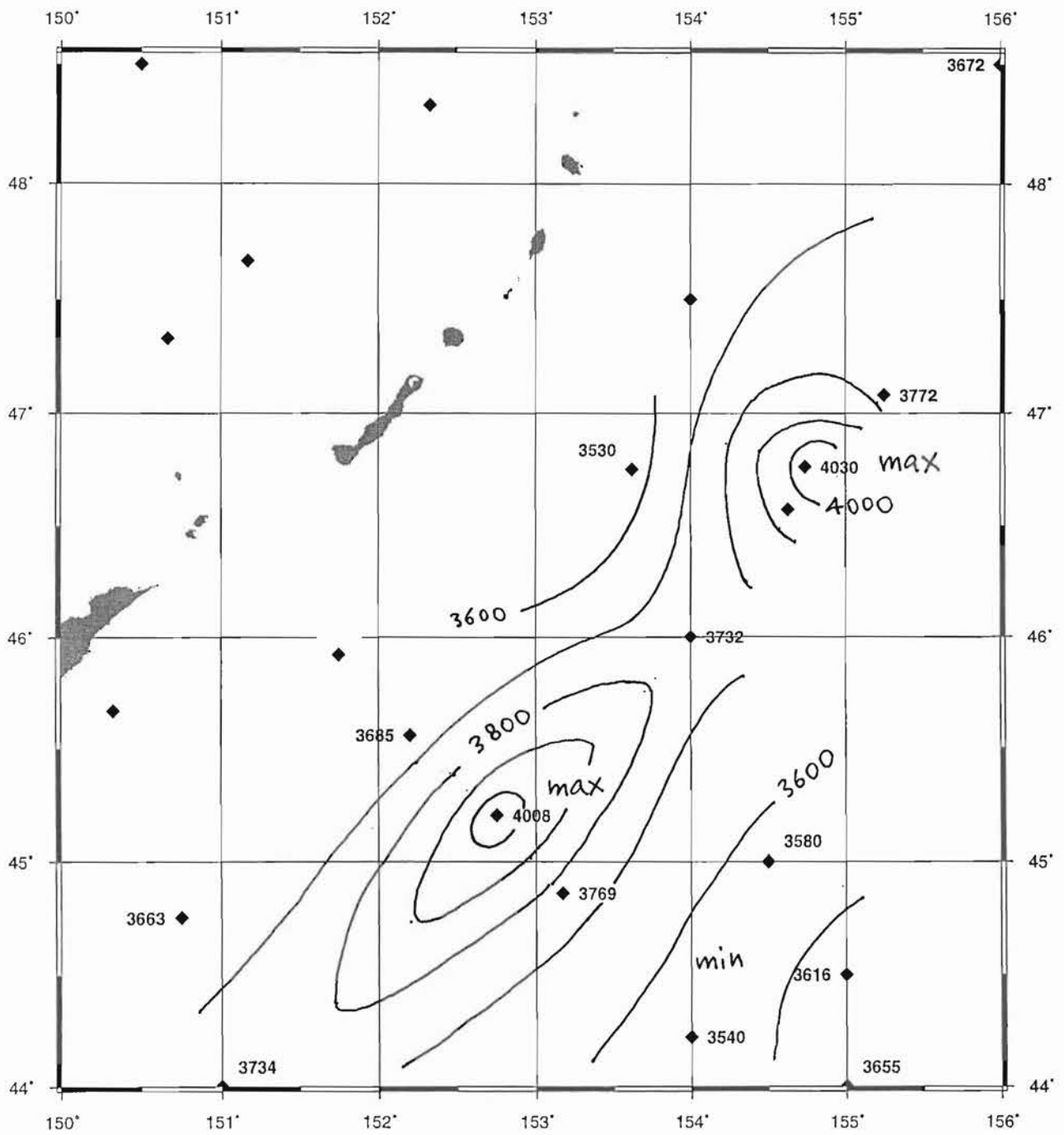
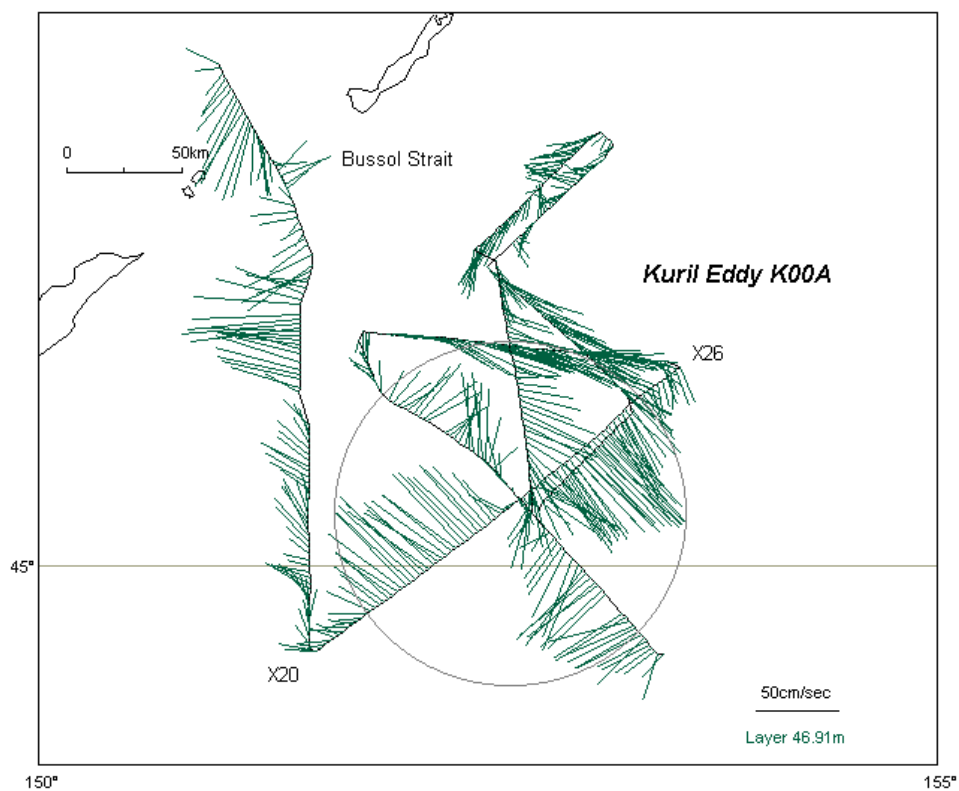
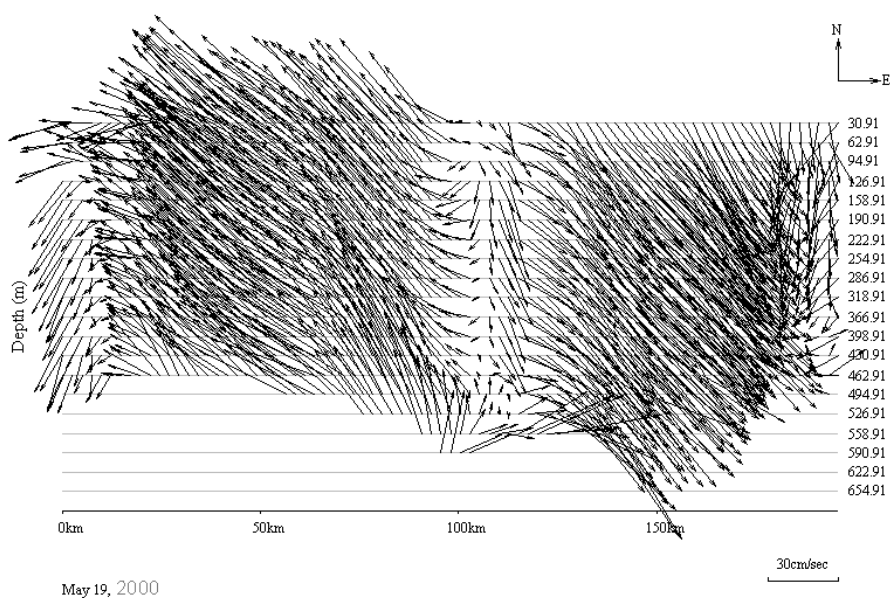


Fig.21 Depth of isopycnal surface $\sigma_{\theta} = 27.78$ (m)
Mercator Projection

GMT Jun 8 14:09



(a)



(b)

Fig. 22. Distribution of currents in the area of eddy K00A at 50 m depth (a) and current vectors at depth 30-600 m along SW-NE section across the eddy (b). Running mean averaged results of ADCP measurements of May 17-21, 2000.

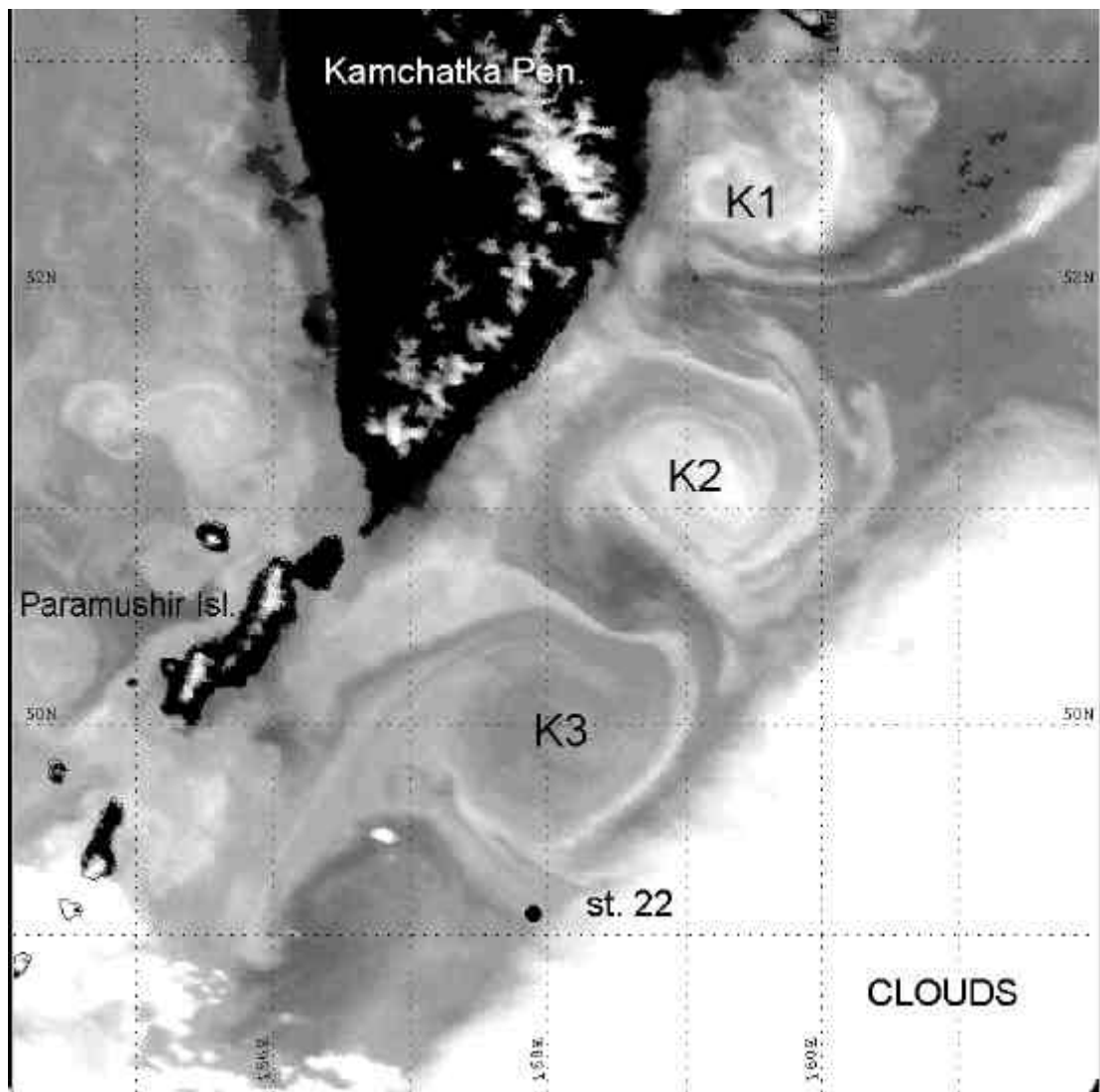


Fig. 23. Mesoscale eddies of the East-Kamchatka Current. NOAA-12 AVHRR infrared image for June 1, 2000 20:26 UTC. Cold water is represented by light shades of gray, clouds are white.

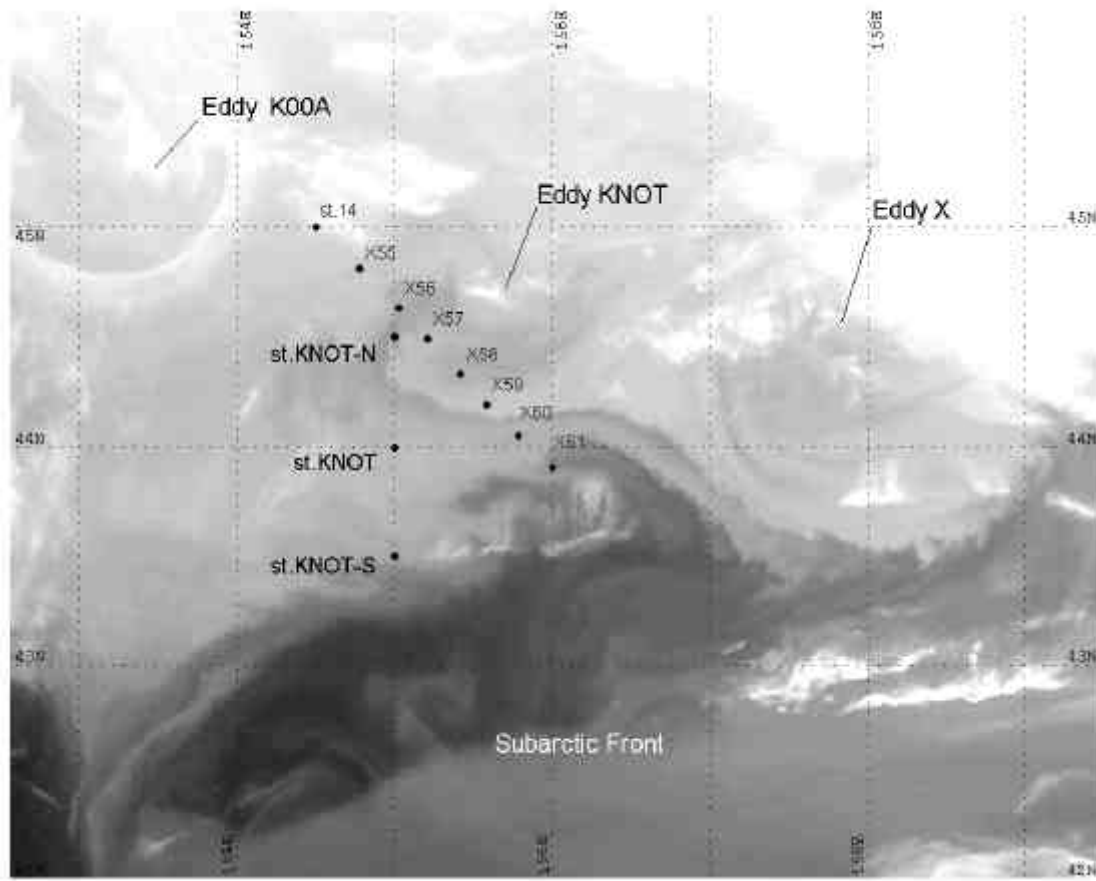


Fig. 24. Mesoscale eddies at the northern edge of Subarctic Front. NOAA-15 AVHRR infrared image of May 27, 2000, 08:52 UTC.

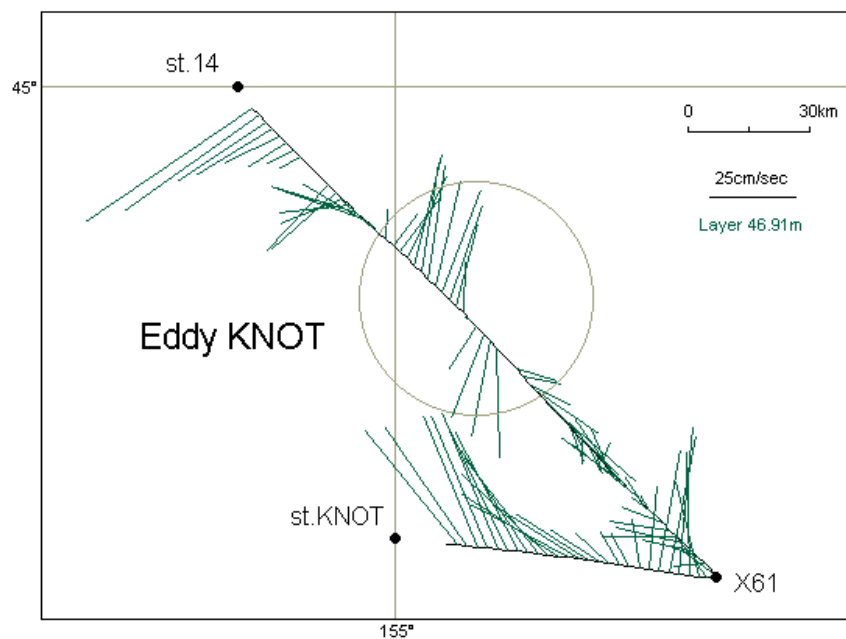


Fig. 25. Currents vectors at 45 m depth across an anticyclonic eddy near station KNOT by ADCP measurements on June 5, 2000.

3.19 Shipboard ADCP

Satoshi Okumura

(Global Ocean Development Inc.)

(1) Introduction

Acoustic Doppler Current Profiler (ADCP) measurements were performed continuously throughout MR00-K03 cruise from the departure of Sekinehama on 9 May 2000 to the return to Sekinehama on 10 June 2000.

(2) Methods

The current profile data were measured by VM-75 shipboard ADCP system manufactured by RD Instruments, Inc. U.S.A..

Major parameters for the measurement configuration are as follows:

Frequency:	75 kHz
Average:	every 300 sec.
Depth cell length:	1600 cm
No. of depth cells:	40
First depth cell position:	30.9 m
Last depth cell position:	654.9 m
Ping per ADCP raw data:	16

(3) Preliminary results

Fig. 3.21.1 shows current vectors of running averaged data plotted along the ship's track for first layer(30.9 m).

(4) Remarks

The data acquisition system has stopped because of some trouble, the data was lost from 16:36 May 15 to 6:32 May 16 (UTC).

(5) Data archive

ADCP data obtained in this cruise will be submitted to the DMO (Data Management Office), JAMSTEC and will be under their control.

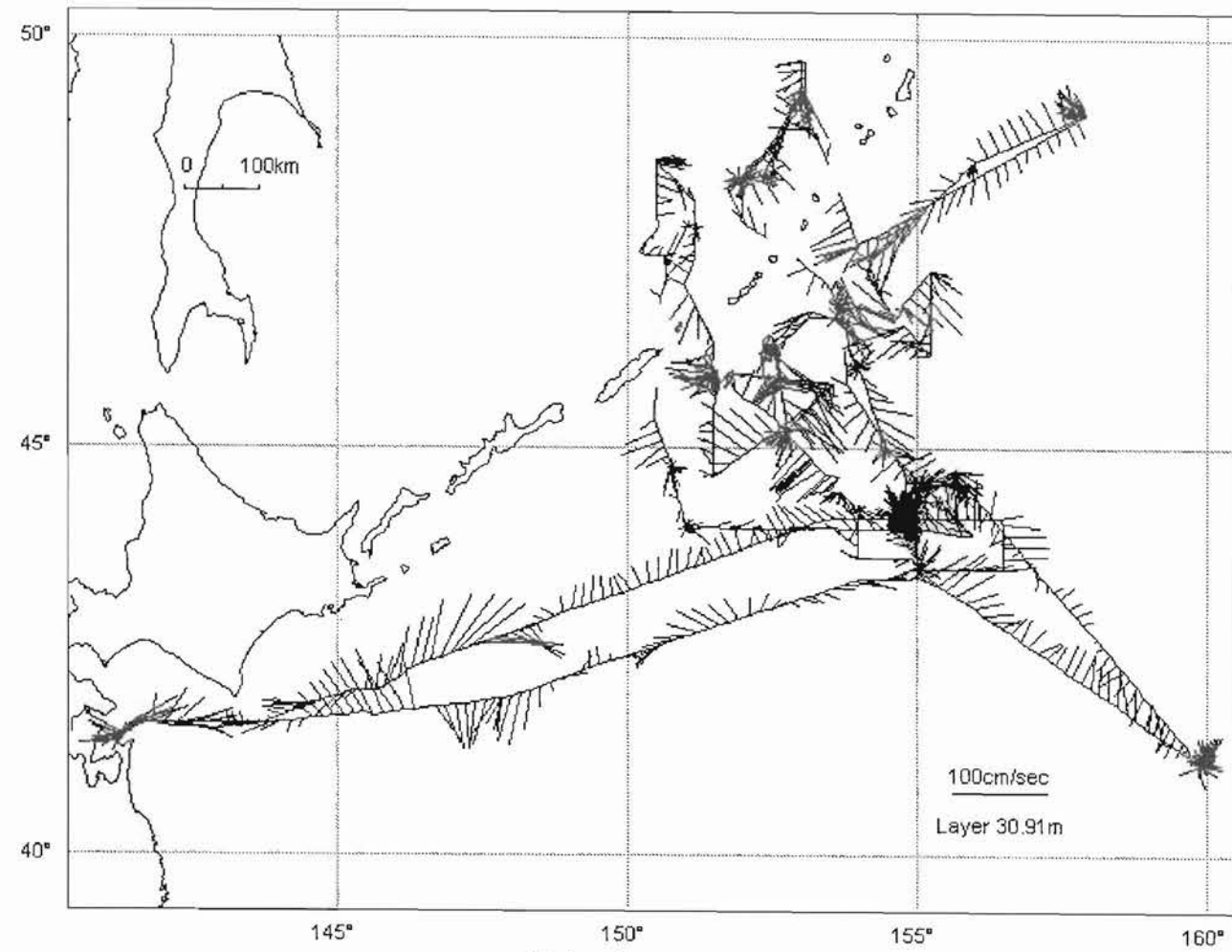
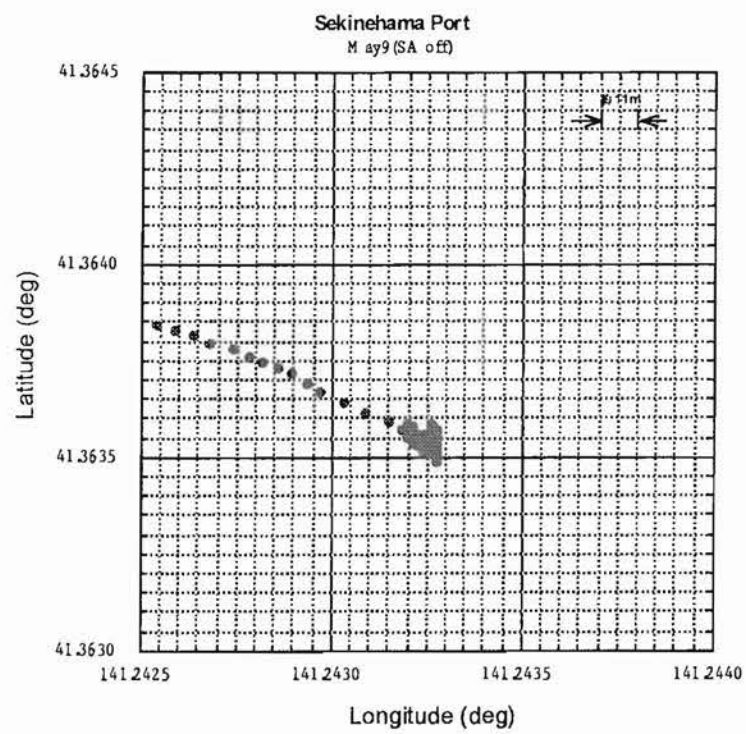
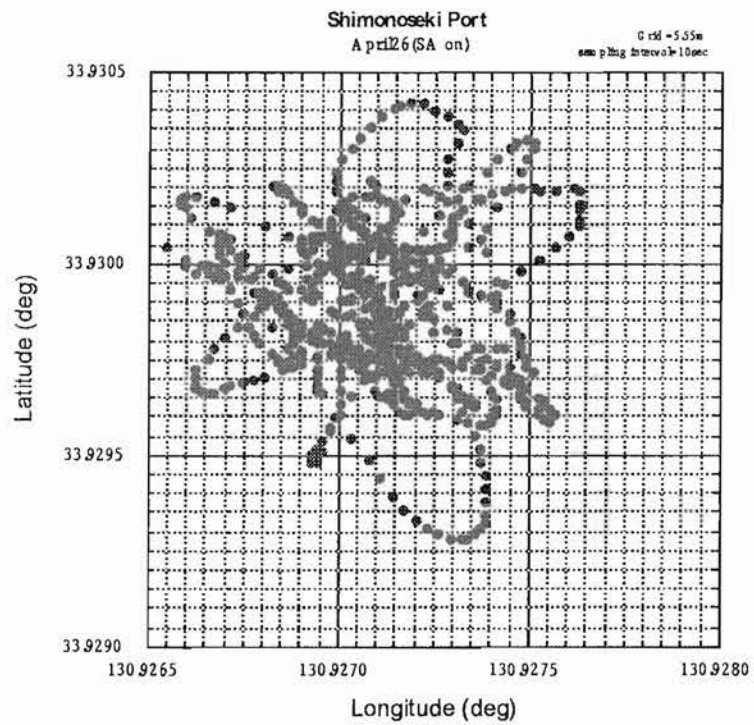


Fig 3. 19. 1

Appendix

U.S. government announced that GPS accuracy was raised on May 1, 2000 (<http://www.navcen.uscg.mil/gps/policynotes/SA.htm>). Following figure shows the GPS position of Mirai at Sekinehama (S.A.(Selective Availability) affected) and Sekinehama (without S.A) port. This will bring us more precise data of ADCP observation.



3.20. Underway Geophysics

3.20.1. Sea Surface Gravity

(1) Personnel; Toshio Furuta and Satoshi Okumura (GODI)

(2) Objective

Sea Surface gravity measurement during MR00-K03 cruise using a LaCoste-Romberg gravity meter S-116 installed on the R/V Mirai from Sekinehama (5/9) to Sekinehama (6/10).

(3) System configuration

The system consists of three components, first is a sensor platform with horizontally stabilized mechanism(two axes of gyros and torque motors), second is an analog/digital control system, and third is a datalogging PC which can record data fed from the control system in a hard disk at every ten second in addition with common navigation information(SOJ). Data is also sent to the Mirai network server through ethernet LAN system via terminal server.

(4)Method

As system can measure only the relative variation of gravity values at the sea, the values should be correlated with the absolute or known gravity values at each port (from start to finish of one cruise or leg). Moreover, the measured values are corrected based on the bathymetry(free-air) and ship movement(eotvos). Consequently, the corrected gravity data should involve the information of crustal and upper mantle structures how they might compensate the discrepancy from isostatic balance.

(5) Data storage:

Media; 3.5" magnetic optical disk (230MB MO)

Place; JAMSTEC Data Management Office

Annex shows the relative and absolute gravity values at Sekinehama, gravity bases or reference points measured by a Scintrex gravity meter CG-3M, these values were used for correction of sea surface gravity meter at the ports.

3.20.2. Surface three component magnetometer

(1) Personnel; Toshio Furuta and Satoshi Okumira (GODI)

(2) Objective

In order to continuously measure the geomagnetic field vectors on the sea surface, a three component magnetometer is a very useful equipment. The magnetic force on the sea is affected by induction of magnetized body beneath the seafloor in addition to the earth dipole magnetic field. The magnetic measurement on the sea is, therefore, one of useful tools for geophysical reconstruction of crustal structure and so on. The geomagnetic field can be divided into three components, i.e., two horizontal (x & y) and one vertical (z) moments. Three-component observation instead of total force includes much information of magnetic structure of magnetized bodies.

(3) System configuration

The system is mainly divided into three segments; sensor unit, control and datalogging unit, and gyro and vertical reference unit (VRU). The sensor unit is installed on the top of foremast, the control and datalogging unit in the dry laboratory, and the VRU also in dry lab. The gyro using this system is as same as navigation gyrocompass. A ring laser gyro in the Doppler Radar Meteorology system was usually used instead of normal VRU, because of high precision

(4) Method

The sensor consists of three axes fluxgate magnetometer and sampling period is 8Hz. The timing of sampling is controlled by the 1pps standard clock generated by GPS signal. Every one second data set which consists of 310 bytes; navigation information, 8 Hz three component of magnetic forces and VRU data is recorded in the external hard disk. The data set is simultaneously sent to the Mirai network server through ethernet LAN system.

(5) Data storage:

Media; 3.5" optical magnetic disk(640MB MO)

Place; JAMSTEC Data Management Office

(6) Results

During MR00-K03 cruise, the magnetic force is continuously measured from

Sekinehama to Sekinehama. Data obtained on the sea will be analyzed in near future. The procedure of quality control of data is mainly to eliminate the effect of ship's magnetized vector condition. In this cruise, the supplementary meteorological instruments were installed closed to the magnetic sensor, it seems that the noises emitted by new instruments cannot be ignored the effect to the sensor.

3.20.3. Multi Narrow Beam Echo Sounding system

(1) Personnel; Toshio Furuta and Satoshi Okumura (GODI)

(2) Objective

R/V Mirai has installed a multi narrow beam echo sounding system (MNBES) manufactured by SeaBeam Inc., SeaBeam 2100 system. This system utilized bathymetry mapping and subbottom profiling. The newest one can measure more than 120 degrees wider swath and available all depth of the world ocean floor.

(3) System configuration

The system consists of mainly four segments; under hull unit, controller electronic circuits, real time display unit, and post processing unit. Under hull unit has two projector alleys; one is for 12kHz and another for 4kHz with one hydrophone alley. The hydrophone alley can receive both returning acoustic signals of 12kHz and 4kHz, interleavingly. Main electronic circuits of 12kHz bathymetry and 4kHz subbottom profiler have the individual consoles in which the cpus and dsp boards process receiving signals. The real time display unit consists of three Indy workstations (W/S), two of them are for 12kHz terminal and real time display, and one for subbottom profiling controller. The system has also output devices such as graphic recorders, color printer and color plotter.

(4) Method

Gridding survey in this cruise was carried out at the several target areas. Each area is approximately 100 n.m. square or less, and depth from 9600m to 1500m. The gridding interval being one and half or twice of depth is different depending on their depths. After the gridding survey, the bathymetric data were fed to post processing W/S by ftp command. The post processing system furnished on this MNBES has two high

performance W/S Indigo² which have “mb-system” software on the basis of the Genetic Mapping Tool (GMT) called SeaView. Consequently, measured data can easily be edited on W/S by automatically or manually to provide gridding data and map images. Finally colored map from A(A4) to E(A0) size were used to specific purposes.

The bathymetry data gridding on the basis of netCDF format were sent to the network server of Mirai to overprint on the navigation track display.

(5) Data storage

Media; Exabyte tape

Place: JAMSTEC Data Management Office and JODC of Japan Marine Safety Agency

(6) Results

The accuracy seems to be enough to deploy the mooring and coring sediments at any depth. It is, of course, required to keep high accuracy that precise correction of sound speed of the target area can be performed based on the temperature structures of water column. During this cruise, CTD casts have done at the deployment sites or very close to the sites, we could use the CTD data to derive sound velocity. The newest system has continuously measured the surface water sound velocity in real time, because sound velocity just at the hydrophone alley is a very important factor to determine the grazing angle of acoustic ray which strongly affects the outer beam of wider swath. Unfortunately, the ssv meter had a trouble and could not operate, so we input the newest sound velocity data at site by site.

Determination of Absolute Gravity Value at JAMSTEC Gravity Base, on 12th June, 2000

2000.6.12

No	Station (unit)	hour	min	sec	pass time day	G _{abs} mgal	G _{read} mgal	ih cm	G _{c1} mgal	Drift mgal	G _{c2} mgal	G _{abs} -G _{c2} mgal	Remarks
1	JAMSTEC G-Base	6	51	28	0.285740741	980368.07	4021.129	46.0	4021.271	0	4021.271		980368.11 (Aomori base)
2	Aomori 1st G-Base	10	35	48	0.441527778	980311.06	3964.096	45.9	3964.238	0.016	3964.222		
					(1-2)	57.01					57.049	-0.039	
3	Hachinohe 1st G-Base	14	7	29	0.588530093	980361.3	4014.269	45.5	4014.409	0.031	4014.379		
					(1-3)	6.77					6.892	-0.122	
					(2-3)	-50.24					-50.157	-0.083	
4	1st Height Base of 6265	16	56	34	0.705949074	980366.58	4019.655	57.2	4019.832	0.042	4019.789		
					(1-4)	1.49					1.482	0.008	
					(2-4)	-55.52					-55.567	0.047	
					(3-4)	-5.28					-5.41	0.13	
5	JAMSTEC G-Base	17	20	30	0.722569444	980368.07	4021.174	45.7	4021.315	0.044	4021.271		

0.101 mgal/day

G_{c1}: Correction of instrumental height, G_{c2}: Correction of instrumental drift

measured by T.Furuta, S.Okumura & S.Sueyoshi

3.20-5

3.21 Long Term Broadband Ocean Bottom Seismic Observation

Hajime SHIOBARA

Earthquake Research Institute, University of Tokyo

Introduction

To study the history and evolution of the earth, it has started to recognize that the interior of the earth plays an important role in the global change, such as continental drift, massive extinction of biological species and climate change. Due to its large area of the ocean, it has been difficult to cover the earth surface by observatories with equal spatial density, which is necessary to construct a high resolution earth interior model. Therefore, geophysical observations in oceanic areas should be a breakthrough for our new knowledge of the earth interior. The Ocean Hemisphere network Project (OHP) aims to this role by constructing seismic, electromagnetic and geodetic networks in the western circum Pacific region with not only land stations but also ocean floor observatories, which will reveal a fine image of the whole mantle structure beneath this region.

Observation

On 1999/8/19, we deployed a long-term broadband ocean bottom seismometer (LT-BBOBS1) in the northwest Pacific as a first mobile ocean bottom seismic observatory of the OHP by R/V Hakuho-maru (ORI, University of Tokyo, KH99-3 leg3). The position is chosen as an typical deep ocean basin and too sparse station density of the northwest Pacific area, and we will construct a borehole seismic observatory in this summer during the ODP cruise (leg 191). This OBS has a broad band velocity sensor (CMG-1T : Guralp, UK), which covers from 3mHz (333s) to 50Hz, to detect signals contains information of deep earth interior. The sensor output is digitized by an ADC (20bit, 128Hz) and recorded continuously during the preset period on four 2.5inch hard disk drive units with 5M byte buffer memory. Like as our standard OBS with a short period sensor, it is designed as a free-fall and self pop-up type OBS. All components except a transducer of the acoustic transponder and the releasing mechanism of an anchor are equipped in a titanium sphere of 65cm diameter, and it will ascend by its buoyancy remained after releasing the anchor by forced electric corrosion of thin titanium plates. The observation period is designed for 400days, and the specifications and two OBS observation data are indicated at the end of this section.

During this cruise (MR00-K03), we recovered this LT-BBOBS1 on 2000/5/27 (Photo 1) and deployed another one (LT-BBOBS3, Photo 2) at the same position. The second one, LT-BBOBS2, was deployed by R/V Natsushima off Sanriku on 1999/9/8 and recovered on 1999/10/31. After the drop of the OBS and after it had reached on the sea floor, we measured distance from the ship to the OBS at above and surrounding four positions for the precise positioning of it on the sea floor. This OBS is planed to recover during the cruise of R/V Kaiei (KR00-06) on this November, when the borehole observation will be initiated by using the ROV.



Photo 1. LT-BBOBS1 at the sea surface recovered after eight months observation.



Photo 2. LT-BBOBS3 on the deck waiting the deployment.

Specification of LT-BBOBS for 400 days observation

Sensor:	CMG-1T, analog feedback velocity output (3200V/m/s), 3 components (Vertical / NS / EW), wide frequency band (3m~50Hz, -3dB), low power consumption (0.3W), active leveling mechanism (cancel up to ± 20 degree, check every day), flux-gate compass with tilt-meter.
Recorder:	HDDR-2B (modified), amplifier gain (-6dB), LPF (30Hz, -24dB/oct.), continuous recording (128Hz sampling), ADC (20bit, ± 2.5 V), media (2.5inch SCSI HDD, 6.5GB x 4), TCXO (± 0.5 ppm), two serial ports for sensor and transponder.
Battery:	DD size lithium cells (3.9V 30Ah, total 76 pcs.).
Transponder:	ranging, anchor releasing, acoustic link between ship and OBS.
Case:	Titanium sphere housing (diameter 65cm), certified for 6000m depth, weight in air (90kg), remained buoyancy (70kg), orange color painted.
Anchor:	Steel (50kg), additional weight (1.3kg x 8, 20kg x 2), total 100.4kg.
Recovery Aid:	Radio beacon (43.528MHz), Xenon flasher.

Recovery Data of LT-BBOBS1

Time:	2000/ 5/27 00:00 (UTC)
Position:	41° 07.0815' N, 159° 55.9331' E, 5599m (bottom, assumed 1500m/s)
Recording:	1999/ 8/20 01:00:00 ~ 2000/ 5/20 01:00:00 (UTC) internal clock has set in 1995 for Y2K problem. 1999/ 8/21 01:00 ~ 2000/ 3/19 09:00 (obtained data, in UTC)
Time diff.:	1999/ 8/19 21:47:00 (UTC) -6.450s 2000/ 5/27 00:17:00 (UTC) +24.880s

Deployment Data of LT-BBOBS3

Time:	2000/ 5/27 03:35 (UTC)
Position:	41° 07.099' N, 159° 55.876' E, 5622m (dropped) 41° 07.107' N, 159° 56.057' E, 5589m (bottom, assumed 1500m/s)
Recording:	2000/ 5/28 12:00:00 ~ 2000/11/20 12:00:00 (UTC)
Time diff.:	2000/ 5/27 02:55:00 (UTC) -4.517s

Results and Discussion

As the total volume of the data obtained by LT-BBOBS1 is huge as 15G byte, it is impossible to process and indicate here. The processed data will be distributed from the data center of the Ocean Hemisphere Research Center, Earthquake Research Institute, University of Tokyo.

Here, some preliminary results are shown, seismic records of large earthquakes and ground noise spectra. In Figure 1, records of two large earthquakes in Taiwan and Mexico are indicated, which we can recognize P, S and some other converted phases clearly. Power spectral densities (PSD) of

ground acceleration records on 08:00~59 1999/9/6 are shown in Figure 2. The vertical component has lower noise level as 10~20dB than horizontal components. From a comparison with the PSD of the same type OBS deployed off Sanriku, the noise level in low frequency band, less than 0.1Hz, is lower as about 10dB. It is probably due to the slower sea bottom current at this site.

Future plan

From the preliminary result from the data, we need to modify the mechanical design of the LT-BBOBS to reduce the noise especially in horizontal components. One possible solution for this problem is to put the sensor in the sediment.

The main aim of this observation will be done by using the whole network data, land stations, borehole stations below the sea floor and this mobile OBS stations. To accomplish it, we should continue this kind of mobile OBS observations if we have a chance to join a research cruise even if it is for other scientific fields.

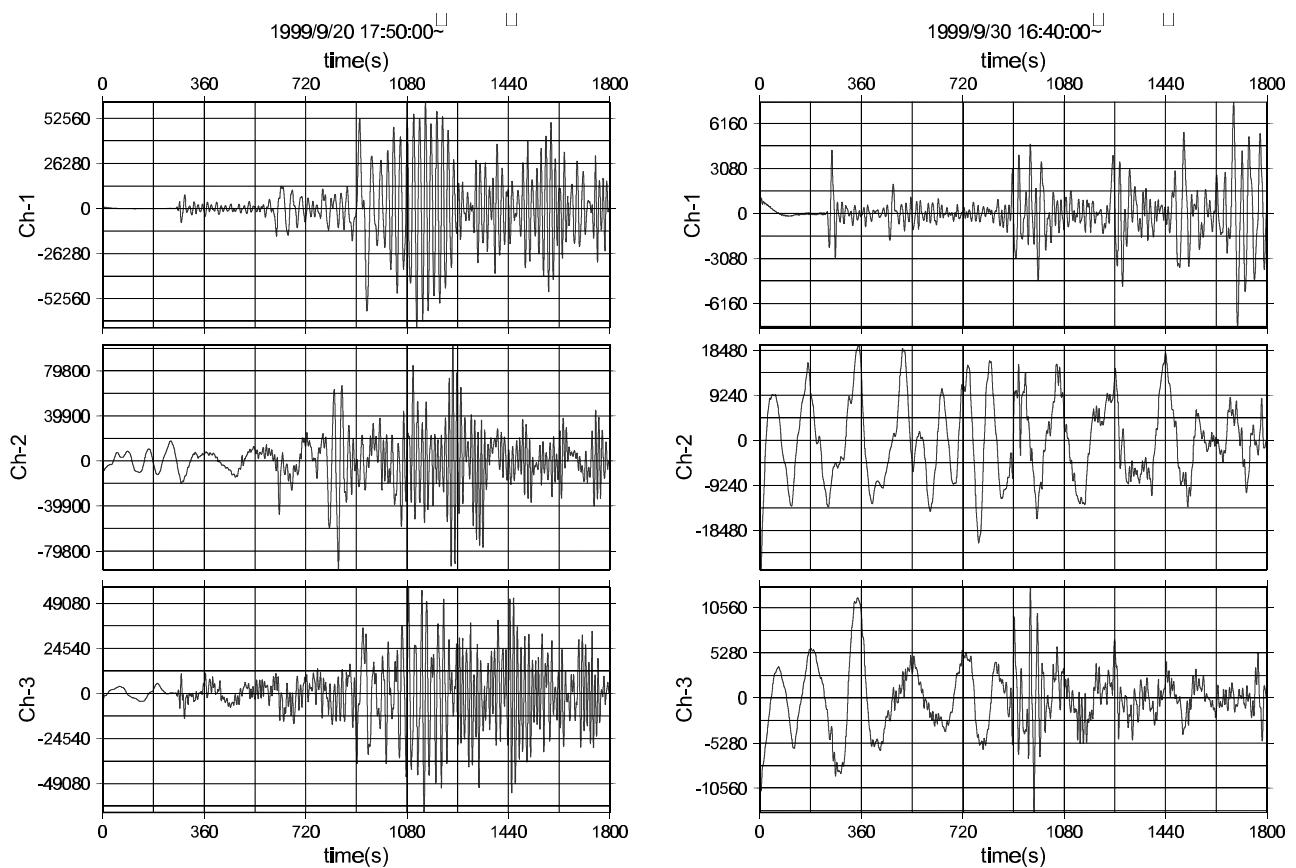


Figure 1. Seismic records of two large earthquakes, (left) occurred in Taiwan (M7.6) on 17:47:19, and (right) in Mexico (M7.5) on 16:31:13. The records are band-pass filtered (0.005~0.1Hz). Ch-1~3 correspond to components of Vertical, NS and EW, respectively.

BBOBS1 1999/9/6 8:00

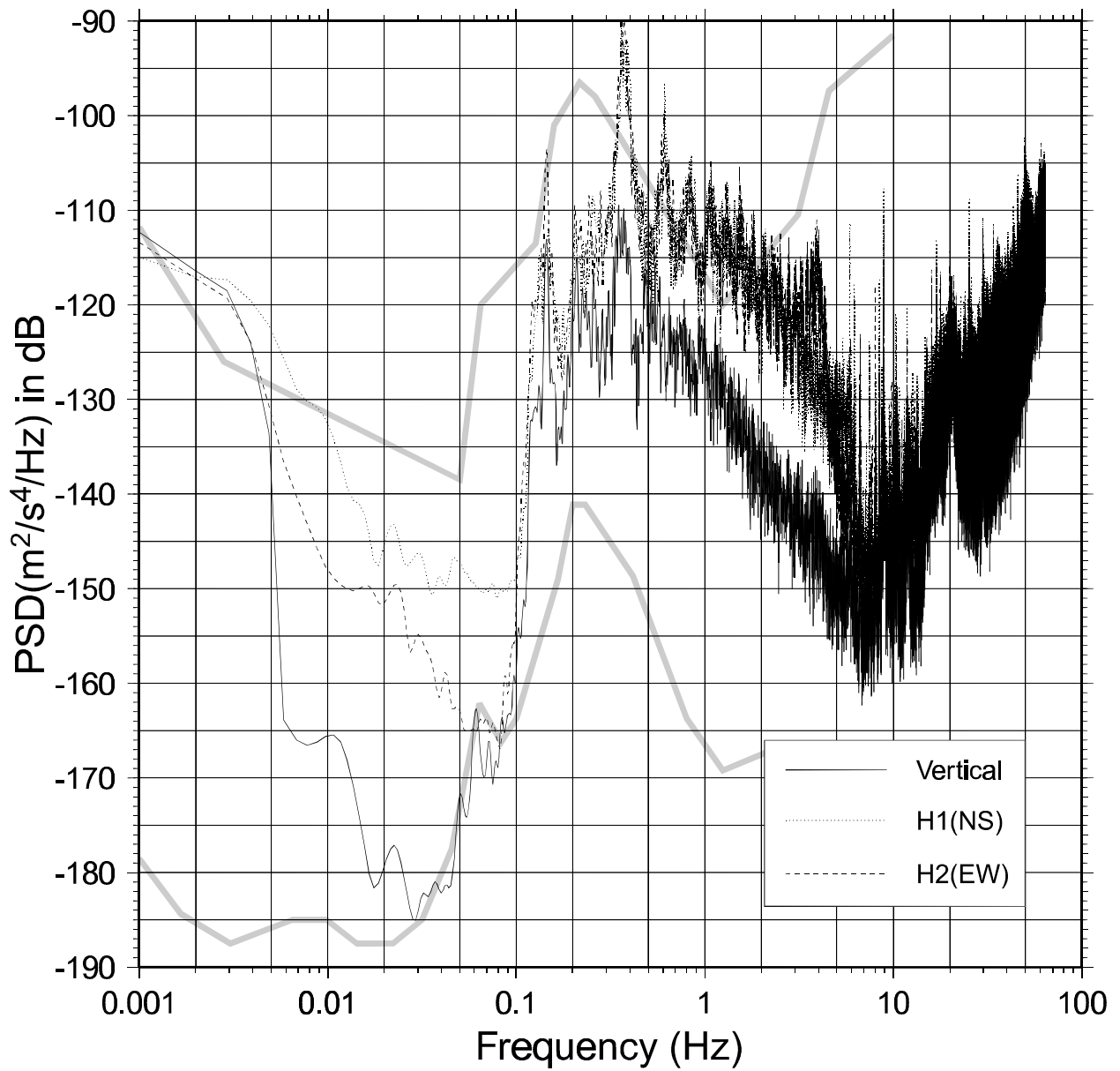


Figure 2. A typical power spectral density of ground acceleration records on 08:00~59 1999/9/6. Two wide and thin lines indicate statistic high and low noise models.

3. 22 SeaFloor ElectroMagnetic Station (SFEMS)

Hiroaki Toh¹⁾, Sawako Honma¹⁾ and Tada-nori Goto²⁾

1) Toyama University

2) Department of Science Education, Aichi University of Education

1. Introduction

Recently, long-term electric and magnetic field variations can be recorded at the ocean floor (e.g. Kasahara et al., 1995; Toh et al., 1998). Such observations are necessary to elucidate the electrical conductivity structure of the deep mantle. Another purpose for such long-life observations is detection for geomagnetic secular variation at the ocean floor to discuss the origin of the earth's magnetic field possibly generated by fluid motion in the earth's core.

For these purposes, a new sea-floor electromagnetic observatory has been developed (Toh et al., 1998). The SeaFloor ElectroMagnetic Station (SFEMS) consists of nine sensors mainly; an Overhauser absolute magnetometer, three-component Fluxgate magnetometers, two-component voltmeters, two tiltmeters and a fiber-optical gyroscope (See Photos 1 and 2). Four electrodes, used for measurements of two horizontal electric fields, are attached to the end of 2.5m arms each other. Since these instruments were designed with a lower power consumption and with a higher protection to corrosion, the life of the SFEMS has been extended to about two years.

Here, we report the recovery trial for the SFEMS installed in 1999. We also report features of a new SFEMS prepared for the installation in MR00-K03 cruise.

2. Trial for recovery of the SFEMS

The SFEMS was successfully deployed in Leg. 3, KH-99 cruise by R/V Hakuho-maru, Ocean Research Institute, University of Tokyo. The deployment was at 23:29:05 UT on August 19 in 1999 and the location was N41 07.00' and E159 56.13'. After the deployment, acoustic rangings were carried out at six sites. We succeeded in the rangings at four sites. On the basis of the measured slant ranges, the ocean bottom location of the SFEMS was determined as N41 06.99' and E159 56.09'.

The recovery phase for the SFEMS was started in MR00-K03 cruise at 21:00 UT on

May 26. After the ship reached just on the SFEMS site, we tried to call the SFEMS on the ocean floor. The code for calling the transponder attached to the SFEMS is 3-B. We called the SFEMS with the 3-B code, but no response was returned from the SFEMS. We also tried acoustic ranging from the ship to the SFEMS, but obtained no response. Although other transmitting code was tested to communicate with SFEMS, there was no reply.

Then, several attempts for the transducer were carried out. First, the transducer was replaced to a reserved one. Also, the transducer was wrapped by an urethane foam to reduce acoustic noises. Actually, the noise level became quite low. We usually installed the transducer from the starboard, but sometimes from the port side or the stern of the vessel. However, these attempts did not make us possible to call the SFEMS.

Four hours later from the start of the recovery, we shifted the ship position because acoustic communications may be interrupted by small sea mounts and so on. The ship was moved to about 0.5 miles south because we succeeded in acoustic ranging around there in 1999. However, no answer from the SFEMS was received at this location. We also tried to call the SFEMS at three ranging sites for the OBS. These ranging sites surrounded the ocean-bottom SFEMS location, but there was no reply.

Finally, the release command was sent to the SFEMS at 22:07 UT, 23:10 UT on May 26 and 03:55 UT on May 27. There was no reply from the SFEMS. Ship crews and researchers carefully looked for the popped-up SFEMS, however, we could not find it. As a result, we could not call SFEMS on the sea-floor with any transmitting codes and could not pick up it on board.

The reason why acoustic communications failed is now under consideration. One possibility is a current leakage at connectors on the transponder. Such a leakage may be loss of electric power of the transponder. Another possibility is a flood into the transponder case. We will find and fix the problem near future.

3. New SFEMS features

A new SFEMS was constructed to replaced the old SFEMS installed in 1999. In this new SFEMS, several new abilities are appended.

- 1) Acoustic Telemetry Modem (ATM)
- 2) Interface Box (IF)

An old ATM has been attached the SFEMS already. However, it was difficult to communicate if the slant range between the ship and the SFEMS is greater than about

4000 m. Therefore, the old-type ATM was not attached to the SFEMS installed in 1999. A new ATM made by Kaiyo Denshi Kogyo Co., Ltd. (Photo 2) allows us to control the sea-floor instruments and to transmit observed data at the maximum rate of 300 baud. The maximum distance for the communication is greater than 6000m. The transmitting code is M-series (Phone# 550). Data transmission and data monitoring were tested on board successfully.

Another feature is a more sophisticated interface (IF) box (Photo 2). This new IF can control all instruments attached to the SFEMS and can record output values from all sensors. In addition, a fiber-optical gyroscope is controlled by the new IF. Since the IF can be controlled and monitored via the ATM, real-time monitoring and transmission of all observed values by the SFEMS are available.

A magnetotelluric variograph (OBEM) is also modified for the new SFEMS. Since only 4MB memory had been adopted in an old OBEM, variations of electric and magnetic field were recorded as differential values. Since differential values have narrow dynamic ranges (and small memory occupations), there was a problem that a large variation of the magnetic and electric field may be over the dynamic range. Now, a new OBEM (OBEM99; Photo 2) has a 16MB flash ROM. This large memory can allow us to record raw electric and magnetic field without using differential values, therefore with a wider dynamic range.

New electrodes were prepared for the new SFEMS. They are Ag-AgCl type. The voltage difference between electrodes was very small and stable (see Fig. 1). All electrodes were soaked in a bottle filled with saline water. The voltage difference is rapidly changed after May 30. It is due to dry condition of the electrodes because they were attached to the SFEMS on board on May 26 - 29. This voltage difference became small after the electrodes were soaked in saline water on May 30..

Unfortunately, the SFEMS installed in 1999 was not recovered in MR00-K03 cruise as described above. Since the transponder attached to the new SFEMS was as same type as the old SFEMS and possibly had same problems, this new SFEMS was not deployed. After some modifications about the transponder, the new SFEMS will show us a real-time monitoring of the electromagnetic field at the ocean floor and record them with a higher accuracy.

References

Kasahara, J. et al., GeO-TOC project-reuse of submarine cables for seismic and geoelectrical measurements, *J. Phys. Earth*, 43, 619-628, 1995.

Toh, H. et al., A new seafloor electromagnetic station with an Overhauser magnetometer, a magnetotelluric variograph and an acoustic telemetry modem, *Earth Planets Space*, 50, 895-903, 1998.

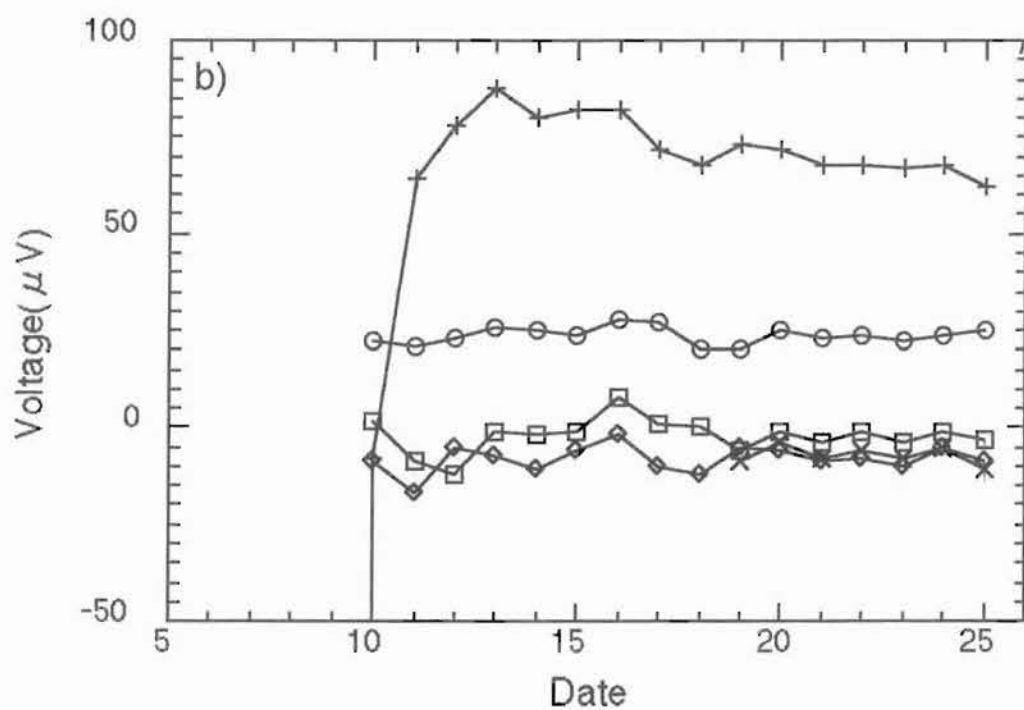
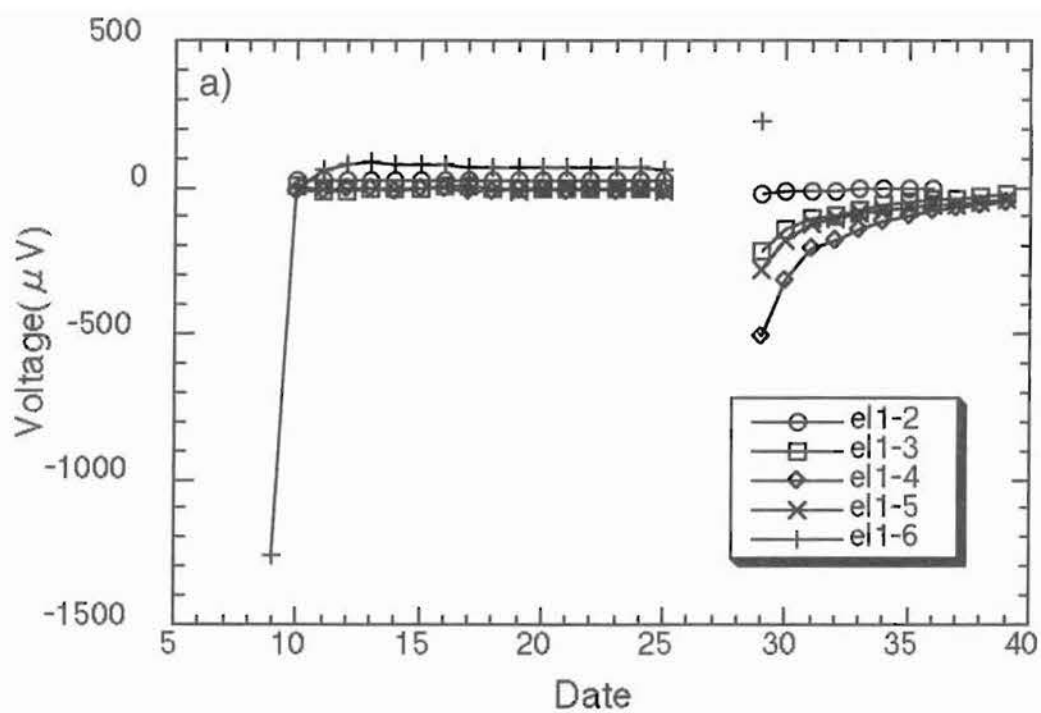


Fig. 1. Voltage difference between two electrodes. Electrode 1 is used for common. Date is counted from May 1. (a) May 9 - June 8, and (b) May 10 - May 25.

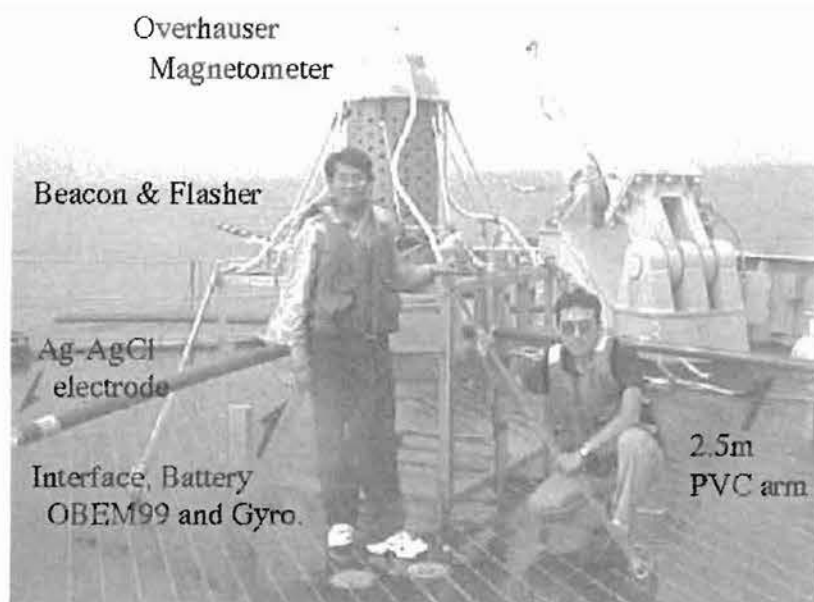


Photo 1. Outer view of the SFEMS.

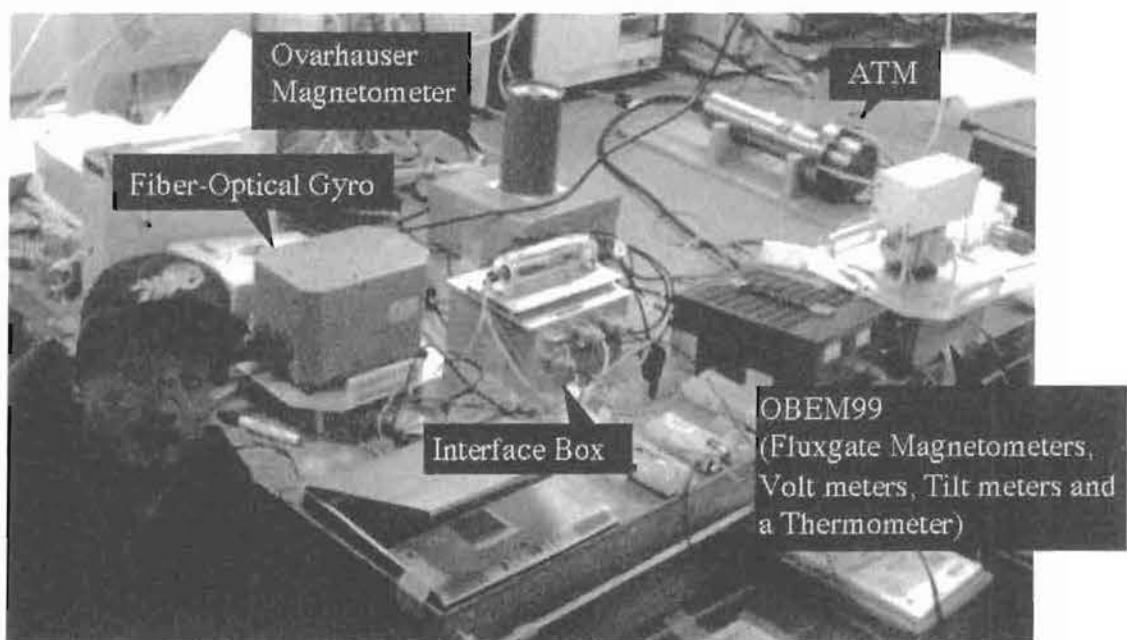


Photo 2. Instruments before the installation in the SFEMS.

Station: TEST

	Start	Bottom	End
Date/Time:	00/05/09, 23:59	00/05/10, 00:17	00/05/10, 00:45
Lat.:	41°54.63'N	41°54.60'N	41°54.58'N
Long.:	147°50.03'E	147°50.07'E	147°50.13'E
Depth (m):	5445	5445	5448

(GMT)

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: TESS01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	999.3	1009.4	3.099	3.030	34.401	27.398
2	698.9	705.5	3.746	3.696	34.240	27.208
3	398.8	402.3	3.031	3.006	33.697	26.842
4	299.8	302.4	1.944	1.929	33.446	26.731
5	199.5	201.2	1.410	1.401	33.261	26.621
6	149.8	151.0	3.297	3.288	33.398	26.580
7	124.2	125.2	3.159	3.151	33.369	26.569
8	100.2	101.0	2.962	2.956	33.307	26.537
9	79.7	80.3	2.532	2.528	33.162	26.458
10	39.2	39.5	4.684	4.681	33.284	26.350
11	19.6	19.8	4.625	4.623	33.273	26.348
12	9.3	9.4	10.690	10.688	34.154	26.172

Station: TEST

	Start	Bottom	End	
Date/Time:	00/05/10, 01:12	00/05/10, 01:42	00/05/10, 02:23	(GMT)
Lat.:	41°54.58'N	41°54.55'N	41°54.54'N	
Long.:	147°50.18'E	147°50.28'E	147°50.31'E	
Depth (m):	5449	5447	5447	

Remarks:	Cast for only CTD d:
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: TESL01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	1000.3	1010.5	3.115	3.046	34.404	27.398	0.8	-	-	-	-	-	-	-	-	-	-	-
2	1000.3	1010.5	3.114	3.045	34.403	27.398	0.8	-	-	-	-	-	-	-	-	-	-	-
3	1000.3	1010.4	3.110	3.041	34.404	27.399	0.9	-	-	-	-	-	-	-	-	-	-	-
4	1000.2	1010.3	3.118	3.048	34.403	27.398	0.8	-	-	-	-	-	-	-	-	-	-	-
5	1000.4	1010.6	3.118	3.048	34.403	27.397	0.8	-	-	-	-	-	-	-	-	-	-	-
6	1000.4	1010.6	3.114	3.045	34.403	27.398	0.8	34.399	45.4	7.374	2370.5	2351.3	-	41.97	2.97	133.3	0.0	-
7	799.5	807.2	3.478	3.421	34.305	27.285	0.9	34.303	44.0	7.355	2355.4	2341.1	0.03	41.64	2.98	123.2	-	-
8	699.2	705.8	3.713	3.663	34.240	27.211	0.9	34.238	44.4	7.350	2344.5	2333.5	0.01	41.13	2.92	115.5	0.0	-
9	598.8	604.3	4.051	4.007	34.176	27.125	0.9	34.185	56.4	7.372	2331.4	2313.9	0.02	39.77	2.83	103.8	0.0	-
10	498.8	503.2	3.901	3.866	34.014	27.012	0.9	34.022	68.8	7.357	2319.2	2298.3	0.02	39.21	2.81	96.17	0.0	-
11	399.6	403.1	2.905	2.881	33.692	26.850	0.8	33.690	136.2	7.409	2278.9	2253.6	0.04	35.06	2.59	79.83	0.0	-
12	300.0	302.5	1.980	1.964	33.467	26.745	0.8	33.468	192.0	7.460	2270.5	2225.7	0.03	31.77	2.40	69.89	0.0	-
13	199.9	201.6	2.103	2.092	33.310	26.610	0.8	33.292	267.8	7.590	2250.4	-	0.05	24.72	1.95	48.87	0.0	0.08
14	149.4	150.7	3.344	3.335	33.395	26.573	0.9	33.384	290.4	7.685	2244.1	2124.6	0.04	19.14	1.54	34.69	0.0	0.07
15	124.8	125.8	3.609	3.601	33.404	26.555	1.0	33.397	294.1	7.705	2247.6	2115.1	0.14	17.63	1.45	30.68	0.0	0.10
16	99.6	100.4	2.666	2.660	33.188	26.467	1.5	33.201	317.3	7.707	2241.0	2112.5	0.20	16.96	1.45	30.13	0.5	0.36
17	80.0	80.7	5.871	5.864	33.532	26.409	2.3	33.490	307.1	7.791	2249.6	2090.3	0.25	12.86	1.18	21.18	1.2	0.56
18	58.6	59.1	5.231	5.227	33.403	26.383	5.6	33.461	315.2	7.811	2250.4	2079.0	0.23	11.16	1.07	18.58	1.1	1.77
19	49.8	50.2	5.975	5.970	33.498	26.369	4.1	33.481	316.3	7.821	2250.4	2073.2	0.22	10.69	1.04	17.72	1.3	1.15
20	39.9	40.2	6.419	6.416	33.563	26.364	4.0	33.562	313.9	7.835	2253.1	2071.4	0.23	10.07	0.93	16.48	1.3	1.12
21	29.6	29.9	6.319	6.317	33.546	26.363	6.9	33.539	318.7	7.840	2250.8	2070.5	0.23	9.69	0.89	15.62	1.2	1.88
22	19.9	20.1	7.121	7.119	33.644	26.334	11.8	33.657	316.8	7.862	2257.9	2061.2	0.23	8.74	0.80	12.83	1.3	3.93
23	9.6	9.6	6.344	6.344	33.481	26.309	30.0	33.445	362.5	7.918	2253.0	2037.3	0.18	4.59	0.53	5.42	0.3	13.10
24	4.4	4.4	4.996	4.996	33.181	26.234	30.0	33.217	391.2	7.936	2250.2	2021.9	0.17	4.31	1.80	7.58	0.0	13.42
	0																	1.34

Station: KN0T1

	Start	Bottom	End
Date/Time:	00/05/11, 10:26	00/05/11, 10:35	00/05/11, 10:56
Lat.:	44°00.03'N	44°00.01'N	44°00.00'N
Long.:	154°59.88'E	154°59.85'E	154°59.84'E
Depth (m):	5312	5309	5310

(GMT)

Remarks:	Cast for only CTD d
	Water samples for JAMSTEC Kawakami

CTD file #: KN1L01.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	300.3	302.8	3.216	3.197	33.944	27.022	0.9
2	300.3	302.8	3.218	3.199	33.945	27.023	0.9
3	249.4	251.5	3.197	3.181	33.858	26.956	0.9
4	249.5	251.6	3.199	3.183	33.856	26.954	0.9
5	199.4	201.0	2.998	2.986	33.713	26.858	0.8
6	199.5	201.2	2.996	2.984	33.712	26.857	0.8
7	149.9	151.1	2.498	2.489	33.502	26.732	0.8
8	149.8	151.0	2.504	2.495	33.504	26.734	0.8
9	99.3	100.1	1.917	1.912	33.183	26.522	1.1
10	99.6	100.3	1.912	1.907	33.183	26.522	1.1
11	74.7	75.2	1.180	1.176	33.032	26.451	1.5
12	74.5	75.1	1.179	1.175	33.031	26.451	1.7
13	59.1	59.5	1.572	1.569	33.015	26.412	3.0
14	58.7	59.1	1.587	1.584	33.015	26.412	3.1
15	49.5	49.9	1.730	1.728	32.996	26.386	3.4
16	49.3	49.7	1.739	1.737	32.997	26.386	3.4
17	39.6	39.9	2.058	2.056	32.989	26.357	4.6
18	39.6	39.9	2.074	2.072	32.990	26.356	4.6
19	29.1	29.3	2.190	2.188	32.979	26.338	5.3
20	29.1	29.3	2.192	2.190	32.979	26.338	5.4
21	19.8	20.0	2.324	2.323	32.975	26.325	5.7
22	19.8	19.9	2.326	2.325	32.975	26.325	5.6
23	9.8	9.9	3.746	3.746	32.994	26.216	4.6
24	9.9	9.9	3.734	3.733	32.998	26.220	4.6

Station: KNOT1

	Start	Bottom	End
Date/Time:	00/05/11, 11:13	00/05/11, 11:29	00/05/11, 11:57
Lat.:	43°59.98'N	43°59.93'N	44°00.05'N
Long.:	154°59.94'E	154°59.91'E	154°59.78'E
Depth (m):	5318	5312	5305

(GMT)

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: KNIS01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	1000.1	1010.2	2.659	2.593	34.439	27.468
2	699.5	706.1	3.101	3.055	34.336	27.346
3	399.3	402.8	3.527	3.500	34.090	27.109
4	299.4	301.9	3.197	3.178	33.915	27.001
5	199.3	201.0	2.740	2.728	33.623	26.809
6	149.7	150.9	2.255	2.247	33.411	26.679
7	124.8	125.8	2.033	2.026	33.225	26.547
8	100.4	101.2	1.476	1.471	33.091	26.480
9	79.8	80.5	1.195	1.191	33.014	26.437
10	39.9	40.3	2.076	2.074	32.993	26.358
11	20.0	20.1	2.359	2.357	32.976	26.323
12	10.1	10.2	3.725	3.724	32.987	26.212

Station: KN0T1

	Start	Bottom	End	
Date/Time:	00/05/11, 12:05	00/05/11, 12:29	00/05/11, 13:06	(GMT)
Lat.:	44°00.05'N	43°59.92'N	43°59.91'N	
Long.:	154°59.88'E	154°59.83'E	154°59.77'E	
Depth (m):	5308	5315	5309	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine

Surface water (0 m) was collected by a bucket

CTD file #: KN1L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TAlk	TDIC	Nitrite	itrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	799.9	807.6	2.975	2.921	34.384	27.396	0.9	34.380	37.9	-	-	-	-	-	-	-	-	-
2	800.0	807.8	2.974	2.921	34.384	27.396	0.9	34.382	37.6	7.360	2375.2		2358.1	0.02	42.66	3.18	138.0	0.0
3	699.0	705.6	3.137	3.090	34.332	27.339	0.9	34.330	36.5	7.348	2369.8		2346.8	0.01	42.80	3.19	133.4	0.0
4	599.2	604.7	3.097	3.058	34.249	27.277	0.9	34.245	22.9	7.303	2356.6		2351.1	0.00	44.09	3.27	132.6	0.1
5	499.1	503.6	3.280	3.247	34.185	27.208	0.9	34.181	31.7	7.311	2342.9		2339.5	0.03	43.30	3.22	122.8	0.1
6	399.5	403.0	3.632	3.605	34.105	27.111	0.9	34.100	45.9	7.328	2334.8		2323.6	0.01	41.86	3.11	108.8	0.1
7	299.2	301.7	3.207	3.188	33.924	27.007	1.0	33.927	50.2	7.287	2314.8		2321.3	0.02	42.63	3.16	103.5	0.0
8	248.9	251.0	3.168	3.152	33.829	26.936	0.9	33.833	70.6	7.311	2299.5		2300.8	0.02	41.17	3.08	95.40	0.0
9	224.0	225.9	3.061	3.047	33.768	26.896	0.9	33.765	88.7	7.333	2303.0		2288.0	0.01	39.95	3.00	90.20	0.0
10	199.7	201.4	2.829	2.817	33.673	26.841	0.9	33.674	115.9	7.365	2292.5		2270.1	0.01	37.87	2.87	83.62	0.1
11	174.4	175.8	2.707	2.697	33.595	26.789	0.9	33.598	141.8	7.404	2277.8		2247.6	0.01	35.67	2.71	77.11	0.0
12	150.1	151.3	2.557	2.548	33.523	26.744	0.8	33.506	171.3	7.446	2274.0		2228.0	0.02	33.81	2.51	70.40	0.1
13	125.9	126.9	2.661	2.653	33.389	26.628	0.9	33.387	261.2	7.612	2265.1		2157.0	0.03	25.63	2.01	48.81	0.1
14	101.2	102.0	1.875	1.870	33.188	26.529	1.1	33.200	312.5	7.664	2250.2		2128.2	0.29	23.46	1.90	42.47	0.1
15	89.8	90.5	1.556	1.552	33.116	26.494	1.4	33.129	323.5	7.666	2239.2		2124.7	0.31	23.57	1.93	42.37	0.2
16	80.7	81.3	1.486	1.483	33.088	26.476	1.7	33.082	332.7	7.673	2242.7		2121.5	0.28	23.18	1.90	41.60	0.4
17	69.4	69.9	1.446	1.443	33.046	26.446	2.2	33.043	336.7	7.676	2241.9		2116.9	0.25	23.27	1.94	41.60	0.3
18	60.4	60.9	1.566	1.563	33.004	26.404	3.1	33.003	340.7	7.681	2236.1		2111.0	0.18	23.68	1.95	42.51	0.3
19	49.9	50.3	1.736	1.733	33.002	26.390	3.4	32.995	342.1	7.685	2235.2		2111.1	0.18	23.40	1.93	42.34	0.3
20	40.5	40.8	1.982	1.980	32.985	26.359	3.7	32.989	343.3	7.695	2236.5		2107.6	0.21	22.68	1.88	41.13	0.3
21	29.4	29.7	2.118	2.117	32.979	26.344	5.0	32.978	343.4	7.710	2235.8		2102.9	0.21	21.10	1.79	38.16	0.3
22	20.0	20.2	2.291	2.290	32.974	26.327	5.4	-	-	7.722	2235.8		2100.3	0.21	20.66	1.76	37.39	0.3
23	9.6	9.7	3.580	3.579	32.994	26.231	4.2	32.988	344.3	7.730	2238.0		2094.2	0.22	20.41	1.73	37.89	0.3
24	4.1	4.1	3.871	3.870	32.993	26.202	4.3	32.991	341.5	7.730	2240.2		2094.4	0.23	20.54	1.67	38.26	0.2
	0																	0.89

Station: KNOT1

	Start	Bottom	End
Date/Time:	00/05/11, 15:59	00/05/11, 16:03	00/05/11, 16:15
Lat.:	44°00.05'N	44°00.14'N	44°00.16'N
Long.:	154°59.93'E	154°59.80'E	154°59.71'E
Depth (m):	5310	5305	5302

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P.Production

CTD file #: KN1S02.DAT

[illegible]

Station: KN0T1

	Start	Bottom	End
Date/Time:	00/05/11, 23:57	00/05/12, 00:15	00/05/12, 00:44
Lat.:	44°00.92'N	44°00.93'N	44°01.37'N
Long.:	154°59.10'E	154°59.11'E	154°58.82'E
Depth (m):	5335	5337	5335

(GMT)

Remarks:	Cast for only CTD d
	Water samples for MAG Narita

CTD file #: KN1L03.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	500.3	504.8	3.284	3.251	34.183	27.207	0.9
2	500.4	504.9	3.287	3.254	34.184	27.207	0.9
3	500.4	504.9	3.283	3.250	34.183	27.207	0.9
4	500.4	504.9	3.284	3.251	34.183	27.207	0.9
5	500.6	505.1	3.288	3.255	34.185	27.208	0.9
6	500.8	505.2	3.287	3.254	34.184	27.208	0.9
7	500.7	505.2	3.289	3.255	34.185	27.208	0.9
8	500.5	505.0	3.288	3.255	34.185	27.208	0.9
9	500.6	505.1	3.288	3.255	34.185	27.208	0.9
10	500.6	505.0	3.288	3.254	34.185	27.208	0.9
11	500.7	505.1	3.288	3.255	34.185	27.208	0.9
12	300.1	302.6	3.206	3.187	33.906	26.993	0.9
13	199.9	201.5	2.802	2.790	33.658	26.831	0.9
14	148.8	150.0	2.442	2.434	33.434	26.682	0.8
15	124.2	125.2	1.949	1.943	33.250	26.573	0.9
16	99.3	100.1	1.196	1.192	33.086	26.494	1.1
17	79.5	80.2	1.405	1.402	33.074	26.471	1.9
18	59.4	59.9	1.790	1.787	33.024	26.404	3.0
19	50.0	50.4	2.030	2.028	33.013	26.377	3.7
20	40.0	40.3	2.233	2.231	32.998	26.350	5.1
21	29.2	29.4	2.327	2.325	32.989	26.336	5.1
22	19.9	20.1	2.667	2.666	32.996	26.314	5.8
23	9.7	9.8	3.954	3.953	33.005	26.204	3.6
24	3.7	3.8	4.012	4.012	33.006	26.199	2.7

Station: KN0T1

	Start	Bottom	End	
Date/Time:	00/05/12, 01:17	00/05/12, 01:27	00/05/12, 01:46	(GMT)
Lat.:	44°01.33'N	44°01.49'N	44°01.62'N	
Long.:	154°56.24'E	154°56.18'E	154°56.07'E	
Depth (m):	5360	5359	5352	

(GMT)

Remarks:	Cast for only CTD de
	Water samples for CREST Plankton (#1-13) and W.Univ. Emerson (#16-24)
	Surface water (0 m) was collected by a bucket

CTD file #: KN1L04.DAT

[illegible]

Station: 5

	Start	Bottom	End	
Date/Time:	00/05/14, 15:29	00/05/14, 15:54	00/05/14, 16:53	(GMT)
Lat.:	44°00.16'N	44°00.07'N	43°59.83'N	
Long.:	150°59.79'E	150°59.83'E	150°59.94'E	
Depth (m):	6974	6974	6965	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 005L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	1501.0	1518.0	2.153	2.054	34.545	27.595	0.8	34.540	-	-	-	-	-	-	-	-	-	-	
2	1500.9	1518.0	2.153	2.054	34.545	27.595	0.8	34.541	-	-	-	-	-	-	-	-	-	-	
3	1500.7	1517.8	2.153	2.054	34.545	27.595	0.8	34.541	52.6	7.406	2395.0		2377.4	0.02	41.85	2.95	159.6	0.0	-
4	1249.8	1263.3	2.293	2.212	34.493	27.541	0.8	34.489	39.9	7.371	2389.3		2378.8	0.01	42.55	3.00	159.2	0.0	-
5	1000.6	1010.7	2.540	2.475	34.430	27.470	0.8	34.427	32.3	7.349	2379.0		2374.8	0.02	42.78	3.02	151.8	0.0	-
6	799.7	807.4	2.740	2.688	34.364	27.401	0.9	34.358	25.7	7.328	2367.2		2369.6	0.02	43.09	3.04	145.0	0.0	-
7	699.6	706.2	2.856	2.810	34.315	27.352	0.9	34.312	23.1	7.315	2359.6		2366.8	0.04	43.23	3.05	140.5	0.0	-
8	599.9	605.4	3.006	2.967	34.263	27.296	0.9	34.260	20.9	7.306	2353.5		2362.7	0.02	43.52	3.07	134.5	0.0	-
9	500.2	504.7	3.158	3.125	34.206	27.236	0.9	34.201	18.1	7.289	2341.6		2355.8	0.01	43.86	3.10	128.0	0.0	-
10	400.5	404.0	3.315	3.288	34.117	27.151	1.0	34.114	18.6	7.272	2328.0		2347.6	0.02	43.92	3.10	121.2	0.0	-
11	299.7	302.2	3.384	3.365	34.002	27.053	1.0	33.996	26.5	7.264	2311.8		2335.4	0.03	43.79	3.09	107.4	0.0	-
12	250.0	252.1	3.373	3.357	33.927	26.994	1.0	33.923	36.1	7.265	2302.5		2326.2	0.02	43.41	3.06	101.6	0.0	-
13	200.0	201.6	3.247	3.234	33.797	26.903	0.9	33.789	65.2	7.292	2288.3		2303.3	0.02	41.99	2.96	92.02	0.0	0.01
14	150.7	151.9	2.335	2.327	33.485	26.732	0.9	33.465	175.2	7.443	2261.4		2228.5	0.03	34.72	2.45	70.39	0.0	0.02
15	124.3	125.3	1.040	1.035	33.154	26.559	1.0	33.148	302.3	7.608	2238.8		2154.4	0.18	27.27	1.92	50.08	0.0	0.07
16	100.0	100.8	0.797	0.793	33.069	26.505	1.4	33.066	334.8	7.654	2231.6		2138.4	0.28	25.20	1.91	44.79	0.0	0.17
17	80.1	80.8	0.994	0.991	33.047	26.475	2.2	33.048	341.7	7.668	2229.6		2127.8	0.26	24.49	1.86	43.77	0.0	0.25
18	61.7	62.2	1.129	1.126	33.040	26.461	4.0	33.038	346.4	7.678	2231.5		2127.8	0.24	24.04	1.82	43.15	0.0	0.55
19	49.8	50.2	1.221	1.219	33.034	26.451	4.6	33.031	348.6	7.685	2230.6		2125.5	0.22	23.72	1.80	42.81	0.1	0.54
20	39.9	40.2	1.259	1.257	33.025	26.441	3.9	33.022	349.5	7.688	2230.7		2120.6	0.20	23.52	1.78	42.38	0.0	0.63
21	28.9	29.2	1.533	1.531	33.032	26.428	3.3	33.034	353.0	7.695	2230.0		2115.6	0.20	23.16	1.76	42.47	0.1	0.50
22	19.8	20.0	1.916	1.915	33.036	26.404	2.8	33.038	354.6	7.698	2229.8		2117.3	0.20	23.07	1.75	42.32	0.0	0.53
23	9.5	9.5	3.080	3.079	33.025	26.302	2.5	33.021	347.8	7.708	2231.3		2110.5	0.25	22.58	1.71	41.85	0.0	0.56
24	4.6	4.7	3.215	3.215	33.028	26.292	2.5	33.021	347.1	7.708	2230.6		2111.7	0.23	22.62	1.60	42.72	0.0	0.51
	0																		0.50

Station: 5

	Start	Bottom	End
Date/Time:	00/05/14, 18:54	00/05/14, 20:30	00/05/14, 22:32
Lat.:	44°00.05'N	43°59.97'N	43°59.39'N
Long.:	150°59.92'E	151°00.11'E	151°00.75'E
Depth (m):	6970	6966	6935

(GMT)

Remarks:	Cast for only CTD d	Water samples for routine
----------	---------------------	---------------------------

CTD file #: 005L02.DAT

[illegible]

Station: 6

	Start	Bottom	End
Date/Time:	00/05/15, 02:24	00/05/15, 02:30	00/05/15, 02:51
Lat.:	44°44.85'N	44°44.78'N	44°44.58'N
Long.:	150°45.05'E	150°45.05'E	150°45.11'E
Depth (m):	5729	5731	5746

(GMT)

Remarks: Cast for only CTD d
Water samples for JAMSTEC Kawakami

CTD file #: 006L01.DAT

Bottle #	CTD data						
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [psu]	Sigma-θ [kg/m³]	Fluo. [mg/m³]
1	300.4	303.1	3.480	3.460	34.016	27.055	0.9
2	300.5	303.2	3.480	3.460	34.016	27.055	0.9
3	250.2	252.4	3.368	3.352	33.938	27.003	0.9
4	250.7	252.9	3.368	3.351	33.937	27.003	0.9
5	199.8	201.6	3.146	3.134	33.785	26.902	0.9
6	199.6	201.3	3.154	3.142	33.785	26.902	0.9
7	149.4	150.6	2.797	2.788	33.609	26.793	0.9
8	149.0	150.2	2.716	2.707	33.584	26.780	0.9
9	99.9	100.7	0.832	0.828	33.102	26.530	1.3
10	100.1	100.9	0.834	0.830	33.100	26.527	1.7
11	74.4	75.0	0.964	0.961	33.037	26.469	2.1
12	74.0	74.6	0.961	0.958	33.037	26.469	2.2
13	58.6	59.1	1.026	1.023	33.022	26.453	2.5
14	59.2	59.7	1.027	1.025	33.021	26.452	2.6
15	48.9	49.4	1.262	1.260	33.030	26.445	4.3
16	48.9	49.4	1.278	1.275	33.030	26.444	4.3
17	39.2	39.5	1.434	1.432	33.026	26.430	5.2
18	39.5	39.8	1.441	1.440	33.027	26.431	5.3
19	28.8	29.0	1.395	1.393	33.009	26.419	4.0
20	28.8	29.1	1.382	1.381	33.005	26.417	3.7
21	19.0	19.2	1.443	1.442	32.996	26.405	3.8
22	19.5	19.7	1.491	1.490	32.996	26.402	3.8
23	9.2	9.3	3.608	3.607	33.021	26.250	8.5
24	8.9	9.0	3.618	3.617	33.026	26.253	7.9

Station: 6

	Start	Bottom	End	(GMT)
Date/Time:	00/05/15, 04:12	00/05/15, 04:27	00/05/15, 04:48	
Lat.:	44°44.86'N	44°44.86'N	44°44.98'N	
Long.:	150°45.17'E	150°45.21'E	150°45.17'E	
Depth (m):	5731	5728	5732	

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 006S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.5	808.7	2.788	2.735	34.351	27.386
2	600.1	605.9	3.031	2.992	34.264	27.295
3	399.9	403.6	3.328	3.301	34.128	27.159
4	299.6	302.3	3.419	3.400	34.013	27.059
5	199.4	201.1	3.220	3.208	33.821	26.924
6	150.2	151.4	2.956	2.947	33.660	26.820
7	123.6	124.7	1.822	1.816	33.356	26.668
8	100.1	101.0	0.791	0.787	33.106	26.535
9	80.0	80.7	0.998	0.995	33.057	26.483
10	39.7	40.0	1.339	1.337	33.008	26.423
11	19.6	19.7	2.162	2.161	33.005	26.361
12	10.3	10.4	3.454	3.453	33.014	26.259

Station: 6

	Start	Bottom	End	
Date/Time:	00/05/15, 04:59	00/05/15, 05:35	00/05/15, 06:21	(GMT)
Lat.:	44°45.00'N	44°44.75'N	44°44.34'N	
Long.:	150°45.17'E	150°45.13'E	150°44.66'E	
Depth (m):	5732	5732	5775	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 006L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	1500.4	1518.2	2.151	2.052	34.536	27.588	0.8	34.532	-	-	-	-	-	-	-	-	-	-
2	1500.4	1518.2	2.151	2.052	34.536	27.588	0.8	34.532	-	-	-	-	-	-	-	-	-	-
3	1500.3	1518.1	2.151	2.052	34.536	27.588	0.8	34.532	51.7	7.387	2401.1	2377.3	0.01	42.29	3.05	159.5	0.0	-
4	1249.4	1263.5	2.327	2.246	34.483	27.531	0.8	34.475	39.4	7.360	2389.5	2376.8	0.02	42.69	3.08	158.5	0.1	-
5	1000.0	1010.6	2.582	2.517	34.419	27.458	0.9	34.415	29.1	7.330	2381.7	2376.2	0.01	43.27	3.12	151.9	0.0	-
6	800.3	808.4	2.767	2.715	34.350	27.387	0.9	34.345	24.7	7.311	2369.1	2369.8	0.02	43.69	3.15	145.4	0.0	-
7	699.9	706.9	2.950	2.904	34.319	27.346	0.9	34.315	16.7	7.294	2362.3	2368.8	0.02	44.15	3.18	141.3	0.1	-
8	599.9	605.7	3.030	2.991	34.264	27.295	0.9	34.260	21.5	7.292	2354.5	2362.9	0.01	43.81	3.16	135.1	0.1	-
9	499.9	504.6	3.189	3.157	34.209	27.236	0.9	34.205	18.9	7.279	2344.7	2360.9	0.01	44.10	3.18	129.0	0.0	-
10	400.1	403.7	3.337	3.311	34.129	27.159	1.0	34.125	19.3	7.265	2332.7	2350.2	0.02	44.21	3.19	120.1	0.1	-
11	300.4	303.0	3.396	3.376	34.036	27.079	1.0	34.033	22.5	7.252	2318.7	2338.4	0.02	44.31	3.19	111.5	0.1	-
12	249.6	251.8	3.379	3.363	33.943	27.006	1.0	33.942	31.0	7.247	2307.2	2328.4	0.02	44.19	3.18	104.2	0.0	-
13	199.7	201.4	3.086	3.073	33.810	26.928	1.0	34.697	70.4	7.294	2293.4	2299.5	0.03	41.35	2.98	94.77	0.1	0.02
14	149.1	150.4	2.725	2.716	33.588	26.782	1.1	33.582	130.5	7.370	2274.4	2255.2	0.04	37.77	2.72	78.36	0.1	0.12
15	123.3	124.3	1.400	1.394	33.258	26.619	1.2	33.244	262.9	7.554	2267.9	2174.0	0.10	29.36	2.12	56.35	0.1	0.15
16	98.9	99.7	0.831	0.827	33.091	26.521	1.8	33.097	323.6	7.634	2238.9	2139.2	0.26	25.40	1.95	46.05	0.4	0.42
17	78.7	79.4	1.035	1.032	33.038	26.465	2.3	33.036	341.8	7.668	2236.7	2128.0	0.25	23.66	1.81	42.40	0.5	0.39
18	59.4	59.9	1.185	1.183	33.031	26.450	3.3	33.030	345.7	7.678	2236.5	2116.5	0.22	23.25	1.78	41.46	0.6	0.52
19	47.7	48.1	1.428	1.426	33.028	26.432	4.4	33.024	349.8	7.691	2236.7	2114.3	0.20	22.73	1.74	41.05	0.4	0.52
20	39.8	40.1	1.428	1.426	33.003	26.412	3.7	33.000	346.4	7.685	2234.8	2114.6	0.19	23.03	1.77	41.40	0.2	0.54
21	28.9	29.2	2.044	2.043	33.000	26.366	7.7	33.004	354.0	7.715	2235.6	2103.8	0.20	21.68	1.66	39.71	0.3	1.02
22	20.2	20.4	3.540	3.538	33.020	26.255	17.1	33.023	365.1	7.781	2240.2	2086.0	0.22	18.50	1.42	34.30	0.5	2.81
23	10.1	10.2	3.741	3.741	33.026	26.241	20.9	33.024	366.5	7.788	2240.0	2079.2	0.21	18.16	1.39	33.64	0.3	2.75
24	3.5	3.5	3.736	3.736	33.026	26.242	18.6	33.024	366.6	7.788	2240.1	2082.3	0.21	18.18	1.31	33.83	0.4	2.40
	0																	3.03

Station: 6

	Start	Bottom	End
Date/Time:	00/05/15, 06:47	00/05/15, 08:10	00/05/15, 09:44
Lat.:	44°44.71'N	44°45.50'N	44°45.70'N
Long.:	150°44.60'E	150°44.96'E	150°45.52'E
Depth (m):	5721	5620	5617

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 006S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	5501.0	5618.6	1.571	1.056	34.695	27.760
2	5501.5	5619.1	1.571	1.056	34.695	27.760
3	4999.4	5100.4	1.504	1.058	34.695	27.765
4	4500.3	4585.9	1.462	1.078	34.693	27.767
5	4000.9	4072.3	1.446	1.121	34.689	27.764
6	3501.8	3560.2	1.474	1.203	34.681	27.756
7	3001.2	3047.6	1.538	1.316	34.668	27.741
8	2501.3	2537.0	1.655	1.478	34.648	27.716
9	2000.1	2026.2	1.862	1.726	34.609	27.669
10	1499.9	1517.7	2.162	2.062	34.533	27.585
11	1250.0	1264.0	2.305	2.224	34.487	27.536
12	998.3	1008.9	2.534	2.469	34.433	27.474

Station: 6

	Start	Bottom	End	
Date/Time:	00/05/15, 09:50	00/05/15, 11:23	00/05/15, 13:11	(GMT)
Lat.:	44°45.65'N	44°45.25'N	44°44.69'N	
Long.:	150°45.51'E	150°45.24'E	150°45.43'E	
Depth (m):	5659	5709	5761	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine and CREST Plankton
Surface water (0 m) was collected by a bucket

CTD file #: 006L03.DAT

[illegible]

Station: 6

	Start	Bottom	End	
Date/Time:	00/05/15, 13:32	00/05/15, 13:38	00/05/15, 13:46	(GMT)
Lat.:	44°44.83'N	44°44.87'N	44°44.98'N	
Long.:	150°45.56'E	150°45.59'E	150°45.69'E	
Depth (m):	5762	5754	5757	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: 006S03.DAT

[illegible]

Station: 7

	Start	Bottom	End	
Date/Time:	00/05/15, 23:53	00/05/16, 00:21	00/05/16, 00:52	(GMT)
Lat.:	45°39.74'N	45°39.76'N	45°39.70'N	
Long.:	150°19.76'E	150°19.82'E	150°19.59'E	
Depth (m):	786	785	781	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 007L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	700.2	707.1	3.269	3.222	34.107	27.147	1.0	-	-	-	-	-	-	-	-	-	-	-	
2	700.1	707.0	3.269	3.222	34.107	27.148	1.0	-	-	-	-	-	-	-	-	-	-	-	
3	700.1	707.0	3.269	3.222	34.108	27.148	1.0	-	-	-	-	-	-	-	-	-	-	-	
4	699.9	706.8	3.269	3.222	34.108	27.149	1.0	-	-	-	-	-	-	-	-	-	-	-	
5	699.5	706.4	3.269	3.222	34.110	27.150	1.0	-	-	-	-	-	-	-	-	-	-	-	
6	699.2	706.1	3.269	3.222	34.108	27.148	1.0	-	-	-	-	-	-	-	-	-	-	-	
7	699.3	706.2	3.269	3.222	34.110	27.150	1.0	34.103	27.7	7.281	2328.8	-	2347.0	0.01	43.72	3.06	118.3	0.0	-
8	600.6	606.4	3.077	3.038	34.014	27.091	1.0	34.010	45.6	7.292	2319.2	-	2326.8	0.01	42.43	3.00	111.2	0.0	-
9	499.4	504.1	2.411	2.382	33.825	26.998	0.9	33.806	104.2	7.535	2301.8	-	2293.5	0.02	37.71	2.76	97.18	0.1	-
10	399.8	403.5	1.830	1.809	33.597	26.860	1.0	33.591	159.7	7.416	2280.2	-	2251.6	0.03	33.68	2.52	79.05	0.0	-
11	300.4	303.1	1.659	1.644	33.461	26.764	1.2	33.459	199.3	7.475	2270.7	-	2222.6	0.10	31.74	2.38	70.45	0.0	-
12	250.0	252.2	1.594	1.582	33.436	26.748	1.1	33.434	206.2	7.482	2268.7	-	2210.7	0.10	31.20	2.35	68.41	0.1	-
13	200.0	201.8	1.351	1.341	33.361	26.705	0.9	33.360	223.8	7.502	2259.3	-	2199.4	0.08	28.92	2.23	59.95	0.1	0.08
14	149.0	150.2	1.179	1.172	33.250	26.627	1.3	33.246	262.5	7.554	2248.8	-	2171.9	0.13	27.51	2.12	54.87	0.1	0.20
15	122.3	123.4	0.881	0.876	33.121	26.542	1.4	33.118	312.9	7.625	2240.2	-	2140.6	0.24	25.95	2.04	47.94	0.2	0.57
16	100.1	101.0	0.861	0.857	33.096	26.523	1.8	33.094	323.0	7.639	2237.8	-	2131.4	0.25	25.59	2.00	46.74	0.2	0.19
17	79.0	79.6	1.103	1.099	33.053	26.474	2.6	33.053	339.5	7.673	2236.9	-	2119.7	0.24	23.89	1.92	44.07	0.3	0.40
18	60.1	60.6	1.189	1.187	33.047	26.463	3.4	33.047	342.2	7.679	2236.1	-	2112.3	0.23	23.58	1.96	43.01	0.4	0.55
19	49.0	49.5	1.652	1.650	33.031	26.419	6.9	33.028	354.3	7.717	2234.7	-	2106.8	0.20	21.65	1.79	38.90	0.5	1.51
20	39.6	39.9	1.835	1.833	33.025	26.402	8.4	33.050	345.7	7.700	2235.6	-	2108.9	0.21	22.67	1.85	41.24	0.4	0.94
21	28.9	29.1	2.095	2.093	33.019	26.378	12.9	33.018	362.9	7.752	2237.0	-	2097.4	0.19	20.30	1.69	36.06	0.4	2.16
22	19.7	19.9	1.671	1.670	32.953	26.356	9.8	32.960	357.1	7.735	2233.8	-	2095.2	0.18	19.66	1.61	34.73	0.3	1.80
23	9.0	9.1	1.506	1.505	32.923	26.343	7.9	32.920	352.6	7.723	2231.5	-	2095.9	0.17	19.06	1.56	33.99	0.2	1.97
24	4.2	4.2	1.394	1.394	32.899	26.331	6.1	32.901	349.3	7.717	2230.6	-	2097.9	0.17	18.79	1.55	34.89	0.2	1.90
	0																		2.32

Station: 7-2

	Start	Bottom	End
Date/Time:	00/05/16, 09:36	00/05/16, 10:37	00/05/16, 11:36
Lat.:	47°21.35'N	47°21.01'N	47°20.94'N
Long.:	150°38.99'E	150°38.54'E	150°38.63'E
Depth (m):	3329	3331	3326

(GMT)

Remarks: Cast for only CTD d
Water samples for routine
Surface water was collected by a bucket

CTD file #: 072S01.DAT

Bottle #	CTD data						Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-0	Salinity	Oxygen	pH (Tris)	TAlk	TDIC	Nitrite	itrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	3313.5	3367.2	1.869	1.607	34.615	27.674	34.610	89.0	7.468	2413.2	2354.6		0.00	39.46	2.80	171.4	0.0
2	3290.7	3343.9	1.868	1.609	34.615	27.673	34.610	89.0	7.465	2412.3	2355.3		0.01	39.43	2.81	171.6	0.1
3	3260.6	3313.1	1.872	1.617	34.613	27.672	34.608	87.1	7.460	2412.5	2361.0		0.01	39.44	2.81	173.4	0.0
4	2999.3	3045.7	1.866	1.637	34.608	27.668	34.603	84.0	7.455	2409.0	2363.0		0.00	39.64	2.84	174.0	0.0
5	2499.2	2534.9	1.881	1.700	34.591	27.653	34.586	79.1	7.441	2409.0	2364.4		0.00	40.09	2.84	169.6	0.0
6	2000.3	2026.5	1.995	1.857	34.547	27.609	34.542	78.9	7.411	2402.1	2365.1		0.00	41.01	2.91	167.4	0.0
7	1504.4	1522.2	2.158	2.058	34.475	27.539	34.470	64.8	7.374	2390.9	2369.6		0.00	41.70	2.96	163.9	0.0
8	999.5	1010.1	2.345	2.282	34.238	27.334	34.237	50.9	7.321	2360.4	2361.0		0.00	41.77	3.03	151.1	0.0
9	699.4	706.3	2.015	1.975	33.900	27.089	33.904	45.0	7.338	2318.0	2306.0		0.00	38.03	2.82	115.0	0.0
10	449.6	453.8	1.350	1.328	33.531	26.841	33.539	92.8	7.409	2274.8	2244.4		0.01	31.72	2.47	72.63	0.0
11	300.1	302.8	1.131	1.118	33.347	26.708	33.348	171.5	7.492	2257.4	2203.8		0.07	27.86	2.20	58.53	0.0
12	149.6	150.9	-0.298	-0.303	33.050	26.546	33.055	221.8	7.597	2241.0	2151.9		0.04	21.21	1.78	38.68	0.0
	0						32.382	299.4		2205.7	2049.7		0.12	9.07	0.89	24.82	0.0

Station: 8

	Start	Bottom	End
Date/Time:	00/05/16, 22:58	00/05/16, 23:10	00/05/16, 23:33
Lat.:	48°29.81'N	48°29.84'N	48°29.96'N
Long.:	150°30.10'E	150°30.03'E	150°30.03'E
Depth (m):	2341	2335	2334

(GMT)

Remarks: Cast for only CTD d
Water samples for JAMSTEC Kawakami

CTD file #: 008L01.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	300.3	303.0	1.090	1.077	33.434	26.781	0.9
2	300.5	303.1	1.083	1.069	33.435	26.782	0.9
3	249.4	251.6	0.925	0.914	33.379	26.747	0.9
4	249.2	251.4	0.924	0.914	33.379	26.747	0.9
5	199.8	201.5	0.759	0.751	33.302	26.695	0.9
6	199.7	201.4	0.756	0.748	33.302	26.695	0.9
7	150.1	151.4	0.269	0.264	33.160	26.608	0.9
8	150.0	151.3	0.263	0.257	33.158	26.607	0.9
9	99.6	100.4	-0.435	-0.438	32.948	26.469	1.6
10	99.2	100.1	-0.432	-0.435	32.948	26.469	1.7
11	74.3	74.9	-0.441	-0.443	32.854	26.393	2.8
12	74.1	74.7	-0.452	-0.454	32.845	26.387	2.5
13	59.4	59.9	-1.271	-1.272	32.735	26.326	2.2
14	59.6	60.1	-1.358	-1.359	32.718	26.315	2.1
15	50.3	50.7	-0.732	-0.734	32.649	26.239	3.6
16	50.2	50.7	-0.752	-0.753	32.652	26.242	3.8
17	39.7	40.0	-0.660	-0.661	32.523	26.134	4.4
18	39.4	39.7	-0.673	-0.674	32.526	26.137	4.7
19	29.3	29.5	-0.506	-0.506	32.502	26.111	4.8
20	29.8	30.0	-0.504	-0.505	32.501	26.111	4.8
21	19.6	19.7	0.327	0.327	32.470	26.048	5.8
22	19.8	20.0	0.538	0.538	32.469	26.037	6.2
23	8.4	8.5	1.022	1.021	32.423	25.972	6.9
24	8.9	9.0	1.038	1.037	32.421	25.970	6.8

Station: 8

	Start	Bottom	End
Date/Time:	00/05/17, 00:34	00/05/17, 00:56	00/05/17, 01:30
Lat.:	48°29.89'N	48°29.87'N	48°29.77'N
Long.:	150°30.27'E	150°30.27'E	150°30.42'E
Depth (m):	2328	2330	2333

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 008S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	1500.0	1517.8	2.149	2.050	34.503	27.561
2	1250.1	1264.1	2.308	2.226	34.446	27.503
3	1000.0	1010.6	2.349	2.286	34.315	27.395
4	800.7	808.8	2.387	2.337	34.163	27.270
5	600.3	606.1	2.187	2.152	33.908	27.082
6	399.7	403.4	1.373	1.353	33.579	26.879
7	299.9	302.6	1.094	1.080	33.444	26.788
8	249.7	251.9	0.855	0.844	33.360	26.736
9	200.0	201.7	0.781	0.772	33.313	26.702
10	174.5	176.1	0.614	0.607	33.263	26.672
11	149.9	151.1	0.388	0.383	33.189	26.624
12	124.9	126.0	-0.150	-0.154	33.075	26.560

Station: 8

	Start	Bottom	End	
Date/Time:	00/05/17, 01:41	00/05/17, 02:21	00/05/17, 03:11	(GMT)
Lat.:	48°29.75'N	48°29.78'N	48°29.73'N	
Long.:	150°30.46'E	150°30.36'E	150°30.36'E	
Depth (m):	2335	2337	2337	

Remarks:	Cast for only CTD d:
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 008L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	2314.9	2346.9	1.887	1.723	34.586	27.649	0.8	34.579	76.2	7.448	2408.3	2361.8	0.00	40.91	2.83	171.3	0.0	-
2	1999.2	2025.3	1.938	1.801	34.565	27.628	0.9	34.560	70.3	7.431	2405.3	2364.8	0.00	41.38	2.84	167.9	0.0	-
3	1499.6	1517.3	2.157	2.057	34.501	27.559	0.9	34.497	52.3	7.390	2397.1	2369.4	0.00	42.62	2.91	162.4	0.0	-
4	1249.6	1263.7	2.298	2.217	34.448	27.505	0.9	34.445	44.3	7.367	2388.4	2366.8	0.00	43.02	2.94	158.5	0.0	-
5	999.5	1010.2	2.335	2.272	34.331	27.409	0.9	34.330	-	7.340	2373.4	2364.0	0.00	42.63	2.99	157.3	0.0	-
6	799.8	807.9	2.370	2.321	34.184	27.288	0.9	34.182	48.8	7.324	2354.2	2349.5	0.00	42.13	2.97	144.0	0.0	-
7	699.9	706.8	2.466	2.423	34.078	27.195	0.9	34.088	56.9	7.324	2340.7	2335.1	0.00	41.69	2.93	130.4	0.0	-
8	600.1	605.9	2.201	2.167	33.918	27.089	0.9	33.923	83.0	7.333	2320.8	2316.9	0.00	39.58	2.85	115.2	0.0	-
9	500.0	504.7	1.889	1.862	33.744	26.974	0.9	33.759	120.7	7.368	2299.0	2287.1	0.00	36.12	2.66	95.34	0.1	-
10	399.7	403.4	1.468	1.448	33.594	26.884	0.9	33.585	151.6	7.384	2281.1	2265.0	0.00	33.81	2.59	80.22	0.0	-
11	300.2	302.9	1.091	1.077	33.436	26.782	1.0	33.439	186.3	7.423	2266.5	2235.4	0.05	30.89	2.43	64.90	0.0	-
12	250.1	252.3	0.860	0.850	33.366	26.740	0.9	33.364	204.3	7.445	2260.6	2222.8	0.03	28.85	2.41	58.77	0.1	-
13	199.5	201.2	0.814	0.805	33.316	26.703	0.9	33.314	223.9	7.478	2256.5	2201.2	0.03	28.04	2.25	54.29	0.1	0.03
14	149.9	151.2	0.398	0.393	33.200	26.633	0.9	33.196	256.7	7.536	2248.1	2176.0	0.05	25.54	2.08	48.54	0.1	0.14
15	124.3	125.4	-0.099	-0.103	33.084	26.565	1.0	33.076	306.6	7.610	2243.0	2154.4	0.10	22.27	1.83	40.86	0.2	0.14
16	99.9	100.7	-0.508	-0.511	32.979	26.497	1.1	32.974	332.3	7.644	2235.4	2135.2	0.15	19.95	1.70	35.37	0.2	0.16
17	80.2	80.9	-0.315	-0.317	32.920	26.441	1.9	32.922	349.8	7.681	2236.6	2119.8	0.16	17.41	1.52	29.64	0.3	0.40
18	59.5	60.0	-1.027	-1.028	32.649	26.249	3.1	32.700	358.4	7.705	2224.2	2100.6	0.16	15.12	1.37	23.97	0.4	0.64
19	50.0	50.5	-0.682	-0.683	32.535	26.145	4.1	32.570	367.9	7.728	2215.9	2083.9	0.15	13.22	1.25	22.38	0.5	0.76
20	39.7	40.0	-0.424	-0.425	32.486	26.096	4.5	32.486	371.8	7.740	2212.3	2075.2	0.12	12.01	1.15	21.11	0.4	0.91
21	29.8	30.0	-0.121	-0.122	32.471	26.070	4.9	32.468	372.6	7.747	2209.8	2067.4	0.11	11.65	1.11	21.44	0.4	1.03
22	19.5	19.7	0.871	0.870	32.434	25.990	6.9	32.438	371.0	7.762	2207.0	2067.1	0.11	10.83	1.06	21.62	0.3	1.33
23	9.8	9.8	0.939	0.939	32.434	25.986	5.2	32.434	370.6	7.764	2208.7	2064.9	0.12	10.68	1.04	21.92	0.2	1.61
24	5.2	5.2	0.971	0.971	32.435	25.985	4.0	32.432	370.1	7.764	2208.4	2065.8	0.12	10.49	1.07	21.74	0.2	1.94
	0																	2.16

Station: 8

	Start	Bottom	End
Date/Time:	00/05/17, 03:37	00/05/17, 03:39	00/05/17, 03:45
Lat.:	48°29.69'N	48°29.68'N	48°29.68'N
Long.:	150°30.36'E	150°30.34'E	150°30.34'E
Depth (m):	2337	2336	2339

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 008S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	100.4	101.2	-0.434	-0.437	32.949	26.470
2	80.1	80.7	-0.966	-0.968	32.847	26.407
3	40.2	40.5	-0.494	-0.495	32.492	26.103
4	30.8	31.0	0.061	0.060	32.467	26.059
5	20.3	20.4	0.878	0.877	32.437	25.992
6	10.3	10.4	0.968	0.967	32.437	25.987
7	20.2	20.3	0.946	0.945	32.436	25.987
8	20.3	20.4	0.958	0.957	32.437	25.988
9	20.3	20.5	0.955	0.954	32.438	25.988
10	20.3	20.5	0.965	0.964	32.438	25.987
11	20.2	20.4	0.966	0.965	32.438	25.988
12	20.2	20.4	0.958	0.957	32.438	25.988

Station: 9

	Start	Bottom	End	(GMT)
Date/Time:	00/05/17, 08:34	00/05/17, 09:18	00/05/17,10:08	
Lat.:	47°39.81'N	47°39.76'N	47°39.79'N	
Long.:	151°09.68'E	151°09.55'E	151°09.35'E	
Depth (m):	3323	3321	3320	

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 009S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	3000.2	3046.6	1.851	1.622	34.611	27.672
2	3000.0	3046.5	1.851	1.622	34.611	27.672
3	3000.2	3046.6	1.851	1.622	34.611	27.672
4	3000.3	3046.8	1.851	1.622	34.611	27.672
5	3000.2	3046.6	1.851	1.622	34.611	27.672
6	3000.0	3046.4	1.851	1.622	34.611	27.672
7	3000.4	3046.8	1.851	1.623	34.611	27.672
8	2499.9	2535.6	1.883	1.702	34.592	27.654
9	2000.9	2027.1	1.989	1.851	34.551	27.613
10	1500.1	1517.8	2.159	2.060	34.476	27.539
11	1250.0	1264.0	2.265	2.184	34.399	27.469
12	1000.3	1011.0	2.368	2.304	34.250	27.341

Station: 9

	Start	Bottom	End	
Date/Time:	00/05/17, 10:16	00/05/17, 11:18	00/05/17, 12:32	(GMT)
Lat.:	47°39.91'N	47°40.25'N	47°40.63'N	
Long.:	151°09.43'E	151°09.64'E	151°09.42'E	
Depth (m):	3321	3323	3321	

Remarks:	Cast for only CTD d: Water samples for routine Bottle #20 sampling failed. Surface water (0 m) was collected by a bucket
----------	---

CTD file #: 009L01.DAT

Bottle #	CTD data							Bottle data													
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a			
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]			
1	3314.9	3368.7	1.846	1.585	34.620	27.679	0.8	34.614	93.6	7.477	2409.0		2357.4	0.00	39.71	2.74	167.6	0.0	-		
2	3293.8	3347.1	1.844	1.585	34.620	27.679	0.8	34.615	93.3	7.475	2409.2		2357.7	0.00	39.68	2.73	166.7	0.0	-		
3	3000.2	3046.6	1.850	1.621	34.612	27.672	0.8	34.607	87.6	7.468	2410.0		2361.1	0.00	40.11	2.77	170.5	0.0	-		
4	2500.2	2535.8	1.882	1.701	34.592	27.654	0.8	34.586	80.1	7.446	2405.9		2363.0	0.00	40.71	2.80	168.0	0.0	-		
5	1999.7	2025.9	1.981	1.843	34.553	27.615	0.8	34.548	67.3	7.417	2400.9		2366.3	0.00	41.46	2.85	166.6	0.0	-		
6	1499.5	1517.3	2.172	2.073	34.469	27.533	0.8	34.465	52.1	7.377	2390.7		2368.8	0.00	42.37	2.91	162.0	0.0	-		
7	1000.2	1010.8	2.407	2.344	34.235	27.326	0.9	34.230	44.0	7.319	2358.1		2358.3	0.00	42.67	2.97	147.6	0.0	-		
8	799.6	807.7	2.268	2.220	34.011	27.158	0.9	34.008	71.0	7.323	2330.0		2331.2	0.00	40.27	2.89	125.9	0.0	-		
9	599.6	605.4	1.761	1.729	33.693	26.942	0.9	33.698	138.0	7.382	2289.9		2269.5	0.00	34.65	2.60	87.86	0.1	-		
10	499.7	504.4	1.398	1.373	33.512	26.823	0.9	33.512	172.7	7.412	2272.8		2240.2	0.00	32.27	2.48	72.05	0.0	-		
11	399.6	403.3	1.454	1.434	33.420	26.746	1.0	33.413	211.0	7.483	2265.8		2214.1	0.10	30.34	2.29	65.87	0.0	-		
12	299.6	302.3	1.230	1.217	33.321	26.681	1.1	33.318	241.9	7.529	2260.6		2193.3	0.12	27.40	2.22	58.99	0.1	-		
13	199.8	201.6	1.025	1.017	33.233	26.623	1.2	33.235	266.9	7.568	2254.0		2172.9	0.10	26.41	2.08	53.53	0.1	0.22		
14	150.0	151.3	0.929	0.923	33.187	26.592	1.3	33.186	282.7	7.595	2251.5		2164.4	0.10	24.93	2.01	49.94	0.1	0.26		
15	124.8	125.9	0.848	0.842	33.146	26.564	1.3	33.142	295.9	7.615	2247.6		2155.7	0.10	23.52	1.93	45.84	0.2	0.26		
16	99.9	100.7	0.736	0.732	33.102	26.535	1.6	33.097	308.4	7.636	2245.2		2139.2	0.10	22.07	1.85	42.04	0.2	0.23		
17	80.7	81.4	0.172	0.169	32.943	26.437	2.2	32.934	332.1	7.663	2236.5		2123.1	0.12	18.32	1.59	31.94	0.3	0.45		
18	59.8	60.3	-0.019	-0.021	32.840	26.363	2.8	32.824	345.9	7.685	2230.5		2111.2	0.13	16.27	1.44	27.02	0.4	0.49		
19	49.8	50.2	0.025	0.023	32.758	26.295	3.6	32.758	350.7	7.693	2225.8		2104.6	0.12	15.35	1.35	25.06	0.5	0.72		
20	40.3	40.7	0.217	0.216	32.725	26.260	4.0	-	-	-	-		-	-	-	-	-	-	-		
21	30.5	30.7	0.590	0.589	32.676	26.201	5.0	32.678	358.6	7.717	2223.3		2091.3	0.12	13.68	1.25	23.07	0.4	1.13		
22	20.2	20.4	0.772	0.771	32.509	26.056	6.4	32.533	362.4	7.734	2214.2		2082.8	0.12	12.19	1.15	21.92	0.3	1.43		
23	9.7	9.8	0.733	0.733	32.423	25.989	6.2	32.420	364.3	7.742	2209.7		2072.2	0.12	11.23	1.07	21.47	0.2	1.39		
24	4.8	4.9	0.732	0.732	32.422	25.988	6.3	32.419	364.3	7.742	2207.0		2070.8	0.11	10.97	1.09	21.53	0.2	1.26		
	0																			1.43	

Station: 9

	Start	Bottom	End
Date/Time:	00/05/17, 12:53	00/05/17, 13:07	00/05/17, 13:29
Lat.:	47°40.20'N	47°40.12'N	47°40.07'N
Long.:	151°09.89'E	151°09.85'E	151°09.61'E
Depth (m):	3319	3322	3322

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 009S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.7	808.8	2.272	2.223	34.022	27.166
2	598.9	604.7	1.776	1.744	33.694	26.942
3	399.8	403.4	1.399	1.380	33.399	26.732
4	299.5	302.2	1.190	1.177	33.303	26.669
5	199.6	201.3	0.997	0.989	33.221	26.615
6	150.3	151.6	0.914	0.908	33.181	26.588
7	125.1	126.2	0.867	0.862	33.149	26.565
8	100.0	100.9	0.795	0.791	33.113	26.540
9	79.6	80.3	0.562	0.559	33.052	26.505
10	39.8	40.1	0.148	0.147	32.748	26.282
11	20.1	20.2	0.696	0.696	32.639	26.165
12	9.7	9.8	0.796	0.796	32.494	26.043

Station: 10

	Start	Bottom	End	
Date/Time:	00/05/18, 23:49	00/05/19, 00:05	00/05/19, 00:44	(GMT)
Lat.:	45°54.99'N	45°54.87'N	45°55.06'N	
Long.:	151°44.98'E	151°44.85'E	151°45.05'E	
Depth (m):	978	975	978	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 010L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	litrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	900.9	910.3	2.658	2.599	34.380	27.421	0.9	-	-	-	-	-	-	-	-	-	-	-	
2	900.8	910.2	2.656	2.598	34.381	27.421	0.9	-	-	-	-	-	-	-	-	-	-	-	
3	900.9	910.2	2.654	2.595	34.381	27.422	0.9	-	-	-	-	-	-	-	-	-	-	-	
4	901.0	910.4	2.653	2.594	34.382	27.422	0.9	-	-	-	-	-	-	-	-	-	-	-	
5	900.8	910.2	2.659	2.600	34.380	27.420	0.9	34.374	26.1	7.323	2327.8		2374.1	0.00	44.49	3.08	148.8	0.0	-
6	799.7	807.8	2.910	2.857	34.332	27.360	0.9	34.329	17.7	7.299	2366.5		2372.3	0.00	44.98	3.11	143.0	0.0	-
7	700.0	707.0	3.109	3.062	34.264	27.288	1.0	34.255	16.8	7.287	2353.6		2366.1	0.00	45.13	3.11	134.0	0.0	-
8	599.6	605.4	3.219	3.179	34.181	27.211	1.0	34.177	21.9	7.281	2340.9		2364.3	0.00	44.95	3.09	126.4	0.0	-
9	499.6	504.3	3.200	3.167	34.132	27.174	1.0	34.129	27.3	7.282	2334.4		2351.2	0.00	44.54	3.08	122.2	0.0	-
10	399.3	403.0	3.281	3.255	34.055	27.105	1.0	34.057	29.7	7.270	2324.7		2338.9	0.00	44.45	3.08	115.0	0.0	-
11	299.7	302.3	2.871	2.853	33.855	26.982	1.0	33.874	69.2	7.306	2305.6		2314.4	0.02	41.61	2.92	101.2	0.0	-
12	250.1	252.3	2.733	2.718	33.739	26.902	1.1	33.737	102.3	7.341	2290.1		2289.4	0.02	39.02	2.76	90.24	0.0	-
13	199.9	201.6	2.388	2.377	33.544	26.775	1.2	33.565	145.7	7.401	2274.4		2250.4	0.03	36.09	2.59	77.74	0.0	0.28
14	149.8	151.1	0.894	0.887	33.216	26.617	1.1	33.205	277.4	7.575	2246.4		2166.6	0.08	27.39	2.10	53.34	0.0	0.37
15	125.0	126.1	0.190	0.186	33.063	26.533	1.5	33.063	326.9	7.642	2234.8		2132.4	0.18	24.92	1.96	45.10	0.2	0.47
16	100.7	101.5	0.348	0.344	33.043	26.509	3.7	33.042	330.7	7.659	2236.5		2122.5	0.21	23.75	1.91	42.96	0.7	1.24
17	80.2	80.9	0.223	0.220	33.028	26.503	3.1	33.026	328.5	7.673	2238.7		2121.8	0.11	21.86	1.82	39.78	0.9	1.68
18	60.2	60.7	0.297	0.295	33.000	26.477	8.9	33.000	336.8	7.700	2238.0		2115.7	0.13	19.98	1.72	36.46	1.1	2.90
19	49.3	49.7	0.424	0.423	32.990	26.462	13.6	32.987	343.0	7.720	2238.2		2109.6	0.13	19.17	1.67	34.76	1.2	4.99
20	39.4	39.7	0.432	0.430	32.947	26.427	16.3	32.949	355.8	7.757	2238.0		2095.1	0.14	16.67	1.52	30.02	1.2	7.24
21	30.0	30.3	0.453	0.452	32.940	26.421	16.2	32.938	359.1	7.769	2237.6		2086.7	0.13	15.81	1.51	28.28	1.4	6.21
22	19.5	19.7	0.702	0.701	32.904	26.378	22.9	32.903	369.4	7.821	2239.8		2065.8	0.12	12.84	1.27	22.37	1.3	9.89
23	10.0	10.1	1.362	1.362	32.835	26.282	23.2	32.831	388.1	7.935	2239.8		2019.8	0.11	6.90	0.82	10.26	0.9	7.46
24	4.4	4.5	1.375	1.375	32.835	26.281	22.7	32.836	387.3	7.930	2239.8		2022.3	0.11	7.03	0.83	10.88	0.9	9.98
	0																		7.36

Station: 11

	Start	Bottom	End	
Date/Time:	00/05/19, 03:55	00/05/19, 04:01	00/05/19, 04:25	(GMT)
Lat.:	45°33.76'N	45°33.32'N	45°33.19'N	
Long.:	152°12.01'E	152°11.79'E	152°11.77'E	
Depth (m):	5437	5436	5420	

Remarks:	Cast for only CTD d
	Water samples for JAMSTEC Kawakami

CTD file #: 0111L01.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	301.2	303.8	1.999	1.983	33.502	26.771	0.8
2	301.2	303.8	2.000	1.984	33.502	26.771	0.8
3	252.6	254.8	1.895	1.882	33.453	26.740	0.8
4	253.1	255.3	1.896	1.883	33.453	26.740	0.8
5	200.3	202.0	1.706	1.696	33.397	26.709	0.8
6	200.7	202.5	1.706	1.696	33.397	26.709	0.8
7	150.7	152.0	1.289	1.282	33.288	26.651	0.8
8	151.6	152.9	1.313	1.306	33.293	26.653	0.8
9	101.1	102.0	0.903	0.899	33.174	26.583	1.0
10	101.4	102.3	0.901	0.897	33.174	26.583	1.0
11	75.1	75.7	0.902	0.899	33.157	26.569	1.8
12	75.0	75.7	0.902	0.899	33.156	26.569	1.8
13	60.1	60.6	1.007	1.004	33.125	26.537	3.4
14	60.4	60.9	0.990	0.988	33.125	26.539	3.9
15	49.0	49.4	1.234	1.232	33.114	26.515	9.4
16	49.5	49.9	1.224	1.222	33.115	26.515	9.2
17	39.8	40.2	2.582	2.580	33.089	26.395	4.5
18	39.9	40.3	2.576	2.574	33.089	26.396	4.5
19	29.6	29.9	2.645	2.643	33.090	26.391	4.5
20	29.6	29.8	2.645	2.643	33.090	26.391	4.5
21	19.9	20.1	2.851	2.850	33.078	26.364	4.3
22	20.0	20.1	2.844	2.843	33.079	26.365	4.4
23	9.7	9.8	2.924	2.923	33.079	26.358	3.2
24	9.6	9.7	2.934	2.933	33.079	26.357	2.5

Station: 11

	Start	Bottom	End
Date/Time:	00/05/19, 04:38	00/05/19, 04:51	00/05/19, 05:12
Lat.:	45°33.26'N	45°33.33'N	45°33.35'N
Long.:	152°11.76'E	152°11.84'E	152°11.75'E
Depth (m):	5412	5412	5397

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 011S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.3	808.4	3.174	3.120	34.218	27.245
2	599.8	605.6	3.218	3.178	34.004	27.070
3	399.8	403.4	2.447	2.423	33.645	26.851
4	301.6	304.2	2.009	1.993	33.507	26.775
5	200.9	202.7	1.730	1.720	33.399	26.709
6	149.8	151.0	1.273	1.267	33.285	26.649
7	125.0	126.1	0.973	0.968	33.211	26.608
8	100.1	101.0	1.059	1.055	33.187	26.584
9	79.3	80.0	1.023	1.020	33.165	26.568
10	40.0	40.4	2.563	2.560	33.086	26.395
11	20.3	20.5	2.816	2.815	33.081	26.369
12	9.6	9.6	2.932	2.932	33.081	26.360

Station: 11

	Start	Bottom	End	
Date/Time:	00/05/19, 05:24	00/05/19, 05:49	00/05/19, 06:36	(GMT)
Lat.:	45°33.27'N	45°33.16'N	45°32.99'N	
Long.:	152°11.73'E	152°11.87'E	152°11.87'E	
Depth (m):	5407	5413	5429	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 011L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	99.7	100.6	0.902	0.898	33.168	26.579	1.2	33.168	332.5	-	-	-	0.38	26.09	2.02	53.06	0.0	-
2	100.3	101.1	0.901	0.897	33.168	26.579	1.2	33.168	332.6	-	-	-	0.38	25.99	2.00	52.17	0.0	-
3	1500.5	1518.3	2.334	2.233	34.486	27.533	0.9	34.482	38.1	7.368	-	2378.4	0.02	42.52	3.00	161.2	0.0	-
4	1249.9	1264.0	2.592	2.508	34.419	27.457	0.9	34.415	31.3	7.349	2377.4	2374.5	0.02	42.71	3.03	152.9	0.0	-
5	1000.1	1010.8	2.914	2.846	34.315	27.346	0.9	34.314	24.5	7.321	2360.5	2364.9	0.02	43.29	3.05	142.1	0.0	-
6	800.0	808.2	3.192	3.137	34.229	27.252	0.9	34.226	18.1	7.294	2345.2	2362.0	0.02	43.90	3.09	131.9	0.0	-
7	700.1	707.0	3.195	3.148	34.169	27.204	0.9	34.167	27.3	7.297	2336.2	2347.3	0.02	43.34	3.05	125.8	0.0	-
8	600.0	605.8	3.246	3.206	34.044	27.099	0.9	34.041	41.0	7.301	2320.3	2328.4	0.02	42.50	3.01	114.1	0.0	-
9	499.8	504.5	3.045	3.013	33.873	26.981	0.9	33.874	73.8	7.328	2301.1	2300.8	0.02	40.17	2.89	100.8	0.0	-
10	399.8	403.5	2.464	2.441	33.651	26.854	0.9	33.648	136.2	7.402	2282.5	2262.6	0.02	35.76	2.64	86.10	0.0	-
11	300.5	303.2	1.979	1.963	33.496	26.768	0.8	33.495	181.2	7.451	2270.9	2235.7	0.04	33.07	2.48	76.74	0.0	-
12	250.0	252.2	1.867	1.855	33.442	26.733	0.8	33.441	195.1	7.468	2266.5	2224.3	0.04	32.33	2.44	72.38	0.0	-
13	200.0	201.8	1.748	1.738	33.393	26.703	0.8	33.393	211.1	7.487	2259.9	2212.8	0.03	31.66	2.38	69.46	0.0	0.05
14	150.0	151.2	1.021	1.014	33.236	26.626	0.8	33.233	307.5	7.602	2249.1	2166.6	0.05	27.44	2.12	56.08	0.0	0.08
15	124.5	125.6	0.934	0.929	33.198	26.601	0.9	33.198	319.6	7.622	2247.0	2154.1	0.10	26.60	2.06	53.34	0.0	0.13
16	99.9	100.7	0.902	0.898	33.169	26.579	1.2	33.167	332.2	7.639	2242.9	2144.0	0.36	25.97	2.03	51.21	0.0	0.20
17	80.6	81.3	0.881	0.877	33.155	26.570	1.6	33.155	334.7	7.646	2242.4	2142.5	0.44	25.83	2.01	50.46	0.0	0.22
18	60.1	60.6	0.992	0.990	33.136	26.547	2.6	33.133	336.4	7.652	2240.6	2135.4	0.40	25.32	1.97	49.16	0.0	0.35
19	49.6	50.0	1.629	1.626	33.097	26.474	5.2	33.098	345.6	7.690	2240.1	2123.5	0.28	23.65	1.86	46.34	0.2	0.91
20	39.6	39.9	2.635	2.632	33.086	26.388	4.6	33.085	346.5	7.715	2241.6	2113.1	0.24	22.56	1.81	46.41	0.1	0.88
21	30.2	30.4	2.673	2.672	33.087	26.386	5.6	33.086	347.7	7.718	2241.1	2115.4	0.23	22.56	1.79	46.48	0.1	1.19
22	19.3	19.5	2.932	2.931	33.087	26.364	4.8	33.086	345.8	7.718	2241.5	2114.5	0.23	22.56	1.81	47.86	0.0	0.78
23	10.0	10.1	2.965	2.965	33.085	26.360	4.2	33.084	345.6	7.718	2241.8	2114.3	0.24	22.58	1.80	48.13	0.0	0.79
24	4.8	4.8	2.974	2.974	33.086	26.359	4.0	33.084	345.7	7.718	2241.0	2113.7	0.24	22.78	1.83	48.20	0.0	0.81
	0																	1.21

Station: 11

	Start	Bottom	End
Date/Time:	00/05/19, 07:02	00/05/19, 08:16	00/05/19, 09:34
Lat.:	45°32.99'N	45°33.05'N	45°33.00'N
Long.:	152°11.87'E	152°11.96'E	152°12.04'E
Depth (m):	5427	5417	5440

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 011S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	4000.0	4071.4	1.448	1.123	34.689	27.764
2	3999.9	4071.3	1.448	1.123	34.689	27.764
3	5000.3	5101.3	1.507	1.060	34.695	27.765
4	4499.8	4585.4	1.461	1.077	34.693	27.767
5	3999.9	4071.2	1.448	1.123	34.689	27.764
6	3499.8	3558.1	1.487	1.215	34.679	27.753
7	2999.9	3046.3	1.571	1.349	34.664	27.735
8	2499.4	2535.0	1.723	1.545	34.637	27.702
9	1999.4	2025.5	1.976	1.838	34.587	27.643
10	1499.9	1517.7	2.316	2.215	34.491	27.538
11	1249.2	1263.3	2.551	2.467	34.430	27.470
12	1000.6	1011.3	2.905	2.837	34.321	27.351

Station: 11

	Start	Bottom	End	
Date/Time:	00/05/19, 09:48	00/05/19, 11:08	00/05/19, 12:46	(GMT)
Lat.:	45°33.02'N	45°33.02'N	45°33.01'N	
Long.:	152°12.02'E	152°11.88'E	152°12.02'E	
Depth (m):	5426	5426	5427	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine and CREST Plankton
Surface water (0 m) was collected by a bucket

CTD file #: 011L03.DAT

[illegible]

Station: 11

	Start	Bottom	End	
Date/Time:	00/05/19, 13:07	00/05/19, 13:14	00/05/19, 13:23	(GMT)
Lat.:	45°33.01'N	45°32.99'N	45°33.02'N	
Long.:	152°12.02'E	152°11.99'E	152°12.03'E	
Depth (m):	5431	5432	5433	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: 011S03.DAT

[illegible]

Station: 12

	Start	Bottom	End	
Date/Time:	00/05/20, 03:08	00/05/20, 04:44	00/05/20, 06:36	(GMT)
Lat.:	45°11.90'N	45°11.88'N	45°11.86'N	
Long.:	152°45.08'E	152°45.50'E	152°46.11'E	
Depth (m):	9528	9527	9497	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 012L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	6000.3	6135.5	1.644	1.058	34.697	27.756	-	34.692	162.3	7.610	2413.6	2311.1	0.04	35.00	2.42	144.1	0.0	-
2	4999.9	5101.0	1.535	1.087	34.694	27.762	-	34.689	158.2	7.603	2417.1	2314.0	0.04	35.29	2.44	145.1	-	-
3	4000.1	4071.5	1.499	1.172	34.685	27.758	-	34.681	146.8	7.585	2420.4	2318.9	0.04	36.10	2.49	149.2	-	-
4	3499.9	3558.3	1.541	1.268	34.675	27.746	-	34.670	134.9	7.565	2419.0	-	0.04	36.83	2.57	153.4	0.0	-
5	2999.6	3046.0	1.626	1.402	34.659	27.727	-	34.654	119.2	7.537	2419.6	2338.2	0.04	37.99	2.65	155.5	0.0	-
6	2500.2	2535.8	1.772	1.593	34.632	27.695	-	34.627	96.9	7.497	2418.6	2354.1	0.04	39.75	2.75	159.7	0.0	-
7	1999.8	2026.0	2.020	1.881	34.571	27.627	-	34.567	63.4	7.426	2409.8	2368.5	0.05	41.80	2.93	164.0	0.0	-
8	1499.9	1517.7	2.361	2.259	34.473	27.520	-	34.469	38.4	7.367	2395.7	2380.2	0.04	43.10	3.03	158.3	0.0	-
9	1000.0	1010.7	2.962	2.894	34.293	27.325	-	34.290	25.9	7.321	2364.0	2359.4	0.04	43.57	3.08	137.1	0.0	-
10	800.5	808.7	3.211	3.157	34.124	27.166	-	34.120	31.5	7.299	2337.6	2342.3	0.05	43.44	3.04	120.3	0.0	-
11	699.6	706.6	3.111	3.065	33.951	27.038	-	33.952	58.3	7.316	2317.3	2318.3	0.05	41.47	2.94	106.3	0.0	-
12	599.5	605.3	2.670	2.633	33.752	26.917	-	33.751	109.2	7.370	2298.5	2281.5	0.04	37.08	2.74	91.97	0.0	-
13	499.8	504.5	2.215	2.186	33.588	26.824	-	33.589	156.4	7.429	2287.2	2251.7	0.05	34.74	2.57	82.24	0.0	-
14	400.6	404.2	2.013	1.992	33.500	26.769	-	33.499	182.9	7.461	2281.1	2234.2	0.04	32.86	2.46	76.08	0.0	-
15	299.8	302.5	1.891	1.876	33.456	26.743	-	33.455	195.6	7.475	2273.9	2228.1	0.04	32.08	2.40	73.15	0.0	-
16	199.9	201.7	1.758	1.748	33.417	26.722	-	33.416	206.8	7.485	2272.6	2218.6	0.06	31.72	2.39	70.35	0.0	0.01
17	149.3	150.6	1.282	1.275	33.308	26.667	-	33.311	270.4	7.556	2264.8	2188.4	0.05	28.96	2.23	61.99	0.0	0.04
18	100.0	100.9	0.984	0.980	33.223	26.617	-	33.223	322.4	7.617	2255.7	2158.2	0.22	26.79	2.08	54.64	0.0	0.13
19	75.8	76.4	1.118	1.115	33.208	26.597	-	33.207	329.8	7.632	2254.5	2148.8	0.43	26.44	2.06	53.51	0.0	0.28
20	50.0	50.4	1.327	1.325	33.194	26.572	-	33.194	336.9	7.649	2255.1	2139.7	0.36	25.58	2.02	52.38	0.1	0.38
21	29.3	29.6	2.520	2.519	33.125	26.429	-	33.125	344.5	7.703	2251.5	2121.4	0.26	23.24	1.86	48.68	0.2	0.71
22	19.7	19.8	2.638	2.637	33.125	26.419	-	33.124	345.1	7.707	2251.7	2123.2	0.26	23.10	1.86	48.14	0.1	0.69
23	10.0	10.1	2.721	2.720	33.123	26.411	-	33.122	345.0	7.707	2250.2	2124.4	0.27	23.01	1.84	48.14	0.2	1.02
24	4.6	4.6	2.803	2.803	33.122	26.403	-	33.122	344.4	7.708	2250.8	2125.2	0.27	22.61	1.84	48.08	0.2	0.97
	0																	1.02

Station: 12

	Start	Bottom	End	
Date/Time:	00/05/21, 08:42	00/05/21, 08:48	00/05/21, 09:04	(GMT)
Lat.:	45°11.91'N	45°11.92'N	45°11.84'N	
Long.:	152°44.97'E	152°45.04'E	152°45.16'E	
Depth (m):	9534	9528	9532	

Remarks:	Cast for only CTD d
	Water samples for JAMSTEC Kawakami

CTD file #: 012L02.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m^3]	[kg/m^3]
1	300.0	302.7	1.855	1.839	33.444	26.736	0.7
2	300.2	302.8	1.855	1.839	33.444	26.736	0.7
3	249.8	252.0	1.806	1.793	33.427	26.726	0.7
4	249.8	252.0	1.806	1.793	33.427	26.726	0.7
5	201.0	202.7	1.624	1.614	33.387	26.707	0.8
6	201.2	203.0	1.615	1.606	33.385	26.706	0.8
7	150.1	151.3	1.153	1.146	33.277	26.651	0.8
8	150.2	151.5	1.160	1.153	33.279	26.652	0.8
9	100.2	101.1	0.964	0.960	33.213	26.611	1.4
10	100.3	101.1	0.965	0.961	33.213	26.610	1.5
11	74.9	75.5	1.022	1.018	33.205	26.601	2.1
12	75.0	75.7	1.026	1.022	33.205	26.600	2.1
13	59.4	59.8	1.282	1.279	33.194	26.575	2.9
14	59.2	59.7	1.296	1.294	33.194	26.574	3.0
15	48.2	48.6	1.370	1.367	33.192	26.568	3.4
16	48.4	48.8	1.377	1.375	33.192	26.567	3.5
17	40.2	40.5	1.410	1.408	33.187	26.562	3.7
18	39.9	40.2	1.417	1.415	33.187	26.561	3.8
19	30.7	31.0	1.758	1.756	33.162	26.517	6.0
20	30.9	31.2	1.848	1.846	33.158	26.507	8.5
21	20.4	20.6	2.866	2.865	33.108	26.386	5.7
22	20.7	20.9	2.968	2.967	33.106	26.376	4.8
23	10.3	10.4	3.158	3.157	33.106	26.359	6.2
24	10.4	10.5	3.182	3.182	33.104	26.356	6.7

Station: 12-2

	Start	Bottom	End
Date/Time:	00/05/21, 11:14	00/05/21, 12:41	00/05/21, 14:26
Lat.:	44°51.92'N	44°51.99'N	44°51.91'N
Long.:	153°10.84'E	153°11.03'E	153°11.01'E
Depth (m):	5675	5664	5667

(GMT)

Remarks: Cast for only CTD d
Water samples for routine

CTD file #: 122L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	5627.5	5749.5	1.596	1.063	34.697	27.760	-	34.691	162.0	7.598	2408.9	2310.1	0.01	36.05	2.41	144.2	0.0	-
2	4999.8	5100.8	1.519	1.072	34.696	27.765	-	34.691	160.5	7.597	2409.1	2312.4	0.01	36.03	2.43	145.0	0.0	-
3	4000.1	4071.5	1.470	1.144	34.688	27.762	-	34.684	150.4	7.580	2413.8	2321.6	0.01	36.80	2.47	149.2	0.0	-
4	3499.5	3557.8	1.495	1.223	34.680	27.754	-	34.675	140.3	7.563	2413.8	2328.5	0.00	37.50	2.53	152.4	-	-
5	2999.8	3046.2	1.569	1.346	34.665	27.736	-	34.661	124.2	7.532	2414.8	2337.1	0.01	39.07	2.63	156.3	0.0	-
6	2498.9	2534.6	1.683	1.505	34.644	27.711	-	34.639	104.0	7.494	2414.1	2350.7	0.00	40.18	2.72	160.5	0.0	-
7	1999.2	2025.4	1.936	1.799	34.593	27.650	-	34.589	71.0	7.428	2408.8	2367.9	0.01	42.82	2.87	163.6	0.0	-
8	1498.6	1516.4	2.170	2.071	34.521	27.574	-	34.519	49.8	7.379	2398.2	2375.8	0.00	43.47	2.96	162.4	0.0	-
9	999.3	1009.9	2.628	2.563	34.399	27.439	-	34.395	26.7	7.321	2377.3	2374.8	0.01	44.72	3.06	151.1	0.0	-
10	798.6	806.7	2.913	2.860	34.317	27.348	-	34.315	19.5	7.297	2362.8	2365.7	0.00	45.13	3.08	141.5	0.0	-
11	699.5	706.5	3.068	3.021	34.257	27.286	-	34.255	21.3	7.291	2352.1	2356.9	0.01	45.90	3.12	134.0	0.0	-
12	599.6	605.4	3.179	3.139	34.180	27.214	-	34.178	23.1	7.281	2340.8	2350.4	0.00	45.92	3.10	126.2	0.0	-
13	499.4	504.1	3.310	3.277	34.086	27.127	-	34.083	27.6	7.272	2328.0	2338.2	0.00	45.46	3.10	116.1	0.0	-
14	400.2	403.9	3.221	3.195	33.972	27.044	-	33.969	49.8	7.289	2314.0	2318.0	0.01	43.35	2.98	105.5	0.0	-
15	299.9	302.5	3.011	2.993	33.775	26.907	-	33.779	86.3	7.321	2292.6	2291.7	0.01	40.87	2.86	91.14	0.0	-
16	199.8	201.5	2.205	2.195	33.533	26.781	-	33.539	166.3	7.426	2275.3	2242.9	0.01	34.29	2.51	76.06	0.0	0.04
17	149.2	150.5	1.928	1.921	33.419	26.710	-	33.418	204.8	7.470	2265.3	2218.4	0.04	31.67	2.38	67.68	0.0	0.07
18	99.7	100.5	1.021	1.017	33.208	26.603	-	33.210	297.5	7.590	2249.1	2162.0	0.13	27.07	2.09	52.50	0.0	0.15
19	75.0	75.6	0.848	0.845	33.130	26.551	-	33.127	313.6	7.624	2239.6	2140.7	0.25	25.90	2.02	47.58	0.2	0.28
20	49.1	49.5	1.079	1.077	33.063	26.483	-	33.064	339.2	7.674	2238.0	2120.9	0.25	23.36	1.92	41.51	0.8	0.68
21	29.6	29.8	2.171	2.169	33.011	26.366	-	33.011	363.7	7.781	2240.8	2083.7	0.21	17.97	1.55	29.80	0.8	3.34
22	19.7	19.9	2.464	2.463	33.005	26.338	-	33.004	370.6	7.805	2237.8	2073.7	0.21	17.36	1.46	27.84	0.4	3.84
23	9.4	9.5	2.960	2.959	32.998	26.290	-	32.998	375.9	7.832	2238.6	2062.1	0.20	16.01	1.37	25.63	0.2	3.00
24	4.5	4.5	2.969	2.968	32.999	26.290	-	32.997	375.3	7.832	2241.0	2064.0	0.21	15.59	1.35	25.56	0.2	3.59

Station: 13

	Start	Bottom	End
Date/Time:	00/05/22, 00:41	00/05/22, 00:57	00/05/22, 01:21
Lat.:	44°12.93'N	44°12.95'N	44°12.97'N
Long.:	154°00.20'E	154°00.34'E	154°00.44'E
Depth (m):	5055	5054	5050

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 013S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.5	808.6	2.862	2.809	34.403	27.421
2	600.2	606.0	3.009	2.970	34.296	27.323
3	399.2	402.9	3.255	3.229	34.153	27.185
4	300.3	303.0	3.317	3.298	34.059	27.105
5	200.4	202.1	3.414	3.401	33.906	26.974
6	150.0	151.3	3.014	3.005	33.679	26.829
7	124.5	125.5	2.116	2.109	33.407	26.687
8	100.0	100.9	1.714	1.709	33.218	26.565
9	79.4	80.0	1.154	1.151	33.080	26.492
10	39.4	39.8	1.619	1.617	33.033	26.424
11	19.7	19.8	2.222	2.221	32.993	26.347
12	9.4	9.5	3.887	3.886	32.954	26.170

Station: 13

	Start	Bottom	End	
Date/Time:	00/05/22, 01:35	00/05/22, 01:59	00/05/22, 02:49	(GMT)
Lat.:	44°12.93'N	44°12.90'N	44°12.89'N	
Long.:	154°00.29'E	154°00.30'E	154°00.36'E	
Depth (m):	5051	5043	5041	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 013L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	1500.3	1518.1	2.069	1.971	34.560	27.614	0.9	-	-	-	-	-	-	-	-	-	-	-
2	1500.3	1518.1	2.069	1.971	34.560	27.614	0.9	-	-	-	-	-	-	-	-	-	-	-
3	1500.3	1518.0	2.070	1.972	34.560	27.614	0.9	34.556	65.7	7.401	2404.4		2370.6	0.02	42.67	2.93	171.5	0.0
4	1249.8	1263.9	2.231	2.151	34.513	27.563	0.9	34.510	43.6	7.368	2397.0		2377.8	0.01	43.49	3.01	169.9	0.0
5	999.5	1010.2	2.459	2.394	34.455	27.497	0.9	34.453	25.2	7.324	2390.6		2379.9	0.01	44.77	3.09	166.0	0.0
6	799.6	807.7	2.868	2.816	34.405	27.422	0.9	34.401	35.7	7.346	2376.6		2367.6	0.01	43.63	3.03	146.3	0.0
7	699.4	706.3	3.009	2.963	34.372	27.383	0.9	34.370	35.6	7.343	2369.6		2360.8	0.02	43.37	3.02	141.5	0.0
8	600.0	605.8	2.988	2.949	34.306	27.332	0.9	34.303	27.3	7.311	2364.5		2354.2	0.02	44.40	3.08	140.9	0.0
9	499.7	504.4	3.087	3.054	34.243	27.273	1.0	34.240	24.7	7.295	2354.6		2352.7	0.01	45.04	3.07	134.6	0.0
10	399.1	402.8	3.231	3.205	34.168	27.199	1.0	34.169	23.9	7.275	2338.6		2347.8	0.01	45.06	3.08	126.8	0.0
11	299.3	302.0	3.310	3.290	34.064	27.110	1.0	34.065	29.0	7.265	2325.8		2341.3	0.02	44.57	3.09	115.7	0.0
12	249.8	252.0	3.403	3.387	34.008	27.056	1.0	34.007	23.2	7.240	2316.5		2338.5	0.03	45.05	3.12	110.0	0.0
13	199.9	201.7	3.424	3.411	33.920	26.984	1.0	33.928	28.8	7.233	2304.2		2330.1	0.02	44.06	3.16	102.1	0.0
14	149.4	150.7	2.999	2.991	33.674	26.827	0.9	33.686	92.7	7.311	2281.4		2277.0	0.02	40.80	2.90	84.06	0.0
15	125.0	126.0	2.458	2.451	33.495	26.730	0.9	33.475	171.8	7.426	2265.8		2228.6	0.03	34.93	2.57	68.92	0.0
16	99.8	100.7	1.608	1.603	33.207	26.564	1.0	33.200	297.3	7.612	2242.9		2146.0	0.09	26.00	2.02	46.36	0.0
17	80.3	81.0	1.172	1.168	33.089	26.498	1.4	33.087	327.4	7.642	2235.4		2130.4	0.33	24.70	1.95	42.65	0.0
18	59.2	59.7	1.284	1.281	33.044	26.455	1.9	33.049	335.5	7.661	2236.9		2120.9	0.33	23.15	1.85	41.42	0.2
19	50.0	50.4	1.393	1.391	33.042	26.446	2.5	33.039	337.4	7.668	2233.8		2116.9	0.31	22.52	1.82	40.11	0.2
20	40.4	40.7	1.642	1.640	33.030	26.420	3.6	33.027	342.3	7.678	2233.3		2114.3	0.24	22.77	1.84	39.94	0.2
21	29.9	30.1	1.792	1.790	33.014	26.396	5.5	33.018	346.9	7.685	2232.5		2110.5	0.20	22.83	1.83	40.11	0.1
22	20.0	20.2	2.064	2.063	33.002	26.366	4.8	33.004	345.2	7.691	2232.7		2107.4	0.22	22.06	1.79	38.80	0.1
23	10.2	10.3	3.528	3.527	32.953	26.204	4.8	32.959	342.7	7.725	2230.6		2094.0	0.22	19.97	1.67	36.42	0.0
24	5.2	5.3	3.762	3.761	32.952	26.180	4.6	32.952	341.5	7.730	2231.3		2094.6	0.23	19.31	1.67	36.31	0.0
	0																	1.05

Station: 13

	Start	Bottom	End
Date/Time:	00/05/22, 03:42	00/05/22, 03:53	00/05/22, 06:16
Lat.:	44°13.02'N	44°13.01'N	44°13.60'N
Long.:	154°00.34'E	154°00.17'E	154°00.54'E
Depth (m):	5067	5081	5101

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 013S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	4500.2	4585.9	1.470	1.086	34.693	27.766
2	4500.6	4586.2	1.470	1.086	34.693	27.766
3	4500.2	4585.8	1.471	1.087	34.693	27.766
4	4500.0	4585.7	1.471	1.087	34.693	27.766
5	3999.4	4070.8	1.439	1.114	34.690	27.766
6	3500.3	3558.6	1.445	1.174	34.684	27.760
7	2999.1	3045.4	1.489	1.268	34.674	27.749
8	2499.8	2535.5	1.585	1.409	34.656	27.728
9	1999.6	2025.7	1.770	1.635	34.623	27.688
10	1499.1	1516.8	2.038	1.940	34.563	27.618
11	1249.0	1263.1	2.202	2.121	34.519	27.570
12	1000.4	1011.0	2.463	2.399	34.453	27.495

Station: 13

	Start	Bottom	End
Date/Time:	00/05/22, 06:30	00/05/22, 07:43	00/05/22, 09:13
Lat.:	44°13.35'N	44°13.02'N	44°13.46'N
Long.:	154°00.51'E	154°00.41'E	154°00.89'E
Depth (m):	5093	5061	5100

(GMT)

Remarks:	Cast for only CTD d
	Water samples for routine

CTD file #: 013L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	3499.8	3558.1	1.453	1.182	34.684	27.760	-	34.678	145.137	7.578	2416.8	2325.4	0.00	36.81	2.46	159.0	0.0	-
2	3499.7	3558.0	1.453	1.182	34.684	27.760	-	-	-	-	-	-	-	-	-	-	-	-
3	5031.9	5134.0	1.528	1.076	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
4	5032.2	5134.2	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
5	5031.8	5133.8	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
6	5031.8	5133.8	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
7	5031.9	5133.9	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
8	5031.6	5133.7	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
9	5031.7	5133.7	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
10	5031.6	5133.7	1.528	1.076	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
11	5031.6	5133.6	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
12	5031.4	5133.4	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
13	5031.3	5133.4	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
14	5031.0	5133.1	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
15	5031.2	5133.2	1.528	1.076	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
16	5031.1	5133.1	1.528	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-
17	5031.0	5133.0	1.528	1.076	34.695	27.764	-	34.692	158.6	7.600	2416.9	2312.9	0.01	35.30	2.42	155.2	0.0	-
18	4499.2	4584.8	1.471	1.087	34.694	27.767	-	34.691	157.2	7.598	2414.8	2315.5	0.01	35.86	2.44	155.2	0.0	-
19	3999.5	4070.9	1.443	1.118	34.691	27.766	-	34.686	153.6	7.593	2416.1	2318.4	0.00	36.26	2.45	155.1	0.0	-
20	3500.0	3558.3	1.453	1.183	34.684	27.760	-	34.680	145.0	-	-	-	0.00	36.85	2.49	157.7	0.0	-
21	3000.0	3046.4	1.495	1.274	34.673	27.748	-	34.670	133.0	7.558	2419.8	2336.3	0.02	36.69	2.56	160.7	0.0	-
22	2499.5	2535.2	1.582	1.406	34.657	27.729	-	34.655	116.7	7.527	2417.0	2343.4	0.02	39.14	2.63	166.0	0.0	-
23	1999.7	2025.9	1.759	1.624	34.624	27.690	-	34.621	98.5	7.477	2416.3	2356.4	0.02	40.29	2.77	170.7	0.0	-
24	1499.7	1517.4	2.024	1.926	34.563	27.619	-	34.560	53.7	7.401	2406.3	2371.6	0.02	42.62	2.93	174.9	0.0	-

Station: KNOT2-S

	Start	Bottom	End	
Date/Time:	00/05/22, 16:38	00/05/22, 17:22	00/05/22, 18:30	(GMT)
Lat.:	43°30.03'N	43°29.99'N	43°30.01'N	
Long.:	154°59.96'E	154°59.99'E	155°00.08'E	
Depth (m):	5483	5485	5485	

Remarks:	Cast for only CTD d:
	Water samples for CREST routine
	DO was measured on board by CREST.

CTD file #: K2SL01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TALK	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	3000.0	3046.4	1.528	1.306	34.670	27.743	0.7	34.665	128.7	-	-	-	0.01	38.78	2.59	158.9	-	-
2	1999.0	2025.1	1.830	1.694	34.614	27.676	0.8	34.610	-	-	-	-	0.01	41.88	2.81	166.1	-	-
3	1499.3	1517.1	2.106	2.008	34.549	27.602	0.8	34.546	55.1	-	-	-	0.01	43.68	2.94	166.6	-	-
4	1249.6	1263.7	2.284	2.202	34.497	27.546	0.9	34.494	40.2	-	-	-	0.01	44.63	3.00	163.7	-	-
5	999.6	1010.2	2.529	2.464	34.431	27.473	0.9	34.428	30.6	-	-	-	0.03	45.39	3.05	158.2	-	-
6	799.6	807.7	2.788	2.736	34.359	27.392	0.9	34.356	26.4	-	-	-	0.02	45.56	3.08	149.2	-	-
7	699.6	706.5	2.938	2.892	34.312	27.342	0.9	34.309	-	-	-	-	0.02	45.47	3.11	142.8	-	-
8	599.5	605.3	3.091	3.052	34.259	27.285	1.0	34.255	17.7	-	-	-	0.01	45.85	3.11	136.1	-	-
9	500.1	504.8	3.247	3.214	34.196	27.220	1.0	34.189	17.0	-	-	-	0.01	45.86	3.09	128.0	-	-
10	399.9	403.5	3.367	3.341	34.105	27.136	1.0	34.104	20.5	-	-	-	0.02	46.53	3.14	118.5	-	-
11	299.9	302.6	3.352	3.333	33.974	27.033	1.0	33.977	35.6	-	-	-	0.03	45.04	3.05	105.3	-	-
12	250.3	252.5	3.297	3.281	33.884	26.967	0.9	33.878	55.8	-	-	-	0.02	42.33	3.01	97.22	-	-
13	199.9	201.6	3.052	3.040	33.720	26.859	0.9	33.742	87.2	-	-	-	0.03	41.46	2.88	87.90	-	-
14	149.9	151.2	2.493	2.484	33.490	26.723	0.8	33.497	170.2	-	-	-	0.03	34.85	2.50	69.38	-	-
15	124.8	125.8	1.689	1.683	33.228	26.575	0.8	33.227	283.3	-	-	-	0.07	26.67	2.02	48.19	-	-
16	99.9	100.8	0.894	0.890	33.058	26.490	1.2	33.056	334.1	-	-	-	0.32	24.23	1.90	41.66	-	-
17	80.7	81.4	1.157	1.154	33.038	26.458	1.9	33.036	335.0	-	-	-	0.33	23.55	1.85	40.39	-	-
18	60.4	60.9	1.562	1.559	33.009	26.408	2.8	33.005	338.0	-	-	-	0.27	22.97	1.82	39.57	-	-
19	50.0	50.4	1.941	1.938	33.006	26.379	3.5	33.005	340.2	-	-	-	0.25	22.10	1.78	38.69	-	-
20	40.1	40.5	2.364	2.362	33.023	26.360	5.4	33.021	347.3	-	-	-	0.23	20.90	1.68	36.42	-	-
21	30.3	30.5	2.662	2.660	33.016	26.330	7.2	33.010	350.9	-	-	-	0.22	20.32	1.66	35.54	-	-
22	19.6	19.7	3.277	3.276	32.986	26.253	6.5	32.977	344.9	-	-	-	0.22	20.25	1.65	36.23	-	-
23	10.6	10.7	4.241	4.241	32.949	26.130	5.6	32.950	339.5	-	-	-	0.23	19.88	1.63	36.49	-	-
24	5.4	5.5	4.245	4.245	32.951	26.132	5.7	32.947	338.4	-	-	-	0.24	19.29	1.64	36.61	-	-

Station: KNOT2

	Start	Bottom	End	
Date/Time:	00/05/22, 22:01	00/05/22, 23:17	00/05/23, 00:58	(GMT)
Lat.:	44°00.09'N	44°00.09'N	44°00.06'N	
Long.:	154°59.90'E	155°00.11'E	155°00.00'E	
Depth (m):	5306	5313	5311	

Remarks:	Cast for only CTD d
	Water samples for routine, W.Univ.Emerson (#17-23), and sediment traps (#16,24)

CTD file #: KN2L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TALK	TDIC	Nitrite	itrate	Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	5251.3	5360.5	1.556	1.075	34.696	27.762	-	34.690	158.7	7.597	2414.3		2313.3	0.01	36.19	2.42	152.2	0.0	-
2	5000.0	5101.0	1.524	1.077	34.695	27.764	-	34.690	158.7	7.597	2413.8		2315.9	0.01	36.25	2.40	151.9	0.0	-
3	4499.1	4584.7	1.475	1.090	34.694	27.766	-	34.688	157.1	7.592	2414.2		2317.5	0.00	36.16	2.42	151.3	0.0	-
4	4000.6	4072.0	1.456	1.130	34.689	27.764	-	34.683	151.7	7.581	2414.5		2322.7	0.01	36.41	2.44	152.6	0.0	-
5	3498.7	3556.9	1.467	1.196	34.682	27.758	-	34.677	143.1	7.566	2418.4		2328.0	0.01	37.70	2.49	155.3	0.0	-
6	2999.7	3046.1	1.523	1.301	34.670	27.744	-	34.666	129.2	7.543	2418.3		2334.8	0.01	37.86	2.55	159.7	0.0	-
7	2499.3	2534.9	1.629	1.452	34.650	27.720	-	34.645	108.8	7.504	2421.8		2347.7	0.02	39.86	2.69	166.0	0.0	-
8	2250.1	2280.8	1.711	1.555	34.634	27.701	-	34.631	99.5	7.478	2419.7		2359.4	0.01	40.62	2.75	169.6	0.0	-
9	2000.1	2026.3	1.826	1.690	34.612	27.675	-	34.608	80.5	7.448	2411.3		2364.3	0.02	41.72	2.84	170.5	0.0	-
10	1749.9	1771.7	1.971	1.853	34.581	27.638	-	34.577	63.8	7.414	2409.9		2375.6	0.01	42.80	2.91	170.7	0.0	-
11	1499.6	1517.4	2.140	2.041	34.545	27.596	-	34.541	53.3	7.390	2405.6		2372.2	0.01	43.37	2.94	166.6	0.0	-
12	1249.4	1263.4	2.336	2.254	34.491	27.537	-	34.488	41.4	7.363	2395.3		2374.0	0.01	43.99	2.98	161.8	0.0	-
13	1000.3	1010.9	2.575	2.510	34.421	27.461	-	34.418	31.4	7.333	2381.6		2373.3	0.01	44.37	3.03	155.5	0.0	-
14	900.3	909.7	2.698	2.639	34.390	27.425	-	34.387	28.7	7.326	2375.5		2371.5	0.01	44.35	3.05	150.9	0.0	-
15	799.5	807.6	3.014	2.961	34.376	27.386	-	34.373	36.3	7.352	2371.1		2364.0	0.02	43.37	3.03	138.8	0.0	-
16	1000.3	1010.9	2.574	2.509	34.421	27.461	-	-	-	-	-	-	-	-	-	-	-	-	-
17	5000.1	5101.1	1.524	1.077	34.695	27.764	-	34.689	-	-	-	-	-	-	-	-	-	-	-
18	4000.4	4071.8	1.456	1.130	34.689	27.764	-	34.682	-	-	-	-	-	-	-	-	-	-	-
19	2999.7	3046.1	1.523	1.302	34.670	27.744	-	34.664	-	-	-	-	-	-	-	-	-	-	-
20	1999.7	2025.9	1.826	1.690	34.612	27.675	-	34.608	-	-	-	-	-	-	-	-	-	-	-
21	1499.5	1517.2	2.139	2.040	34.545	27.596	-	34.541	-	-	-	-	-	-	-	-	-	-	-
22	1000.4	1011.0	2.575	2.510	34.421	27.461	-	34.418	-	-	-	-	-	-	-	-	-	-	-
23	699.2	706.1	3.215	3.168	34.334	27.333	-	34.333	-	-	-	-	-	-	-	-	-	-	-
24	4999.9	5101.0	1.524	1.077	34.695	27.764	-	-	-	-	-	-	-	-	-	-	-	-	-

Station: KN0T2

	Start	Bottom	End	
Date/Time:	00/05/23, 01:59	00/05/23, 02:08	00/05/23, 02:27	(GMT)
Lat.:	44°00.10'N	44°00.17'N	44°00.22'N	
Long.:	155°00.07'E	154°59.96'E	154°59.95'E	
Depth (m):	5312	5309	5306	

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: KN2S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	599.9	605.7	3.151	3.112	34.256	27.277
2	499.6	504.3	3.206	3.173	34.168	27.202
3	399.6	403.2	3.268	3.242	34.054	27.106
4	299.3	302.0	3.250	3.231	33.917	26.998
5	199.3	201.1	2.808	2.797	33.669	26.839
6	149.9	151.2	2.585	2.576	33.525	26.744
7	124.5	125.5	2.328	2.322	33.330	26.608
8	99.2	100.0	2.119	2.114	33.213	26.531
9	79.8	80.5	2.266	2.262	33.193	26.504
10	39.8	40.2	4.114	4.111	33.297	26.420
11	20.0	20.2	4.860	4.858	33.151	26.225
12	10.0	10.1	5.339	5.339	33.132	26.155

Station: KN0T2

	Start	Bottom	End	
Date/Time:	00/05/23, 04:22	00/05/23, 04:46	00/05/23, 05:56	(GMT)
Lat.:	44°00.89'N	44°00.06'N	43°59.89'N	
Long.:	154°59.93'E	154°59.95'E	154°59.99'E	
Depth (m):	5307	5309	5314	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine

Surface water (0 m) was collected by a bucket

CTD file #: KN2L02.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	itrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25 °C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	799.9	808.1	2.870	2.817	34.362	27.388	0.9	-	-	-	-	-	-	-	-	-	-	-	
2	799.7	807.8	2.869	2.816	34.362	27.387	0.9	34.359	31.4	7.341	2371.3		2366.3	0.00	43.70	3.10	143.4	0.0	-
3	700.3	707.2	3.164	3.117	34.340	27.343	0.9	34.338	35.9	7.357	2362.7		2351.8	0.00	43.18	3.06	133.6	0.0	-
4	600.0	605.8	3.110	3.070	34.260	27.284	0.9	34.257	24.6	7.313	2360.2		2352.1	0.01	44.26	3.13	133.2	0.0	-
5	499.5	504.2	3.218	3.185	34.173	27.205	1.0	34.172	25.0	7.292	2340.3		2350.0	0.01	44.43	3.13	125.4	0.0	-
6	399.2	402.9	3.332	3.306	34.055	27.100	1.0	34.638	26.7	7.274	2322.0		2341.0	0.01	44.62	3.15	113.4	0.0	-
7	299.5	302.2	3.194	3.175	33.895	26.985	1.0	33.899	59.3	7.303	2305.3		2314.1	0.01	42.30	3.01	99.84	0.0	-
8	250.6	252.8	3.074	3.058	33.798	26.919	1.0	33.795	78.3	7.318	2293.5		2295.9	0.01	41.31	2.94	92.56	0.0	-
9	225.2	227.1	2.980	2.966	33.740	26.881	0.9	33.739	98.1	7.348	2288.6		2285.0	0.02	39.42	2.84	87.59	0.0	-
10	199.8	201.5	2.795	2.784	33.662	26.835	0.9	33.662	119.0	7.372	2282.1		2271.1	0.02	38.16	2.76	82.51	0.0	0.01
11	175.4	176.9	3.083	3.072	33.637	26.789	0.9	33.634	149.3	7.439	2286.5		2241.6	0.01	34.75	2.53	72.62	0.0	-
12	150.0	151.3	2.394	2.386	33.463	26.710	0.9	33.458	190.0	7.475	2264.0		2227.5	0.02	32.75	2.39	65.72	0.0	0.02
13	125.3	126.4	2.645	2.638	33.321	26.575	0.9	33.319	294.0	7.661	2248.5		2136.2	0.04	23.64	1.79	42.18	0.0	0.05
14	101.1	102.0	2.365	2.359	33.221	26.518	1.4	33.221	322.0	7.691	2241.9		2122.4	0.39	22.33	1.73	38.80	0.1	0.16
15	90.9	91.7	2.918	2.913	33.268	26.510	1.5	33.264	320.7	7.705	2245.4		2118.4	0.38	21.33	1.66	37.43	0.2	-
16	79.4	80.0	2.956	2.952	33.269	26.507	1.6	33.278	320.8	7.713	2245.5		2117.6	0.36	20.94	1.64	36.80	0.3	0.22
17	68.7	69.3	2.916	2.912	33.248	26.494	2.0	33.247	323.8	7.710	2245.7		2119.4	0.36	21.15	1.66	37.18	0.3	-
18	59.8	60.3	3.670	3.666	33.312	26.476	2.3	33.305	320.5	7.725	2245.8		2113.5	0.34	20.12	1.59	35.49	0.4	0.28
19	48.9	49.3	3.456	3.453	33.263	26.458	3.2	33.269	325.9	7.728	2247.0		2115.3	0.32	20.00	1.60	35.68	0.5	0.35
20	40.0	40.3	3.026	3.024	33.167	26.419	3.7	33.172	333.1	7.722	2240.6		2113.3	0.29	20.68	1.65	36.80	0.5	0.63
21	29.7	30.0	3.571	3.570	33.192	26.389	5.4	33.195	334.6	7.737	2242.5		2107.9	0.25	19.80	1.59	35.80	0.5	0.76
22	20.1	20.3	3.342	3.341	33.110	26.346	6.6	33.113	338.8	7.732	2240.9		2104.4	0.23	20.17	1.64	36.62	0.4	0.93
23	9.0	9.1	5.329	5.328	33.186	26.200	8.7	33.186	334.4	7.791	2241.1		2085.6	0.21	17.10	1.42	33.56	0.4	1.94
24	4.5	4.5	5.288	5.287	33.073	26.115	6.5	33.116	337.3	7.791	2238.2		2086.5	0.22	17.35	1.43	34.25	0.3	1.60
	0																	1.55	

Station: KN0T2

	Start	Bottom	End
Date/Time:	00/05/23, 08:35	00/05/23, 08:41	00/05/23, 09:06
Lat.:	44°00.03'N	44°00.04'N	44°00.04'N
Long.:	154°59.94'E	154°59.94'E	154°59.95'E
Depth (m):	5311	5312	5310

(GMT)

Remarks: Cast for only CTD data

Water samples for CREST Plankton (#4-16) and W.Univ. Emerson (#17-24)

CTD file #: KN2L03.DAT

[illegible]

Station: KNOT2

	Start	Bottom	End	
Date/Time:	00/05/23, 09:22	00/05/23, 10:57	00/05/23, 12:14	(GMT)
Lat.:	44°00.76'N	44°00.33'N	44°00.70'N	
Long.:	154°59.87'E	155°00.05'E	154°59.89'E	
Depth (m):	5307	5309	5309	

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: KN2S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	5001.0	5102.0	1.523	1.076	34.694	27.763
2	4500.8	4586.5	1.473	1.089	34.693	27.766
3	3999.0	4070.3	1.458	1.132	34.689	27.763
4	3500.3	3558.6	1.474	1.202	34.681	27.756
5	2999.3	3045.7	1.525	1.303	34.670	27.743
6	2501.2	2536.9	1.639	1.462	34.649	27.718
7	1999.4	2025.5	1.838	1.702	34.609	27.671
8	1500.9	1518.6	2.132	2.033	34.548	27.599
9	1250.0	1264.0	2.325	2.243	34.498	27.543
10	999.9	1010.6	2.578	2.513	34.420	27.459
11	801.4	809.5	3.032	2.978	34.371	27.380
12	699.5	706.5	3.203	3.156	34.328	27.330

Station: KNOT2

	Start	Bottom	End
Date/Time:	00/05/23, 12:27	00/05/23, 12:37	00/05/23, 13:05
Lat.:	44°00.56'N	44°00.48'N	44°00.15'N
Long.:	154°59.93'E	154°59.90'E	154°59.80'E
Depth (m):	5308	5307	5303

(GMT)

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for MAG Narita (#4-17) and W.Univ.Emerson (#18-24)

CTD file #: KN2L04.DAT

[illegible]

Station: KNOT2

	Start	Bottom	End
Date/Time:	00/05/23, 16:07	00/05/23, 16:11	00/05/23, 16:21
Lat.:	43°59.54'N	43°59.59'N	43°59.70'N
Long.:	155°00.39'E	155°00.41'E	155°00.42'E
Depth (m):	5327	5327	5326

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: KN2S03.DAT

[illegible]

Station: KNOT2-N

	Start	Bottom	End
Date/Time:	00/05/24, 22:00	00/05/24, 23:09	00/05/25, 01:00
Lat.:	44°31.12'N	44°30.41'N	44°29.99'N
Long.:	154°59.77'E	155°00.13'E	155°00.11'E
Depth (m):	5139	5121	5125

(GMT)

Remarks:	Cast for only CTD data
	Water samples for CREST routine
	The wire-out was about 4500m depth
	Oxygen was measured on board by CREST.
	Attention !! #6 & #8

CTD file #: K2NL01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TALK	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	2999.9	3046.3	1.516	1.294	34.671	27.745	-	34.665	130.4	7.560	-	-	0.00	37.27	2.60	154.1	-	-
2	1999.1	2025.3	1.813	1.678	34.614	27.677	-	34.609	81.8	7.468	-	-	0.00	40.34	2.87	163.8	-	-
3	1499.9	1517.6	2.149	2.050	34.550	27.600	-	34.547	55.7	7.418	-	-	0.00	41.89	2.97	158.7	-	-
4	1249.7	1263.8	2.325	2.243	34.495	27.541	-	34.493	42.6	7.384	-	-	0.00	42.56	3.04	157.1	-	-
5	999.3	1010.0	2.689	2.623	34.440	27.466	-	34.436	36.7	7.373	-	-	0.00	42.61	3.05	146.2	-	-
6	599.8	605.6	3.351	3.310	34.283	27.280	-	34.280	36.2	7.368	-	-	0.00	42.15	3.03	126.0	-	-
7	699.3	706.2	3.159	3.112	34.332	27.337	-	34.329	35.5	7.357	-	-	0.00	42.23	3.05	132.2	-	-
8	799.5	807.6	3.016	2.963	34.378	27.387	-	34.376	36.8	7.355	-	-	0.00	42.42	3.03	136.7	-	-
9	500.1	504.8	3.686	3.651	34.232	27.207	-	34.229	45.0	7.368	-	-	0.00	40.89	2.95	115.9	-	-
10	400.1	403.7	3.760	3.732	34.119	27.109	-	34.115	50.4	7.355	-	-	0.00	41.00	2.95	107.6	-	-
11	298.5	301.1	3.316	3.297	33.914	26.989	-	33.914	67.7	7.341	-	-	0.00	40.45	2.92	97.60	-	-
12	248.7	250.9	3.572	3.556	33.858	26.920	-	33.860	99.2	7.399	-	-	0.00	37.38	2.71	85.36	-	-
13	199.5	201.3	4.190	4.176	33.815	26.824	-	33.807	139.3	7.489	-	-	0.02	32.88	2.44	69.32	-	-
14	150.6	151.9	4.330	4.319	33.686	26.707	-	33.681	191.4	7.576	-	-	0.01	27.90	2.13	54.48	-	-
15	125.7	126.8	4.726	4.717	33.663	26.646	-	33.664	224.8	7.647	-	-	0.02	24.23	1.87	45.22	-	-
16	98.4	99.3	4.767	4.760	33.591	26.584	-	33.588	275.0	7.722	-	-	0.02	20.44	1.62	36.30	-	-
17	78.9	79.6	4.707	4.701	33.530	26.542	-	33.530	300.3	7.750	-	-	0.24	19.13	1.53	33.11	-	-
18	60.0	60.5	5.095	5.091	33.569	26.530	-	33.569	302.0	7.766	-	-	0.45	18.11	1.46	31.24	-	-
19	48.6	49.0	5.736	5.732	33.632	26.504	-	33.635	299.4	7.782	-	-	0.45	17.15	1.38	29.64	-	-
20	39.9	40.2	5.348	5.345	33.549	26.485	-	33.551	305.8	7.774	-	-	0.39	17.47	1.42	30.73	-	-
21	31.4	31.7	5.427	5.424	33.506	26.442	-	33.508	317.1	7.792	-	-	0.30	16.59	1.38	30.33	-	-
22	20.6	20.8	6.101	6.099	33.318	26.211	-	33.321	325.0	7.815	-	-	0.19	15.65	1.38	31.53	-	-
23	9.9	10.0	6.232	6.232	33.329	26.204	-	33.328	323.8	7.821	-	-	0.18	15.31	1.36	31.24	-	-
24	4.7	4.8	6.255	6.255	33.331	26.202	-	33.330	323.5	7.820	-	-	0.18	15.33	1.37	31.30	-	-

Station: KNOT2-N

	Start	Bottom	End
Date/Time:	00/05/25, 01:23	00/05/25, 01:45	00/05/25, 02:10
Lat.:	44°30.03'N	44°30.21'N	44°30.39'N
Long.:	155°00.17'E	155°00.48'E	155°00.96'E
Depth (m):	5124	5123	5146

(GMT)

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: K2NS01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	1001.0	1011.6	2.665	2.599	34.444	27.471
2	599.0	604.8	3.360	3.320	34.284	27.280
3	300.3	302.9	3.745	3.724	33.953	26.979
4	200.4	202.1	4.070	4.056	33.807	26.830
5	149.5	150.8	4.335	4.324	33.696	26.714
6	99.5	100.3	4.795	4.787	33.583	26.575
7	79.4	80.1	4.724	4.718	33.533	26.543
8	40.0	40.4	5.624	5.621	33.593	26.487
9	20.2	20.4	6.075	6.074	33.318	26.215
10	20.0	20.2	6.068	6.066	33.318	26.215
11	19.9	20.0	6.099	6.097	33.320	26.213
12	9.9	10.0	6.295	6.294	33.338	26.202

Station: 23

	Start	Bottom	End
Date/Time:	00/05/27, 07:52	00/05/27, 08:07	00/05/27, 08:26
Lat.:	41°07.01'N	41°06.93'N	41°06.94'N
Long.:	159°56.38'E	159°56.38'E	159°56.43'E
Depth (m):	5622	5616	5615

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 023S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.5	808.6	3.473	3.416	34.313	27.292
2	599.8	605.6	4.056	4.012	34.199	27.143
3	401.1	404.8	4.524	4.494	33.952	26.897
4	299.3	301.9	5.015	4.992	33.816	26.735
5	199.7	201.4	6.260	6.242	33.862	26.621
6	150.3	151.6	6.227	6.214	33.822	26.593
7	126.2	127.3	6.241	6.230	33.809	26.581
8	99.4	100.3	6.786	6.777	33.876	26.563
9	79.5	80.1	6.815	6.807	33.849	26.537
10	41.0	41.4	8.067	8.063	33.889	26.391
11	19.3	19.5	11.598	11.596	34.231	26.067
12	9.4	9.5	11.710	11.709	34.223	26.040

Station: 23

	Start	Bottom	End	
Date/Time:	00/05/27, 08:38	00/05/27, 10:01	00/05/27, 11:55	(GMT)
Lat.:	41°07.01'N	41°07.03'N	41°07.05'N	
Long.:	159°56.38'E	159°56.32'E	159°56.47'E	
Depth (m):	5617	5619	5614	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 023L01.DAT

Bottle #	CTD data							Bottle data												
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a		
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]		
1	5550.2	5669.5	1.587	1.065	34.697	27.760	-	34.692	160.1	7.609	2414.6	34.692	2314.5	0.01	36.01	2.42	147.8	0.0	-	
2	4998.6	5099.6	1.526	1.078	34.695	27.763	-	34.690	158.2	7.606	2414.6	34.690	2314.2	0.03	36.24	2.44	148.5	0.0	-	
3	3998.3	4069.6	1.476	1.150	34.687	27.761	-	34.682	148.9	7.591	2416.5	-	2314.5	0.01	36.84	2.50	149.9	0.0	-	
4	3498.6	3556.8	1.498	1.226	34.679	27.753	-	34.674	139.0	7.573	2419.1	34.674	2328.4	0.01	37.54	2.54	152.5	0.0	-	
5	2998.6	3045.0	1.560	1.337	34.666	27.737	-	34.662	124.6	7.546	2417.6	34.662	2338.1	0.01	38.60	2.62	156.5	0.0	-	
6	2498.6	2534.3	1.696	1.519	34.641	27.708	-	34.638	101.9	7.504	2417.6	34.638	2353.4	0.02	39.93	2.72	160.6	0.0	-	
7	1998.7	2024.8	1.930	1.793	34.597	27.654	-	34.594	72.5	7.448	2410.9	34.594	2370.4	0.02	41.94	2.88	162.6	0.0	-	
8	1498.8	1516.6	2.340	2.239	34.516	27.557	-	34.512	45.1	7.391	2397.9	34.512	2373.3	0.02	43.57	3.02	156.8	0.0	-	
9	999.1	1009.8	3.027	2.958	34.388	27.394	-	34.384	37.0	7.366	2372.8	34.384	2359.4	0.01	43.64	3.04	137.0	0.0	-	
10	798.9	807.0	3.498	3.442	34.306	27.285	-	34.306	41.7	7.370	2356.3	34.306	2341.2	0.01	42.76	2.99	123.3	0.0	-	
11	698.7	705.6	3.797	3.747	34.253	27.213	-	34.254	47.1	7.377	2345.7	34.254	2327.4	0.01	42.07	2.92	114.2	0.0	-	
12	598.5	604.3	4.057	4.013	34.199	27.143	-	34.196	54.9	7.386	2334.0	34.196	2308.9	0.02	40.83	2.87	104.9	0.0	-	
13	499.2	503.9	4.384	4.347	34.110	27.038	-	34.104	71.6	7.406	2318.0	34.104	2291.1	0.01	38.07	2.72	91.44	0.0	-	
14	399.4	403.1	4.750	4.719	34.005	26.915	-	34.009	99.3	7.452	2302.0	34.009	2261.5	0.02	35.11	2.54	78.02	0.0	-	
15	299.9	302.5	4.774	4.751	33.819	26.765	-	33.823	154.3	7.536	2280.5	33.823	2213.0	0.02	29.62	2.20	59.94	0.0	-	
16	200.1	201.8	6.136	6.119	33.846	26.623	-	33.843	281.5	7.771	2261.4	33.843	2110.2	0.02	16.42	1.24	27.34	0.0	0.03	
17	150.6	151.9	6.141	6.128	33.818	26.601	-	33.817	284.2	7.771	2261.3	33.817	2110.1	0.03	16.48	1.26	27.13	0.0	0.04	
18	100.1	101.0	6.883	6.874	33.894	26.564	-	33.894	276.4	7.785	2267.5	33.894	2105.4	0.10	15.60	1.17	25.65	0.0	0.18	
19	75.2	75.9	6.870	6.863	33.855	26.534	-	33.851	295.3	7.806	2263.0	33.851	2099.1	0.37	14.07	1.13	24.44	0.4	0.72	
20	52.4	52.8	8.273	8.268	34.029	26.470	-	34.034	276.0	7.833	2268.5	34.034	2090.7	0.19	12.77	0.99	21.14	0.2	0.55	
21	29.9	30.1	9.034	9.030	34.014	26.341	-	34.019	289.6	7.871	2274.7	34.019	2073.8	0.21	10.33	0.87	20.40	0.2	0.51	
22	19.9	20.0	10.952	10.950	34.126	26.103	-	34.120	283.9	7.911	2274.3	34.120	2055.2	0.18	7.81	0.70	16.63	0.1	0.58	
23	10.1	10.2	11.408	11.406	34.175	26.059	-	34.175	279.4	7.920	2272.4	34.175	2057.0	0.17	7.28	0.64	15.55	0.1	0.43	
24	5.3	5.3	11.462	11.461	34.155	26.034	-	34.153	279.2	7.917	2272.3	34.153	2055.5	0.17	7.45	0.64	15.96	0.1	0.55	
	0																			0.55

Station: 23

	Start	Bottom	End
Date/Time:	00/05/27, 12:14	00/05/27, 13:29	00/05/27, 14:50
Lat.:	41°07.05'N	41°06.89'N	41°06.60'N
Long.:	159°56.53'E	159°56.33'E	159°56.35'E
Depth (m):	5615	5614	5612

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 023S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	5000.6	5101.7	1.526	1.078	34.693	27.762
2	5001.7	5102.8	1.526	1.078	34.693	27.762
3	5001.3	5102.4	1.526	1.078	34.693	27.762
4	4499.0	4584.6	1.487	1.103	34.691	27.763
5	3999.8	4071.2	1.477	1.150	34.686	27.760
6	3500.0	3558.3	1.495	1.223	34.679	27.753
7	2997.7	3044.1	1.568	1.345	34.664	27.736
8	2499.8	2535.5	1.707	1.529	34.640	27.706
9	1999.4	2025.6	1.945	1.807	34.595	27.652
10	1500.3	1518.1	2.318	2.217	34.515	27.558
11	1250.4	1264.5	2.647	2.563	34.463	27.488
12	999.8	1010.4	3.021	2.952	34.393	27.399

Station: 18

	Start	Bottom	End	
Date/Time:	00/05/30, 10:31	00/05/30, 11:22	00/05/30, 12:34	(GMT)
Lat.:	48°20.07'N	48°19.95'N	48°20.08'N	
Long.:	152°20.05'E	152°19.93'E	152°19.99'E	
Depth (m):	3222	3224	3224	

Remarks:	Cast for only CTD data
----------	------------------------

Water samples for routine

Surface water (0 m) was collected by a bucket

CTD file #: 018L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TAlk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	3196.1	3247.0	1.860	1.611	34.614	27.674	0.8	34.610	87.6	7.480	2412.6	2361.2	0.03	40.09	2.81	178.1	0.0	-
2	3179.2	3229.7	1.859	1.612	34.614	27.674	0.8	34.610	87.7	7.479	2414.4	2363.9	0.04	40.01	2.81	177.9	0.1	-
3	2999.8	3046.2	1.859	1.630	34.610	27.670	0.8	34.605	85.6	7.474	2413.7	2364.5	0.04	40.25	2.82	176.5	0.0	-
4	2499.7	2535.4	1.880	1.699	34.592	27.654	0.8	34.587	78.9	7.460	2411.0	2367.1	0.03	41.16	2.84	173.9	0.0	-
5	2000.4	2026.6	1.976	1.838	34.554	27.616	0.8	34.549	67.1	7.433	2406.4	2369.5	0.02	41.82	2.90	170.8	0.0	-
6	1500.1	1517.9	2.160	2.060	34.484	27.545	0.8	34.480	52.0	7.395	2392.6	2369.8	0.03	42.77	2.95	165.4	0.0	-
7	999.7	1010.3	2.373	2.309	34.269	27.356	0.9	34.266	41.6	7.337	2366.6	2359.0	0.04	43.02	3.03	155.6	0.0	-
8	799.6	807.7	2.268	2.220	34.086	27.218	0.9	34.080	59.7	7.331	2351.9	2338.3	0.03	41.43	2.97	137.9	0.0	-
9	599.6	605.4	1.958	1.924	33.795	27.009	1.0	33.792	121.1	7.388	2302.1	2283.2	0.04	36.67	2.68	99.59	0.1	-
10	499.3	504.0	1.790	1.764	33.674	26.925	1.0	33.669	150.1	7.422	2289.7	2262.0	0.04	34.77	2.56	87.78	0.0	-
11	399.9	403.6	1.335	1.315	33.494	26.813	1.0	33.492	181.5	7.441	2269.9	2236.6	0.05	31.73	2.43	68.84	0.0	-
12	300.5	303.1	1.321	1.307	33.409	26.745	1.0	33.409	204.9	7.482	2264.5	2216.8	0.10	30.20	2.31	62.83	0.0	-
13	200.4	202.1	1.088	1.080	33.296	26.670	0.9	33.295	237.6	7.532	2255.4	2191.7	0.12	27.25	2.11	52.48	0.0	0.05
14	150.4	151.7	1.025	1.019	33.231	26.621	1.1	33.227	257.6	7.573	2252.3	2171.5	0.13	25.63	2.02	49.92	0.3	0.10
15	124.8	125.8	0.886	0.880	33.176	26.586	1.0	33.172	272.2	7.595	2247.6	2163.8	0.14	24.11	1.93	45.91	0.1	0.08
16	100.5	101.3	0.464	0.460	33.071	26.525	1.0	33.081	296.2	7.622	2241.7	2151.4	0.13	21.80	1.79	38.67	0.1	0.05
17	78.9	79.6	0.123	0.120	32.989	26.477	1.1	32.993	313.4	7.643	2236.4	2138.8	0.13	20.20	1.66	34.36	0.2	0.13
18	60.1	60.6	-0.038	-0.040	32.843	26.367	2.2	32.856	335.2	7.678	2230.3	2120.7	0.16	17.45	1.49	29.04	0.3	0.31
19	49.2	49.6	0.038	0.036	32.777	26.310	3.2	32.776	344.3	7.699	2225.0	2109.1	0.17	16.04	1.39	26.91	0.4	0.63
20	40.3	40.6	0.237	0.236	32.717	26.252	4.0	32.698	350.1	7.718	2221.1	2097.0	0.16	14.79	1.30	25.22	0.4	0.78
21	29.6	29.9	0.929	0.928	32.631	26.145	5.9	32.636	352.1	7.736	2218.9	2089.7	0.15	13.61	1.22	24.61	0.4	0.92
22	19.8	20.0	1.369	1.368	32.595	26.089	8.9	32.599	353.8	7.752	2217.2	2080.7	0.15	12.94	1.17	24.19	0.2	1.90
23	10.1	10.1	1.527	1.527	32.494	25.997	7.6	32.492	355.4	7.765	2211.6	2069.8	0.15	11.24	1.06	22.13	0.2	1.76
24	4.4	4.4	1.530	1.530	32.492	25.995	7.5	32.492	355.3	7.767	2212.2	2070.0	0.15	11.22	1.05	22.01	0.2	1.56
	0																	1.69

Station: 17

	Start	Bottom	End	
Date/Time:	00/05/31, 05:29	00/05/31, 05:35	00/05/31, 05:56	(GMT)
Lat.:	48°59.95'N	49°00.00'N	49°00.09'N	
Long.:	153°10.09'E	153°10.00'E	153°09.08'E	
Depth (m):	2852	2853	2864	

Remarks:	Cast for only CTD d
	Water samples for JAMSTEC Kawakami

CTD file #: 017L01.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	299.9	302.5	1.516	1.501	33.442	26.759	0.8
2	299.7	302.4	1.516	1.501	33.443	26.759	0.8
3	250.3	252.5	1.437	1.425	33.379	26.713	0.8
4	250.5	252.7	1.447	1.435	33.378	26.712	0.8
5	201.3	203.0	1.228	1.219	33.300	26.664	0.8
6	201.3	203.0	1.216	1.206	33.297	26.662	0.8
7	149.4	150.7	0.818	0.812	33.210	26.617	0.7
8	149.5	150.8	0.800	0.794	33.206	26.615	0.8
9	99.3	100.1	0.536	0.532	33.100	26.545	1.1
10	99.5	100.4	0.509	0.506	33.092	26.540	1.3
11	75.2	75.8	0.708	0.705	33.022	26.472	2.2
12	75.5	76.2	0.717	0.714	33.020	26.471	2.2
13	61.2	61.7	0.072	0.070	32.927	26.429	1.6
14	61.3	61.8	0.056	0.054	32.924	26.427	1.7
15	49.8	50.2	-0.010	-0.011	32.830	26.355	2.7
16	49.6	50.0	0.021	0.019	32.821	26.346	2.7
17	38.9	39.2	0.233	0.232	32.789	26.310	3.2
18	32.7	33.0	0.579	0.578	32.762	26.270	4.2
19	27.8	28.0	1.006	1.005	32.746	26.233	5.4
20	24.2	24.4	1.134	1.133	32.736	26.217	6.7
21	18.3	18.5	1.337	1.337	32.712	26.185	7.2
22	14.2	14.3	1.527	1.526	32.686	26.151	7.6
23	9.5	9.5	1.754	1.754	32.654	26.110	7.9
24	5.4	5.4	1.830	1.830	32.647	26.099	7.8

Station: 17

	Start	Bottom	End
Date/Time:	00/05/31, 06:15	00/05/31, 06:30	00/05/31, 06:54
Lat.:	49°00.05'N	49°00.01'N	49°00.00'N
Long.:	153°09.91'E	153°10.01'E	153°09.90'E
Depth (m):	2858	2860	2863

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 017S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	801.0	809.2	2.447	2.397	34.165	27.267
2	600.1	605.9	2.218	2.183	33.850	27.033
3	399.4	403.0	1.789	1.768	33.571	26.843
4	299.5	302.2	1.513	1.498	33.449	26.765
5	200.1	201.8	1.221	1.212	33.299	26.664
6	150.5	151.8	0.776	0.770	33.203	26.614
7	123.9	125.0	0.744	0.739	33.152	26.575
8	100.6	101.4	0.436	0.432	33.062	26.520
9	80.1	80.8	0.257	0.254	33.006	26.484
10	40.3	40.6	0.933	0.931	32.747	26.238
11	20.0	20.2	1.695	1.694	32.671	26.128
12	10.3	10.4	1.906	1.906	32.644	26.091

Station: 17

	Start	Bottom	End	
Date/Time:	00/05/31, 07:11	00/05/31, 07:56	00/05/31, 09:01	(GMT)
Lat.:	49°00.07'N	49°00.02'N	49°00.09'N	
Long.:	153°09.88'E	153°09.90'E	153°09.64'E	
Depth (m):	2862	2859	2869	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 017L02.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	2812.7	2855.0	1.843	1.633	34.608	27.670	0.8	34.604	84.5	7.470	2412.8	2363.3	0.03	40.34	2.87	181.2	0.0	-	
2	2796.4	2838.2	1.843	1.635	34.608	27.670	0.8	34.603	84.4	7.462	2414.7	2363.9	0.03	40.09	2.87	181.0	0.0	-	
3	2499.4	2535.1	1.867	1.686	34.595	27.657	0.8	34.591	80.0	7.450	2409.8	2365.7	0.03	40.61	2.90	178.2	0.0	-	
4	1999.2	2025.3	1.945	1.807	34.563	27.626	0.9	34.558	69.9	7.427	2405.9	2367.9	0.02	41.35	2.95	174.2	0.0	-	
5	1500.1	1517.9	2.139	2.040	34.500	27.560	0.9	34.497	54.2	7.388	2395.0	2368.8	0.02	42.74	3.02	168.9	0.0	-	
6	999.7	1010.3	2.449	2.385	34.330	27.399	0.9	34.327	37.7	7.329	2371.6	2360.4	0.03	43.51	3.10	159.5	0.0	-	
7	800.0	808.1	2.444	2.394	34.162	27.264	0.9	34.161	49.0	7.318	2348.4	2347.0	0.03	42.57	3.11	143.8	0.0	-	
8	699.8	706.7	2.389	2.346	34.047	27.177	1.0	34.048	64.5	7.323	2333.8	2333.8	0.05	41.47	3.03	130.5	0.0	-	
9	599.8	605.6	2.273	2.238	33.862	27.039	1.0	33.866	97.2	7.351	2310.7	2301.6	0.03	38.92	2.89	108.2	0.0	-	
10	500.2	504.9	2.021	1.993	33.704	26.932	0.9	33.701	139.2	7.383	2293.3	2275.2	0.03	36.07	2.73	91.58	0.0	-	
11	399.5	403.2	1.712	1.691	33.543	26.826	0.9	33.543	166.4	7.415	2275.7	2249.4	0.04	33.67	2.62	77.27	0.0	-	
12	300.1	302.7	1.527	1.512	33.428	26.747	0.9	33.429	193.6	7.453	2266.9	2222.0	0.07	31.99	2.52	67.89	0.0	-	
13	200.0	201.7	1.126	1.117	33.294	26.666	0.9	33.296	239.4	7.524	2257.7	2193.1	0.10	27.78	2.17	54.83	0.0	0.04	
14	150.2	151.5	0.883	0.877	33.226	26.626	0.8	33.220	282.3	7.570	2252.0	2176.6	0.06	26.79	2.09	52.22	0.0	0.03	
15	125.0	126.1	0.873	0.868	33.187	26.595	0.8	33.187	270.8	7.572	2248.6	2161.1	0.06	24.26	1.95	44.68	0.0	0.03	
16	99.5	100.3	0.476	0.473	33.100	26.548	1.1	33.104	314.1	7.572	2243.8	2148.0	0.24	22.76	1.82	41.69	0.0	0.08	
17	79.7	80.4	0.267	0.264	33.027	26.500	1.1	33.026	313.7	7.633	2240.4	2139.6	0.11	20.69	1.72	35.72	0.0	0.00	
18	59.6	60.1	0.197	0.195	32.975	26.462	1.2	32.969	318.7	7.644	2238.0	2132.6	0.09	19.82	1.65	33.82	0.0	0.15	
19	49.9	50.3	-0.043	-0.044	32.900	26.413	1.7	32.901	330.3	7.659	2232.0	2119.4	0.16	18.51	1.57	30.72	0.1	0.28	
20	40.4	40.7	0.010	0.009	32.820	26.346	2.6	32.806	342.6	7.688	2229.0	2110.5	0.18	16.44	1.42	27.05	0.1	0.63	
21	30.8	31.1	1.248	1.246	32.744	26.216	6.0	32.740	354.5	7.741	2226.7	2089.6	0.16	14.22	1.28	24.34	0.1	1.35	
22	20.1	20.2	1.664	1.663	32.674	26.132	8.5	32.660	357.4	7.760	2222.2	2078.3	0.16	12.66	1.19	23.14	0.2	2.01	
23	10.4	10.5	1.783	1.783	32.652	26.107	8.3	32.649	357.2	7.763	2221.7	2077.4	0.16	12.51	1.15	22.76	0.1	1.83	
24	4.9	4.9	1.793	1.793	32.651	26.105	8.1	32.650	357.0	7.763	2222.1	2076.6	0.16	12.47	1.13	22.76	0.1	1.69	
	0																		2.05

Station: 17

	Start	Bottom	End
Date/Time:	00/05/31, 09:22	00/05/31, 10:08	00/05/31, 10:53
Lat.:	49°00.02'N	49°00.05'N	48°59.95'N
Long.:	153°09.88'E	153°09.47'E	153°09.33'E
Depth (m):	2859	2874	2876

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 017S02.DAT

Bottle #	CTD data					
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [psu]	Sigma- θ [kg/m ³]
1	2502.0	2537.7	1.861	1.680	34.597	27.660
2	2502.3	2538.1	1.861	1.680	34.597	27.660
3	2502.5	2538.2	1.861	1.680	34.597	27.660
4	2502.9	2538.6	1.861	1.680	34.597	27.660
5	2503.3	2539.0	1.861	1.680	34.597	27.660
6	2503.3	2539.1	1.861	1.680	34.597	27.660
7	2499.4	2535.0	1.861	1.680	34.597	27.660
8	2499.6	2535.2	1.861	1.680	34.597	27.660
9	1999.9	2026.0	1.944	1.807	34.564	27.627
10	1500.2	1518.0	2.136	2.037	34.503	27.563
11	1250.5	1264.6	2.279	2.197	34.443	27.503
12	1000.6	1011.3	2.484	2.420	34.324	27.391

Station: 19

	Start	Bottom	End	
Date/Time:	00/05/31, 18:39	00/05/31, 19:12	00/05/31, 20:07	(GMT)
Lat.:	47°29.80'N	47°29.83'N	47°29.91'N	
Long.:	153°59.18'E	153°59.30'E	153°59.44'E	
Depth (m):	2102	2098	2095	

Remarks:	Cast for only CTD d:
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 019L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25 °C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	2057.2	2084.3	1.914	1.772	34.589	27.649	0.9	-	-	-	-	-	-	-	-	-	-	-	
2	2057.2	2084.4	1.915	1.773	34.589	27.649	0.9	34.584	72.5	7.439	2407.8	-	2367.0	0.02	41.86	2.83	170.5	0.0	
3	1999.8	2025.9	1.966	1.828	34.578	27.636	1.0	34.574	67.5	7.428	2406.0	-	2369.9	0.03	42.20	2.85	170.1	0.0	
4	1499.6	1517.3	2.374	2.272	34.481	27.526	1.0	34.478	33.8	7.352	2391.8	-	2380.5	0.02	44.17	3.01	166.0	0.0	
5	1250.0	1264.1	2.547	2.463	34.439	27.477	1.0	34.437	23.3	7.326	2384.1	-	2383.3	0.02	45.11	3.07	162.2	0.0	
6	999.9	1010.5	2.784	2.717	34.377	27.407	1.0	34.374	18.1	7.309	2372.8	-	2375.1	0.02	45.41	3.07	153.0	0.0	
7	799.7	807.9	2.875	2.823	34.346	27.374	1.1	34.343	17.2	7.304	2368.8	-	2365.2	0.02	45.22	3.09	148.1	0.0	
8	699.5	706.4	2.945	2.899	34.237	27.281	1.1	34.233	28.0	7.299	2354.0	-	2354.9	0.02	44.59	3.04	136.8	0.0	
9	599.7	605.5	3.240	3.200	34.213	27.235	1.2	34.209	16.3	7.281	2346.8	-	2357.4	0.03	45.41	3.09	131.3	0.0	
10	499.6	504.3	3.377	3.343	34.155	27.176	1.1	34.154	15.9	7.270	2339.5	-	2352.5	0.03	45.54	3.08	124.2	0.0	
11	400.3	404.0	3.485	3.458	34.081	27.106	1.1	34.078	16.2	7.255	2323.0	-	2345.9	0.02	46.02	3.11	115.8	0.0	
12	300.3	303.0	3.554	3.534	33.965	27.008	1.2	33.962	26.5	7.250	2307.1	-	2329.8	0.03	45.48	3.11	104.4	0.0	
13	200.2	202.0	3.513	3.500	33.816	26.892	1.1	33.814	59.2	7.289	2292.7	-	2301.9	0.04	42.79	2.99	92.15	0.0	
14	149.3	150.6	1.321	1.314	33.266	26.631	1.1	33.264	252.2	7.543	2248.6	-	2180.7	0.06	30.45	2.25	56.07	0.0	
15	125.2	126.3	0.573	0.568	33.101	26.544	1.0	33.103	314.7	7.627	2237.5	-	2140.0	0.19	26.40	2.04	45.91	0.0	
16	99.9	100.7	0.846	0.841	33.059	26.494	1.3	33.059	333.7	7.654	2234.4	-	2127.8	0.41	25.49	1.98	43.99	0.1	
17	80.2	80.9	1.293	1.289	33.040	26.451	2.3	33.040	341.9	7.679	2233.6	-	2118.0	0.28	24.06	1.90	42.49	0.4	
18	59.8	60.3	1.827	1.824	32.950	26.342	3.4	32.947	343.2	7.778	2236.3	-	2085.7	0.19	17.31	1.57	27.06	1.7	
19	49.5	49.9	1.956	1.954	32.883	26.279	2.5	32.882	345.7	7.837	2235.8	-	2058.5	0.16	13.51	1.33	19.35	2.1	
20	40.6	40.9	1.943	1.941	32.884	26.281	2.4	32.883	345.8	7.835	2235.7	-	2058.7	0.17	13.59	1.33	19.67	2.1	
21	30.3	30.5	1.941	1.940	32.884	26.281	2.8	32.883	345.9	7.835	2236.3	-	2058.1	0.16	13.51	1.33	19.23	2.1	
22	21.1	21.3	1.955	1.954	32.882	26.279	2.5	32.883	346.0	7.835	2234.9	-	2061.3	0.16	13.42	1.32	19.10	2.1	
23	10.1	10.2	1.962	1.962	32.882	26.278	2.9	32.881	346.0	7.838	2236.6	-	2058.1	0.17	13.35	1.30	19.29	2.1	
24	4.7	4.8	1.965	1.965	32.882	26.277	2.4	32.881	345.8	7.838	2235.8	-	2058.9	0.16	13.31	1.31	19.29	2.1	
	0																		0.45

Station: 22

	Start	Bottom	End
Date/Time:	00/06/01, 09:35	00/06/01, 09:44	00/06/01, 10:10
Lat.:	49°04.73'N	49°04.90'N	49°05.15'N
Long.:	157°54.75'E	157°54.73'E	157°54.83'E
Depth (m):	6762	6856	6985

(GMT)

Remarks: Cast for only CTD d
Water samples for JAMSTEC Kawakami

CTD file #: 022101.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	300.4	303.1	3.494	3.474	34.035	27.069	1.1
2	300.2	302.9	3.494	3.474	34.034	27.068	1.2
3	251.1	253.3	3.578	3.562	33.978	27.015	1.1
4	251.6	253.8	3.578	3.561	33.979	27.016	1.1
5	200.4	202.2	3.492	3.479	33.872	26.939	1.1
6	200.6	202.4	3.491	3.478	33.871	26.938	1.2
7	151.3	152.6	3.028	3.019	33.610	26.773	1.2
8	151.2	152.5	3.020	3.011	33.605	26.770	1.3
9	100.7	101.5	1.062	1.058	33.085	26.502	1.6
10	100.9	101.8	1.059	1.054	33.085	26.502	1.7
11	76.0	76.6	1.284	1.281	33.074	26.479	2.1
12	75.9	76.6	1.280	1.276	33.074	26.479	1.9
13	60.1	60.6	1.441	1.439	33.070	26.465	2.2
14	60.7	61.2	1.443	1.440	33.070	26.465	2.3
15	50.0	50.4	1.571	1.569	33.063	26.451	2.5
16	50.1	50.5	1.573	1.571	33.063	26.451	3.1
17	39.5	39.9	1.706	1.704	33.035	26.419	3.8
18	39.2	39.6	1.742	1.740	33.034	26.416	4.1
19	28.8	29.0	2.817	2.815	32.778	26.127	17.5
20	28.4	28.7	2.815	2.814	32.779	26.128	16.5
21	20.5	20.6	2.841	2.840	32.693	26.057	14.1
22	20.6	20.8	2.847	2.846	32.691	26.056	11.0
23	9.5	9.6	2.894	2.893	32.692	26.052	11.0
24	9.7	9.8	2.893	2.892	32.692	26.052	15.4

Station: 22

	Start	Bottom	End	
Date/Time:	00/06/01, 10:21	00/06/01, 10:28	00/06/01, 10:38	(GMT)
Lat.:	49°05.17'N	49°05.14'N	49°05.14'N	
Long.:	157°54.93'E	157°54.97'E	157°55.02'E	
Depth (m):	7016	7011	6969	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: 022S01.DAT

[illegible]

Station: 22

	Start	Bottom	End	
Date/Time:	00/06/01, 10:48	00/06/01, 11:14	00/06/01, 12:01	(GMT)
Lat.:	49°04.94'N	49°04.88'N	49°04.76'N	
Long.:	157°54.99'E	157°54.64'E	157°54.32'E	
Depth (m):	6920	6734	6604	

Remarks:	Cast for only CTD data
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 022L02.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	1502.0	1519.8	2.104	2.005	34.543	27.597	0.9	-	-	-	-	-	-	-	-	-	-	-
2	1502.7	1520.6	2.103	2.004	34.543	27.597	0.9	-	-	-	-	-	-	-	-	-	-	-
3	1503.2	1521.0	2.103	2.004	34.543	27.597	0.9	34.539	48.2	7.387	2401.1	-	2380.6	0.00	43.46	3.02	166.2	0.0
4	1249.6	1263.6	2.291	2.209	34.497	27.545	0.9	34.495	33.2	7.352	2396.7	-	2383.8	0.01	44.72	3.09	163.6	0.0
5	998.9	1009.6	2.556	2.491	34.430	27.469	1.0	34.426	23.5	7.322	2384.2	-	2384.5	0.00	45.22	3.14	156.5	0.0
6	799.4	807.5	2.823	2.771	34.360	27.390	1.0	34.357	17.7	7.303	2370.3	-	2376.5	0.00	45.67	3.17	146.9	0.0
7	698.9	705.8	2.970	2.925	34.316	27.342	1.0	34.313	15.9	7.293	2363.8	-	2373.2	0.01	45.48	3.15	141.3	0.0
8	598.5	604.3	3.114	3.075	34.273	27.294	1.1	34.272	14.9	7.287	2355.2	-	2363.1	0.02	45.79	3.16	136.0	0.0
9	499.5	504.2	3.268	3.235	34.204	27.225	1.1	34.200	16.1	7.275	2345.0	-	2356.8	0.01	45.74	3.15	127.4	0.0
10	400.0	403.6	3.412	3.386	34.133	27.155	1.1	34.130	16.6	7.263	2333.6	-	2351.6	0.00	45.88	3.15	121.1	0.0
11	299.5	302.1	3.514	3.495	34.034	27.066	1.2	34.033	19.3	7.245	2319.1	-	2341.0	0.01	46.46	3.20	110.4	0.0
12	249.7	251.9	3.552	3.535	33.971	27.012	1.2	33.975	30.7	7.259	2310.5	-	2330.8	0.03	45.21	3.12	105.5	0.0
13	200.4	202.2	3.498	3.485	33.874	26.940	1.2	33.871	37.4	7.244	2297.8	-	2318.4	0.02	45.63	3.13	96.54	0.0
14	151.1	152.4	2.709	2.700	33.561	26.762	1.3	33.532	146.9	7.391	2267.8	-	2243.5	0.05	37.45	2.70	73.85	0.0
15	123.9	125.0	0.650	0.645	33.105	26.543	1.3	33.133	302.8	7.608	2240.8	-	2147.8	0.18	27.23	2.09	47.93	0.0
16	100.1	100.9	1.097	1.093	33.079	26.495	2.0	33.078	329.2	7.650	2236.4	-	2128.3	0.35	25.83	2.01	46.16	0.3
17	79.6	80.2	1.236	1.233	33.070	26.479	2.1	33.069	326.5	7.652	2236.7	-	2129.2	0.37	25.56	2.01	44.17	0.5
18	59.1	59.6	1.486	1.483	33.066	26.459	2.5	33.066	330.1	7.659	2236.8	-	2121.1	0.29	24.86	2.00	42.81	0.7
19	49.9	50.3	1.655	1.653	33.053	26.437	3.6	33.053	333.9	7.673	2237.5	-	2118.1	0.24	23.85	1.95	40.84	0.8
20	38.8	39.1	1.761	1.759	33.044	26.422	3.5	33.042	333.9	7.681	2237.4	-	2119.9	0.22	22.83	1.95	38.38	1.3
21	29.7	30.0	2.670	2.668	32.855	26.201	17.3	32.857	350.5	7.869	2235.9	-	2039.5	0.15	13.05	1.14	17.64	1.1
22	19.3	19.5	2.824	2.823	32.701	26.065	11.1	32.697	361.5	7.983	2232.7	-	1984.5	0.10	6.10	0.61	5.78	1.7
23	9.7	9.8	2.851	2.850	32.696	26.059	12.8	32.693	362.0	7.988	2231.2	-	1984.3	0.10	5.82	0.59	5.28	0.8
24	4.5	4.6	2.853	2.852	32.696	26.059	12.4	32.695	361.9	7.988	2229.3	-	1986.3	0.11	5.81	0.56	5.22	0.8
	0																	3.68

Station: 22

	Start	Bottom	End
Date/Time:	00/06/01, 12:21	00/06/01, 12:34	00/06/01, 12:57
Lat.:	49°04.80'N	49°04.84'N	49°04.83'N
Long.:	157°54.39'E	157°54.49'E	157°54.48'E
Depth (m):	6645	6685	6649

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 022S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	801.7	809.9	2.818	2.765	34.362	27.392
2	600.1	605.9	3.108	3.068	34.277	27.298
3	399.8	403.5	3.426	3.400	34.129	27.150
4	299.8	302.4	3.549	3.529	34.031	27.060
5	199.5	201.2	3.470	3.458	33.851	26.924
6	150.8	152.1	2.661	2.652	33.535	26.745
7	125.2	126.2	0.829	0.824	33.111	26.537
8	99.9	100.8	1.090	1.085	33.075	26.492
9	79.7	80.4	1.257	1.253	33.073	26.480
10	39.9	40.2	2.004	2.002	33.041	26.402
11	19.5	19.6	2.888	2.887	32.712	26.068
12	9.5	9.6	2.897	2.897	32.714	26.069

Station: 22

	Start	Bottom	End	
Date/Time:	00/06/01, 14:09	00/06/01, 15:44	00/06/01, 17:51	(GMT)
Lat.:	49°05.06'N	49°05.05'N	49°05.04'N	
Long.:	157°54.74'E	157°54.97'E	157°55.06'E	
Depth (m):	6935	6987	7000	

Remarks: Cast for only CTD d Water samples for routine and CREST Plankton
--

CTD file #: 022L03.DAT

[illegible]

Station: 22

	Start	Bottom	End
Date/Time:	00/06/01, 18:15	00/06/01, 19:30	00/06/01, 20:48
Lat.:	49°05.04'N	49°04.99'N	49°04.89'N
Long.:	157°55.00'E	157°55.31'E	157°55.83'E
Depth (m):	6987	7048	7103

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 022S03.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	5000.3	5101.4	1.527	1.079	34.694	27.763
2	5000.3	5101.4	1.527	1.079	34.694	27.763
3	5000.5	5101.5	1.527	1.079	34.694	27.763
4	4500.0	4585.6	1.490	1.106	34.692	27.763
5	3999.5	4070.9	1.479	1.153	34.687	27.760
6	3500.3	3558.6	1.499	1.227	34.679	27.753
7	2999.6	3046.0	1.551	1.329	34.668	27.740
8	2500.0	2535.7	1.663	1.486	34.647	27.715
9	2000.1	2026.2	1.855	1.719	34.609	27.670
10	1499.3	1517.1	2.109	2.010	34.544	27.598
11	1250.1	1264.2	2.316	2.235	34.493	27.540
12	999.8	1010.4	2.571	2.506	34.430	27.468

Station: 21

	Start	Bottom	End	(GMT)
Date/Time:	00/06/02, 03:13	00/06/02, 03:26	00/06/02, 03:46	
Lat.:	48°30.11'N	48°30.16'N	48°30.23'N	
Long.:	155°59.75'E	155°59.79'E	155°59.88'E	
Depth (m):	5051	5040	5052	

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 021S03.DAT

Bottle #	CTD data					
	Depth [m]	Pressure [db]	Temp. [°C]	Pot-Temp [°C]	Salinity [psu]	Sigma- θ [kg/m ³]
1	800.5	808.6	2.869	2.816	34.352	27.380
2	599.8	605.6	3.166	3.126	34.254	27.275
3	400.3	404.0	3.447	3.420	34.117	27.139
4	300.1	302.8	3.542	3.522	34.000	27.037
5	199.8	201.5	3.520	3.507	33.831	26.903
6	150.0	151.3	1.997	1.989	33.391	26.683
7	125.3	126.4	0.714	0.709	33.105	26.539
8	99.9	100.7	1.153	1.149	33.074	26.487
9	79.8	80.4	1.342	1.338	33.071	26.472
10	40.0	40.3	2.107	2.105	33.005	26.365
11	19.3	19.5	3.648	3.647	32.745	26.027
12	9.6	9.7	3.816	3.815	32.701	25.976

Station: 21

	Start	Bottom	End
Date/Time:	00/06/02, 03:59	00/06/02, 04:23	00/06/02, 05:09
Lat.:	48°30.09'N	48°30.07'N	48°30.03'N
Long.:	155°59.95'E	155°59.90'E	155°59.93'E
Depth (m):	5059	5060	5066

(GMT)

Remarks:	Cast for only CTD d
	Water samples for routine

CTD file #: 021L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	TALK	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	1500.1	1517.8	2.111	2.012	34.542	27.596	0.9	-	-	-	-	-	-	-	-	-	-	-
2	1500.1	1517.9	2.110	2.011	34.542	27.596	0.9	-	-	-	-	-	-	-	-	-	-	-
3	1500.2	1518.0	2.112	2.013	34.541	27.595	0.9	34.538	47.9	7.394	2398.6	2380.1	0.00	43.79	2.99	165.0	-	-
4	1249.6	1263.7	2.277	2.196	34.496	27.546	0.9	34.494	38.0	7.369	2394.0	2386.0	0.01	44.26	3.02	161.4	0.0	-
5	999.8	1010.5	2.585	2.520	34.427	27.464	1.0	34.426	21.0	7.328	2381.8	2384.1	0.03	45.17	3.08	156.5	0.0	-
6	800.1	808.2	2.847	2.795	34.357	27.386	1.0	34.357	16.7	7.310	2369.8	2377.0	0.01	45.35	3.12	147.2	0.0	-
7	700.4	707.3	3.008	2.962	34.306	27.330	1.0	34.307	-	7.301	2359.5	2365.6	0.01	45.65	3.12	142.0	0.0	-
8	600.3	606.1	3.160	3.120	34.254	27.275	1.2	34.254	15.0	7.293	2352.4	2360.6	0.00	45.94	3.12	135.5	0.0	-
9	500.0	504.7	3.290	3.256	34.192	27.214	1.1	34.192	15.0	7.281	2341.0	2355.6	0.00	45.92	3.14	128.6	0.0	-
10	400.3	404.0	3.435	3.408	34.123	27.145	1.2	34.123	16.5	7.273	2331.0	2348.2	0.01	46.03	3.12	120.7	0.0	-
11	299.9	302.6	3.535	3.515	34.018	27.052	1.2	34.021	19.3	7.255	2315.1	2343.2	0.02	46.29	3.14	110.2	0.0	-
12	250.2	252.4	3.504	3.487	33.927	26.982	1.2	33.931	25.7	7.245	2302.0	2330.2	0.03	46.23	3.16	102.2	0.1	-
13	200.2	202.0	3.535	3.522	33.831	26.902	1.2	33.847	52.1	7.289	2295.5	2304.2	0.03	43.58	2.99	94.61	0.0	0.08
14	149.6	150.9	2.586	2.578	33.522	26.741	1.4	33.564	135.5	7.392	2271.6	2248.1	0.07	37.72	2.72	75.03	0.1	0.12
15	124.9	126.0	0.936	0.931	33.216	26.615	1.8	33.171	293.2	7.603	2248.0	2152.0	0.09	27.54	2.13	48.76	0.1	0.12
16	100.0	100.9	0.894	0.890	33.061	26.493	1.6	33.060	328.4	7.661	2232.5	2130.0	0.31	24.70	2.01	42.18	0.9	0.12
17	80.4	81.1	1.273	1.269	33.073	26.479	1.7	33.073	327.9	7.668	2233.8	2124.7	0.36	25.00	2.02	42.66	0.7	0.18
18	59.7	60.2	1.541	1.538	33.062	26.452	2.6	33.065	329.7	7.673	2235.1	2119.7	0.29	24.49	2.01	41.42	0.9	0.30
19	50.1	50.6	1.665	1.662	33.044	26.429	3.0	33.037	331.7	7.697	2236.9	2116.2	0.25	22.24	1.97	35.44	1.7	0.38
20	40.3	40.6	1.897	1.895	32.996	26.374	3.4	33.004	337.0	7.738	2238.7	2107.8	0.23	19.19	1.85	27.21	2.5	0.41
21	30.8	31.0	3.350	3.348	32.917	26.192	7.2	32.949	348.8	7.858	2238.6	2057.7	0.18	13.74	1.31	16.78	1.8	0.92
22	20.2	20.4	3.535	3.533	32.837	26.111	9.9	32.817	358.4	7.985	2236.8	1996.0	0.13	7.30	0.69	6.91	0.9	1.58
23	10.1	10.2	4.070	4.069	32.751	25.990	8.8	32.754	361.9	8.034	2237.8	1972.0	0.12	4.81	0.45	4.05	0.6	2.36
24	4.9	4.9	4.438	4.437	32.765	25.964	2.8	32.762	356.7	8.029	2235.3	1972.3	0.10	5.12	0.49	4.36	0.7	1.48
	0							1.58										

Station: 21

	Start	Bottom	End
Date/Time:	00/06/02, 05:24	00/06/02, 06:56	00/06/02, 07:45
Lat.:	48°30.02'N	48°30.04'N	48°30.02'N
Long.:	156°00.01'E	156°00.04'E	155°59.91'E
Depth (m):	5071	5069	5066

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 021S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	4500.9	4586.5	1.473	1.089	34.693	27.766
2	4500.9	4586.6	1.474	1.089	34.693	27.766
3	4501.0	4586.7	1.474	1.089	34.693	27.766
4	4500.9	4586.6	1.473	1.089	34.693	27.766
5	4000.1	4071.5	1.460	1.134	34.689	27.764
6	3499.3	3557.6	1.480	1.209	34.681	27.756
7	2999.2	3045.6	1.535	1.313	34.670	27.743
8	2499.4	2535.0	1.643	1.466	34.650	27.719
9	1999.5	2025.7	1.837	1.701	34.613	27.674
10	1503.1	1520.9	2.086	1.988	34.549	27.604
11	1249.8	1263.8	2.260	2.179	34.503	27.552
12	999.4	1010.1	2.561	2.496	34.434	27.472

Station: 21

	Start	Bottom	End	
Date/Time:	00/06/02, 07:50	00/06/02, 09:10	00/06/02, 10:44	(GMT)
Lat.:	48°29.98'N	48°30.01'N	48°30.16'N	
Long.:	155°59.88'E	155°59.84'E	155°59.90'E	
Depth (m):	5075	5063	5057	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for routine and CREST Plankton

CTD file #: 021L02.DAT

[illegible]

Station: 21

	Start	Bottom	End	
Date/Time:	00/06/02, 10:59	00/06/02, 11:06	00/06/02, 11:16	(GMT)
Lat.:	48°30.21'N	48°30.22'N	48°30.25'N	
Long.:	155°59.94'E	155°59.98'E	156°00.00'E	
Depth (m)	5064	5074	5076	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: 021S01.DAT

[illegible]

Station: 20-3

	Start	Bottom	End
Date/Time:	00/06/03, 01:55	00/06/03, 03:25	00/06/03, 05:00
Lat.:	46°45.46'N	46°45.42'N	46°45.32'N
Long.:	154°44.57'E	154°44.71'E	154°44.67'E
Depth (m):	7375	7379	7384

(GMT)

Remarks:	Cast for only CTD data Water samples for salinity
----------	--

CTD file #: 203S01.DAT

[illegible]

Station: 20-4

	Start	Bottom	End	
Date/Time:	00/06/03, 07:26	00/06/03, 08:52	00/06/03, 10:47	(GMT)
Lat.:	47°09.96'N	47°10.02'N	47°10.07'N	
Long.:	155°14.96'E	155°14.97'E	155°15.06'E	
Depth (m):	7279	7280	7294	

Remarks:	Cast for only CTD d
	Water samples for salinity
	CTD observations was carried out to 6000 m depth
	204S02.DAT: Downcast, 204S04.DAT:Upcast

CTD file #: 204S02.DAT, 204S04.DAT

[illegible]

Station: 16

	Start	Bottom	End
Date/Time:	00/06/03, 21:30	00/06/03, 22:22	00/06/03, 23:22
Lat.:	46°45.06'N	46°45.05'N	46°45.02'N
Long.:	153°37.09'E	153°36.97'E	153°36.85'E
Depth (m):	3982	3975	3979

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 016S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	3488.1	3546.1	1.440	1.170	34.685	27.762
2	3482.1	3539.9	1.439	1.171	34.685	27.762
3	3474.8	3532.5	1.440	1.172	34.685	27.762
4	3469.5	3527.1	1.441	1.173	34.685	27.762
5	3463.3	3520.8	1.441	1.174	34.685	27.762
6	3499.6	3557.9	1.439	1.169	34.686	27.762
7	2999.5	3045.9	1.516	1.295	34.672	27.745
8	2500.1	2535.8	1.634	1.458	34.650	27.720
9	2000.5	2026.6	1.819	1.683	34.614	27.677
10	1499.5	1517.3	2.086	1.988	34.548	27.603
11	1249.1	1263.1	2.262	2.181	34.505	27.554
12	999.6	1010.2	2.527	2.462	34.436	27.476

Station: 16

	Start	Bottom	End	
Date/Time:	00/06/03, 23:31	00/06/04, 00:36	00/06/04, 01:58	(GMT)
Lat.:	46°44.94'N	46°44.98'N	46°44.99'N	
Long.:	153°36.93'E	153°36.97'E	153°37.03'E	
Depth (m):	3990	3981	3974	

Remarks:	Cast for only CTD d:
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 016L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	Nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	3940.9	4010.7	1.425	1.107	34.691	27.767	-	34.687	-	7.598	2412.9	2321.1	0.03	36.36	2.49	146.1	0.0	-	
2	2999.9	3046.3	1.517	1.296	34.670	27.744	-	34.667	-	7.556	2415.0	2335.8	0.03	38.27	2.61	153.1	0.0	-	
3	1999.3	2025.4	1.826	1.690	34.611	27.673	-	34.609	-	7.464	2411.7	2365.1	0.02	41.59	2.87	163.2	0.0	-	
4	1499.4	1517.2	2.078	1.979	34.548	27.603	-	34.546	54.9	7.403	2404.7	2378.6	0.03	42.87	2.99	163.8	0.0	-	
5	1249.6	1263.7	2.275	2.194	34.499	27.548	-	34.497	35.3	7.362	2395.8	2384.0	0.02	44.61	3.09	163.2	0.0	-	
6	1000.1	1010.8	2.529	2.464	34.433	27.474	-	34.432	25.2	7.333	2383.8	2385.2	0.03	45.08	3.14	155.6	0.0	-	
7	798.9	807.0	2.806	2.754	34.367	27.398	-	34.365	20.1	7.312	2375.7	2377.8	0.02	45.40	3.19	146.8	0.0	-	
8	699.7	706.6	2.968	2.922	34.319	27.344	-	34.316	16.7	7.304	2363.0	2375.5	0.04	45.85	3.19	139.6	0.0	-	
9	599.5	605.3	3.133	3.094	34.264	27.285	-	34.264	14.6	7.290	2355.6	2365.9	0.03	45.68	3.18	133.2	0.0	-	
10	499.6	504.3	3.262	3.229	34.204	27.226	-	34.201	15.7	7.282	2344.7	2361.8	0.03	45.75	3.17	126.1	0.0	-	
11	399.2	402.9	3.294	3.268	34.122	27.157	-	34.121	22.4	7.279	2331.8	2350.1	0.02	45.52	3.17	118.7	0.0	-	
12	300.0	302.6	3.363	3.344	34.022	27.071	-	34.021	30.2	7.273	2317.5	2338.6	0.04	45.16	3.17	109.4	0.0	-	
13	200.4	202.1	3.313	3.300	33.912	26.988	-	33.919	39.6	7.267	2304.1	2326.2	0.04	44.80	3.16	99.59	0.0	0.04	
14	148.6	149.9	3.019	3.010	33.686	26.835	-	33.661	105.6	7.343	2280.5	2274.6	0.04	40.65	2.90	80.71	0.0	0.07	
15	123.8	124.9	1.725	1.719	33.319	26.645	-	33.306	235.3	7.521	2253.4	2191.8	0.08	32.05	2.40	57.95	0.0	0.11	
16	99.9	100.7	0.951	0.947	33.095	26.516	-	33.091	322.1	7.640	2236.1	2139.3	0.41	26.51	2.08	44.58	0.1	0.16	
17	80.0	80.7	1.025	1.021	33.058	26.483	-	33.060	333.6	7.660	2235.4	2128.7	0.35	25.31	2.02	42.70	0.3	0.26	
18	59.2	59.7	1.466	1.463	33.021	26.425	-	33.024	341.1	7.686	2235.3	2119.0	0.24	23.94	1.95	40.26	0.6	0.54	
19	49.8	50.2	1.769	1.766	33.007	26.392	-	33.008	346.4	7.703	2235.0	2112.8	0.21	22.71	1.89	38.10	0.5	0.78	
20	40.2	40.6	2.210	2.208	32.993	26.348	-	32.994	347.0	7.724	2234.6	2106.6	0.19	22.04	1.83	36.14	0.4	0.90	
21	29.3	29.5	3.779	3.777	32.933	26.164	-	32.939	342.3	7.772	2234.7	2088.0	0.21	20.10	1.68	30.85	0.4	1.14	
22	19.1	19.2	4.212	4.210	32.935	26.123	-	32.936	339.4	7.774	2234.8	2088.1	0.21	19.98	1.67	31.29	0.3	1.24	
23	9.8	9.9	4.324	4.324	32.935	26.110	-	32.935	338.5	7.776	2233.9	2086.6	0.22	20.17	1.67	31.73	0.3	0.97	
24	4.9	4.9	4.330	4.330	32.934	26.110	-	32.935	338.4	7.773	2234.7	2089.3	0.22	20.00	1.66	31.79	0.2	1.26	
	0																		1.26

Station: 16

	Start	Bottom	End
Date/Time:	00/06/04, 03:03	00/06/04, 03:16	00/06/04, 03:39
Lat.:	46°45.14'N	46°45.19'N	46°45.27'N
Long.:	153°36.82'E	153°36.80'E	153°36.71'E
Depth (m):	3971	3973	3970

(GMT)

Remarks:	Cast for only CTD d: Water samples for iron
----------	--

CTD file #: 016S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.1	808.2	2.851	2.798	34.358	27.386
2	600.3	606.1	3.083	3.043	34.285	27.306
3	400.1	403.8	3.289	3.263	34.148	27.179
4	300.0	302.7	3.365	3.345	34.026	27.074
5	200.6	202.3	3.201	3.188	33.813	26.919
6	149.8	151.1	2.269	2.261	33.468	26.723
7	125.5	126.6	0.995	0.990	33.122	26.535
8	100.6	101.4	0.935	0.931	33.076	26.502
9	80.3	81.0	1.024	1.020	33.058	26.483
10	40.0	40.3	1.843	1.841	33.000	26.381
11	20.1	20.2	4.350	4.348	32.936	26.109
12	10.2	10.2	4.338	4.337	32.938	26.112

Station: 15

	Start	Bottom	End
Date/Time:	00/06/04, 08:52	00/06/04, 09:04	00/06/04, 09:26
Lat.:	46°00.17'N	46°00.06'N	46°00.02'N
Long.:	153°59.85'E	153°59.90'E	154°00.06'E
Depth (m):	8388	8176	8196

(GMT)

Remarks:	Cast for only CTD d
	Water samples for Kawakami JAMSTEC

CTD file #: 015L02.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	299.5	302.2	3.249	3.230	34.002	27.066	1.1
2	299.7	302.4	3.241	3.222	34.003	27.067	1.1
3	249.5	251.7	3.082	3.067	33.902	27.001	1.3
4	249.3	251.5	3.085	3.070	33.903	27.002	1.1
5	200.0	201.7	2.958	2.946	33.776	26.912	1.1
6	199.5	201.2	2.981	2.969	33.776	26.909	1.1
7	150.6	151.9	2.362	2.353	33.552	26.783	1.1
8	150.9	152.2	2.353	2.344	33.547	26.780	1.1
9	99.9	100.7	0.879	0.875	33.118	26.540	1.4
10	99.9	100.8	0.879	0.875	33.118	26.540	1.3
11	74.5	75.1	0.987	0.984	33.062	26.488	2.2
12	74.5	75.1	0.993	0.990	33.058	26.485	2.3
13	59.7	60.2	1.257	1.255	33.042	26.455	3.1
14	60.3	60.8	1.270	1.267	33.042	26.454	3.1
15	49.5	49.9	1.449	1.447	33.024	26.428	3.5
16	49.3	49.8	1.514	1.512	33.034	26.432	3.6
17	40.0	40.3	3.243	3.241	32.924	26.206	8.2
18	40.1	40.4	3.384	3.382	32.916	26.187	7.6
19	29.8	30.0	3.712	3.710	32.903	26.146	8.0
20	29.5	29.8	3.714	3.712	32.903	26.146	8.2
21	19.0	19.2	3.714	3.713	32.903	26.146	8.2
22	19.8	20.0	3.715	3.714	32.903	26.146	8.6
23	9.6	9.7	3.712	3.711	32.903	26.146	8.7
24	9.7	9.8	3.711	3.711	32.903	26.146	8.4

Station: 15

	Start	Bottom	End
Date/Time:	00/06/04, 09:38	00/06/04, 09:54	00/06/04, 10:17
Lat.:	46°00.04'N	46°00.11'N	46°00.11'N
Long.:	154°00.01E	154°00.02'E	153°59.93'E
Depth (m):	8188	8206	8215

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 015S01.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	800.1	808.2	2.783	2.731	34.369	27.401
2	599.6	605.4	3.076	3.036	34.280	27.304
3	400.2	403.8	3.328	3.301	34.129	27.160
4	299.8	302.5	3.199	3.180	33.995	27.065
5	200.3	202.0	2.974	2.962	33.773	26.908
6	150.9	152.2	2.253	2.245	33.510	26.758
7	125.4	126.5	1.649	1.643	33.335	26.663
8	100.3	101.1	0.899	0.895	33.126	26.545
9	79.9	80.6	0.954	0.951	33.072	26.498
10	38.7	39.0	3.372	3.369	32.904	26.179
11	19.8	19.9	3.699	3.697	32.907	26.151
12	10.0	10.1	3.703	3.702	32.907	26.150

Station: 15

	Start	Bottom	End	
Date/Time:	00/06/04, 10:29	00/06/04, 10:53	00/06/04, 11:49	(GMT)
Lat.:	46°00.06'N	45°59.98'N	45°59.94'N	
Long.:	154°00.01'E	154°00.14'E	154°00.24'E	
Depth (m):	8213	8172	8160	

Remarks:	Cast for only CTD d:
	Water samples for routine
	Surface water (0 m) was collected by a bucket

CTD file #: 015L01.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	59.6	60.1	1.099	1.097	33.048	26.470	2.9	-	336.3	7.401	-	-	2125.8	0.30	23.71	1.96	41.21	0.8	-
2	60.0	60.5	1.126	1.123	33.046	26.466	3.2	-	-	-	-	-	-	-	-	-	-	-	-
3	1501.0	1518.8	2.087	1.988	34.544	27.599	1.0	34.541	53.9	7.370	2401.1	2377.6	0.02	42.94	2.95	166.3	0.0	-	-
4	1250.4	1264.5	2.245	2.164	34.499	27.551	1.0	34.498	39.9	7.341	2392.8	2380.6	0.02	44.01	3.02	165.0	0.0	-	-
5	999.9	1010.5	2.470	2.406	34.440	27.485	1.0	34.439	29.3	7.314	2382.6	2381.6	0.03	44.62	3.07	157.8	0.0	-	-
6	799.3	807.4	2.782	2.730	34.370	27.402	1.0	34.368	17.9	7.306	2370.8	2380.1	0.04	45.09	3.10	148.9	0.0	-	-
7	700.3	707.2	2.895	2.849	34.336	27.364	1.1	34.336	17.0	7.294	2365.5	2375.8	0.04	45.20	3.12	144.9	0.0	-	-
8	599.2	605.0	3.071	3.032	34.278	27.302	1.1	34.278	15.5	7.287	2355.0	2369.4	0.02	45.24	3.13	137.2	0.0	-	-
9	499.5	504.2	3.174	3.141	34.218	27.245	1.1	34.216	17.5	7.277	2344.9	2360.0	0.03	45.33	3.11	130.4	0.0	-	-
10	399.0	402.7	3.313	3.286	34.122	27.156	1.1	34.121	23.0	7.284	2323.4	2352.7	0.03	45.25	3.11	120.5	0.0	-	-
11	299.6	302.3	3.210	3.191	34.004	27.071	1.2	34.003	39.7	7.297	2316.3	2335.5	0.05	44.28	3.06	110.1	0.0	-	-
12	248.9	251.1	3.027	3.012	33.886	26.994	1.2	33.895	59.0	7.328	2304.8	2320.0	0.05	42.62	2.99	101.2	0.0	-	-
13	200.1	201.9	2.853	2.841	33.753	26.902	1.2	33.768	88.5	7.456	2292.0	2295.3	0.05	40.37	2.85	90.32	0.0	0.07	-
14	149.3	150.6	2.046	2.038	33.450	26.726	1.2	33.444	187.2	7.546	2262.0	2225.4	0.06	34.07	2.49	67.72	0.0	0.09	-
15	124.8	125.9	1.436	1.431	33.281	26.635	1.3	33.265	252.5	7.632	2248.1	2182.4	0.19	29.83	2.26	55.87	0.0	0.10	-
16	99.3	100.2	0.938	0.934	33.119	26.537	1.5	33.108	312.5	7.654	2238.9	2140.6	0.27	25.65	2.03	45.12	0.5	0.16	-
17	79.5	80.2	0.906	0.903	33.078	26.506	1.8	33.079	324.9	7.678	2237.4	2132.9	0.28	24.60	1.99	43.96	0.6	0.20	-
18	60.0	60.5	1.075	1.073	33.051	26.474	2.8	-	-	-	-	-	-	-	-	-	-	0.39	-
19	50.8	51.2	1.214	1.212	33.042	26.458	3.0	33.042	338.9	7.688	2236.0	2121.6	0.29	23.49	1.94	40.25	0.9	0.44	-
20	39.9	40.3	1.333	1.331	33.035	26.444	3.1	33.034	342.9	7.701	2236.6	2116.2	0.28	22.39	1.91	37.58	1.1	0.36	-
21	30.3	30.5	1.884	1.882	33.002	26.380	4.3	32.966	349.5	7.793	2236.5	2078.9	0.22	17.13	1.57	26.94	1.0	1.00	-
22	19.5	19.7	3.182	3.181	32.925	26.213	7.3	32.924	348.7	7.843	2237.8	2059.6	0.18	14.22	1.32	21.28	0.7	1.44	-
23	9.3	9.3	3.601	3.601	32.904	26.158	8.3	32.905	347.7	7.865	2238.7	2053.5	0.17	13.00	1.22	18.84	0.5	1.15	-
24	4.4	4.4	3.633	3.632	32.903	26.154	8.5	32.904	347.7	7.865	2231.8	2050.7	0.19	12.91	1.21	18.71	0.5	1.39	-
	0																		1.89

Station: 15

	Start	Bottom	End	
Date/Time:	00/06/04, 11:56	00/06/04, 11:59	00/06/04, 12:08	(GMT)
Lat.:	45°59.92'N	45°59.91'N	45°59.93'N	
Long.:	154°00.13'E	154°00.13'E	154°00.12'E	
Depth (m):	8158	8171	8167	

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: 015S02.DAT

[illegible]

Station: 15

	Start	Bottom	End
Date/Time:	00/06/04, 12:45	00/06/04, 14:06	00/06/04, 15:37
Lat.:	45°59.94'N	45°59.99'N	45°59.94'N
Long.:	154°00.09'E	153°59.91'E	153°59.57'E
Depth (m):	8178	8207	8327

(GMT)

Remarks: Cast for only CTD d: Water samples for iron

CTD file #: 015S03.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m ³]
1	5000.3	5101.3	1.523	1.075	34.695	27.764
2	5000.6	5101.7	1.523	1.075	34.695	27.764
3	5000.6	5101.7	1.523	1.075	34.695	27.764
4	4499.0	4584.6	1.481	1.097	34.693	27.765
5	3999.7	4071.1	1.468	1.143	34.689	27.763
6	3500.1	3558.4	1.488	1.217	34.681	27.755
7	3000.0	3046.5	1.548	1.325	34.669	27.741
8	2500.2	2535.9	1.657	1.480	34.649	27.717
9	1999.8	2025.9	1.842	1.706	34.611	27.672
10	1500.0	1517.8	2.106	2.007	34.544	27.598
11	1249.9	1263.9	2.249	2.168	34.499	27.550
12	1000.3	1010.9	2.502	2.437	34.439	27.481

Station: 15

	Start	Bottom	End	
Date/Time:	00/06/04, 15:49	00/06/04, 17:22	00/06/04, 19:14	(GMT)
Lat.:	45°59.98'N	46°00.01'N	45°59.99'N	
Long.:	153°59.60'E	153°59.93'E	153°59.93'E	
Depth (m):	8332	8203	8208	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine and CREST Plankton
#14-24 bottles were fired without a brief stop

CTD file #: 015L03.DAT

[illegible]

Station: 14

	Start	Bottom	End	
Date/Time:	00/06/05, 01:06	00/06/05, 02:29	00/06/05, 04:04	(GMT)
Lat.:	44°59.94'N	44°59.93'N	44°59.97'N	
Long.:	154°29.90'E	154°29.87'E	154°30.10'E	
Depth (m):	5085	5083	5076	

Remarks:	Cast for only CTD d: Water samples for routine #17-24 bottles were fired without a brief stop. Surface water (0 m) was collected by a bucket
----------	---

CTD file #: 014L01.DAT

Bottle #	CTD data							Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	nitrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]
1	4999.9	5101.0	1.514	1.067	34.696	27.765	-	34.691	161.5	7.600	2410.9	2315.2	0.02	36.30	2.43	145.9	0.0	-
2	4499.5	4585.1	1.472	1.088	34.693	27.766	-	34.690	157.8	7.595	2414.7	2321.8	0.03	36.51	2.44	147.9	0.0	-
3	3998.8	4070.2	1.444	1.119	34.690	27.766	-	34.686	153.5	7.587	2409.5	2322.6	0.02	36.79	2.46	149.1	0.0	-
4	3498.8	3557.1	1.453	1.182	34.683	27.759	-	34.680	144.8	7.572	2414.1	2332.8	0.02	37.63	2.50	152.0	-	-
5	3000.2	3046.6	1.493	1.272	34.673	27.748	-	34.670	133.3	7.554	2416.4	2339.7	0.03	38.45	2.58	155.3	0.0	-
6	2500.6	2536.3	1.581	1.405	34.656	27.728	-	34.654	115.2	7.519	2415.8	2353.2	0.02	39.77	2.68	161.0	0.0	-
7	1999.7	2025.8	1.755	1.620	34.624	27.690	-	34.622	89.3	7.471	2412.0	2363.6	0.03	41.50	2.81	164.4	0.0	-
8	1498.9	1516.6	2.017	1.919	34.572	27.628	-	34.570	62.8	7.415	2406.7	2375.2	0.02	43.20	2.91	163.2	0.0	-
9	999.3	1010.0	2.423	2.359	34.463	27.507	-	34.461	26.3	7.331	2386.2	2390.2	0.02	45.71	3.08	160.7	0.0	-
10	798.7	806.8	2.715	2.663	34.391	27.424	-	34.389	18.7	7.308	2375.6	2387.0	0.03	46.29	3.10	151.5	0.0	-
11	699.6	706.5	2.862	2.816	34.350	27.378	-	34.347	17.1	7.300	2368.3	2380.3	0.02	45.91	3.13	146.0	0.0	-
12	599.8	605.6	3.002	2.963	34.308	27.332	-	34.305	16.0	7.292	2362.4	2377.2	0.03	46.05	3.13	140.4	0.0	-
13	500.5	505.2	3.139	3.106	34.260	27.282	-	34.257	14.7	7.282	2345.0	2367.6	0.01	46.13	3.12	130.7	0.0	-
14	399.1	402.7	3.308	3.282	34.184	27.205	-	34.181	15.0	7.269	2341.6	2357.1	0.02	46.73	3.12	121.8	0.0	-
15	299.4	302.1	3.460	3.440	34.085	27.111	-	34.081	15.7	7.249	2323.3	2355.3	0.02	47.05	3.15	111.4	0.0	-
16	199.9	201.6	3.539	3.525	33.948	26.995	-	33.946	23.1	7.232	-	2339.3	0.05	46.72	3.17	99.20	0.0	0.01
17	148.4	149.7	3.381	3.371	33.806	26.897	-	33.795	58.5	7.270	2290.3	2309.7	0.03	43.96	3.04	88.31	0.0	0.01
18	99.4	100.2	1.161	1.156	33.096	26.504	-	33.103	314.9	7.622	2238.7	2145.5	0.37	26.67	2.07	46.22	0.2	0.15
19	72.8	73.4	1.318	1.315	33.021	26.434	-	33.026	338.0	7.666	2232.0	2125.0	0.26	24.31	1.91	41.63	0.5	0.36
20	49.9	50.3	1.912	1.910	32.992	26.369	-	33.001	342.6	7.685	2231.6	2118.9	0.19	23.43	1.88	40.62	0.3	0.45
21	30.7	30.9	4.696	4.694	32.911	26.053	-	32.917	329.9	7.753	2229.8	2091.9	0.21	20.61	1.67	35.59	0.2	1.18
22	20.2	20.3	4.725	4.724	32.915	26.053	-	32.918	329.9	7.755	2229.2	2092.3	0.20	20.57	1.66	35.47	0.2	1.15
23	8.2	8.3	4.730	4.730	32.916	26.053	-	32.916	329.8	7.756	2228.9	2089.1	0.20	20.53	1.67	35.47	0.2	1.05
24	3.0	3.1	4.734	4.734	32.915	26.052	-	32.916	330.1	7.756	2229.1	2090.3	0.20	20.51	1.68	35.40	0.3	1.42
	0																	1.42

Station: KNOT3

	Start	Bottom	End
Date/Time:	00/06/05, 15:53	00/06/05, 15:57	00/06/05, 16:10
Lat.:	44°00.14'N	44°00.17'N	44°00.21'N
Long.:	154°59.38'E	154°59.42'E	154°59.58'E
Depth (m):	5286	5284	5284

(GMT)

Remarks:	Cast for only CTD d
	Water samples for P. Production

CTD file #: KN3S01.DAT

Bottle #	CTD data						Bottle data										
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma- θ	Salinity	Oxygen	pH (Tris)	TAlk	TDIC	Nitrite	itrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[psu]	[μmol/kg]	25°C	[μmol/kg]	[μmol/kg]	[μmol/L]	[μmol/L]	[μmol/L]	[μmol/L]	[μmol/kg]	[mg/m³]
1	51.4	51.8	1.640	1.638	33.010	26.403	-	-	-	-	-	-	-	-	-	-	-
2	45.3	45.6	1.852	1.850	33.006	26.385	-	-	-	-	-	-	-	-	-	-	-
3	40.5	40.9	1.909	1.907	32.994	26.372	-	-	-	-	-	-	-	-	-	-	-
4	35.5	35.8	2.735	2.733	32.988	26.301	-	-	-	-	-		0.27	22.22	1.85	40.33	-
5	30.5	30.8	5.798	5.796	32.964	25.968	-	-	-	-	-		0.23	18.01	1.56	35.59	-
6	25.2	25.4	5.956	5.954	32.974	25.957	-	-	-	-	-		0.25	17.28	1.51	35.00	-
7	20.5	20.7	6.015	6.013	32.980	25.955	-	-	-	-	-		0.23	17.30	1.51	35.07	-
8	15.7	15.8	6.021	6.019	32.981	25.955	-	-	-	-	-		0.21	17.22	1.50	35.13	-
9	10.0	10.1	6.024	6.023	32.982	25.955	-	-	-	-	-		0.21	17.28	1.52	35.20	-
10	5.5	5.5	6.022	6.022	32.982	25.955	-	-	-	-	-		0.22	17.24	1.51	35.20	-
11	4.1	4.2	6.017	6.017	32.981	25.955	-	-	-	-	-	-	-	-	-	-	-
12	4.2	4.2	6.019	6.018	32.981	25.955	-	-	-	-	-		0.22	17.20	1.51	35.13	-

Station: KN0T3

	Start	Bottom	End
Date/Time:	00/06/05, 16:30	00/06/05, 16:36	00/06/05, 16:55
Lat.:	43°59.99'N	44°00.01'N	44°00.03'N
Long.:	154°59.69'E	154°59.71'E	154°59.98'E
Depth (m):	5289	5287	6415 ?

(GMT)

Remarks: Cast for only CTD data

Water samples for CREST Plankton (#3-15) and W.Univ.Emerson (#16-24)

CTD file #: KN3L01.DAT

[illegible]

Station: KN0T3

	Start	Bottom	End	
Date/Time:	00/06/05, 22:59	00/06/05, 23:30	00/06/06, 00:02	(GMT)
Lat.:	43°59.72'N	43°59.69'N	43°59.81'N	
Long.:	155°00.14'E	155°00.17'E	155°00.15'E	
Depth (m):	5296	5301	5298	

Remarks:	Cast for only CTD d
----------	---------------------

Water samples for routine

Surface water (0 m) was collected by a bucket

CTD file #: KN3L02.DAT

Bottle #	CTD data							Bottle data											
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.	Salinity	Oxygen	pH (Tris)	Talk	TDIC	Nitrite	itrate+Nitrit	Phosphate	Silicate	Ammonia	Chl.-a	
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]	[psu]	[μmol/kg]	25 °C	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[μmol/kg]	[mg/m³]	
1	999.9	1010.5	2.593	2.528	34.432	27.468	1.0	34.430	33.6	7.348	2384.2		2376.8	0.02	44.03	3.07	154.2	0.0	-
2	799.7	807.9	2.962	2.909	34.377	27.391	1.0	34.376	35.4	7.352	2370.8		2367.3	0.03	43.48	3.05	140.9	0.0	-
3	698.6	705.5	3.071	3.025	34.317	27.333	1.0	34.323	33.0	7.338	2359.8		2364.3	0.04	43.51	3.04	135.8	0.0	-
4	599.4	605.1	3.128	3.088	34.259	27.282	1.0	34.258	27.1	7.313	2350.8		2364.6	0.03	44.00	3.07	133.3	0.0	-
5	498.9	503.6	3.191	3.158	34.175	27.209	1.1	34.172	25.9	7.291	2340.6		2360.4	0.02	44.27	3.09	126.5	0.0	-
6	399.1	402.7	3.312	3.285	34.084	27.125	1.1	34.085	25.9	7.272	2326.9		2351.9	0.03	44.83	3.13	117.0	0.0	-
7	299.6	302.3	3.322	3.303	33.969	27.033	1.1	33.967	36.0	7.265	2312.9		2331.5	0.04	44.48	3.11	107.1	0.0	-
8	249.9	252.1	3.260	3.245	33.856	26.948	1.1	33.857	55.0	7.279	2298.5		2313.9	0.04	43.13	3.04	97.07	0.0	-
9	224.8	226.8	3.188	3.174	33.802	26.912	1.1	33.798	81.7	7.319	2293.5		2297.3	0.04	40.69	2.87	90.71	0.0	-
10	200.0	201.7	3.175	3.163	33.738	26.862	1.0	33.731	118.3	7.385	2285.7		2274.8	0.04	37.04	2.65	81.75	0.0	-
11	175.4	176.9	3.071	3.061	33.679	26.824	1.0	33.676	135.9	7.411	2282.2		2256.9	0.04	35.46	2.57	76.34	0.0	-
12	150.2	151.4	2.666	2.658	33.536	26.746	0.9	33.533	171.7	7.450	2269.9		2231.4	0.04	33.33	2.45	68.79	0.0	-
13	125.4	126.4	2.698	2.691	33.457	26.680	0.9	33.460	213.8	7.526	2262.1		2201.4	0.05	29.49	2.20	58.02	0.0	0.02
14	99.3	100.1	1.921	1.916	33.185	26.524	1.2	33.223	308.5	7.654	2241.0		2140.4	0.19	23.72	1.83	41.92	0.0	0.01
15	89.7	90.5	2.220	2.216	33.168	26.487	1.6	33.167	326.3	7.681	2240.9		2126.2	0.41	22.42	1.77	38.80	0.3	0.03
16	80.8	81.4	2.709	2.704	33.200	26.474	2.2	33.200	327.1	7.701	2241.5		2120.2	0.38	21.23	1.69	36.51	0.5	0.12
17	72.2	72.8	3.096	3.092	33.225	26.459	2.6	33.217	327.3	7.708	2242.1		2118.6	0.36	20.68	1.66	35.43	0.5	0.24
18	62.6	63.1	3.428	3.424	33.246	26.446	3.6	33.242	328.6	7.725	2245.7		2114.7	0.30	19.70	1.61	34.16	0.6	0.50
19	51.3	51.8	2.698	2.695	33.123	26.412	4.2	33.119	339.4	7.713	2238.0		2111.1	0.27	20.63	1.69	36.64	0.6	0.71
20	39.9	40.2	3.092	3.089	33.112	26.370	5.1	33.114	342.9	7.727	2240.9		2108.4	0.22	19.85	1.65	35.62	0.7	0.96
21	30.1	30.3	3.550	3.549	33.058	26.285	6.2	33.043	338.0	7.737	2236.8		2103.5	0.24	19.42	1.65	35.63	0.6	1.15
22	21.4	21.6	5.569	5.567	32.945	25.981	9.8	32.956	324.4	7.783	2233.2		2086.0	0.23	17.57	1.52	34.74	0.5	1.94
23	10.3	10.4	5.846	5.845	32.949	25.951	11.4	32.953	324.0	7.788	2235.3		2083.1	0.22	17.46	1.52	34.61	0.5	1.96
24	5.1	5.2	5.896	5.896	32.952	25.947	7.9	32.954	324.2	7.788	2234.6		2084.8	0.22	17.38	1.50	34.55	0.4	1.71
	0							1.93											

Station: KNOT3

	Start	Bottom	End	
Date/Time:	00/06/06, 01:21	00/06/06, 01:27	00/06/06, 01:39	(GMT)
Lat.:	43°59.51'N	43°59.47'N	43°59.46'N	
Long.:	154°59.66'E	154°59.57'E	154°59.55'E	
Depth (m):	5298	5301	5303	

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: KN3S02.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	259.4	261.7	3.241	3.224	33.853	26.947
2	229.9	231.9	3.109	3.095	33.775	26.898
3	199.6	201.3	3.118	3.106	33.706	26.841
4	179.9	181.4	2.791	2.780	33.604	26.789
5	160.6	162.0	2.552	2.543	33.509	26.734
6	139.5	140.7	2.594	2.587	33.397	26.640
7	120.4	121.4	2.167	2.161	33.206	26.522
8	100.2	101.1	2.143	2.138	33.162	26.488
9	79.3	80.0	3.273	3.268	33.244	26.459
10	39.4	39.8	2.270	2.268	33.046	26.386
11	20.0	20.2	6.038	6.036	32.981	25.953
12	10.2	10.2	6.055	6.054	32.983	25.952

Station: KNOT3

	Start	Bottom	End
Date/Time:	00/06/06, 02:33	00/06/06, 03:04	00/06/06, 04:09
Lat.:	43°59.49'N	43°59.57'N	43°59.80'N
Long.:	154°59.65'E	154°59.50'E	154°59.26'E
Depth (m):	5302	5307	5290

(GMT)

Remarks:	Cast for only CTD d
	Water samples for Narita MAG

CTD file #: KN3L03.DAT

Bottle #	CTD data						
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ	Fluo.
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]	[mg/m³]
1	2000.3	2026.5	1.804	1.668	34.617	27.680	0.9
2	2000.2	2026.4	1.803	1.668	34.617	27.680	0.9
3	2000.3	2026.4	1.802	1.666	34.617	27.680	0.9
4	2000.1	2026.3	1.802	1.666	34.617	27.680	0.9
5	2000.5	2026.7	1.801	1.666	34.617	27.680	0.9
6	1999.9	2026.1	1.803	1.667	34.617	27.680	0.9
7	2000.6	2026.7	1.802	1.667	34.617	27.680	0.9
8	1999.8	2025.9	1.802	1.667	34.617	27.680	0.9
9	2000.6	2026.7	1.802	1.666	34.617	27.680	0.9
10	2000.1	2026.2	1.802	1.666	34.617	27.680	0.9
11	499.6	504.3	3.194	3.162	34.171	27.206	1.0
12	300.0	302.7	3.289	3.270	33.920	26.996	1.1
13	200.2	201.9	2.768	2.756	33.633	26.814	1.0
14	150.0	151.3	2.723	2.714	33.492	26.705	0.9
15	124.9	125.9	2.317	2.310	33.317	26.599	1.0
16	100.6	101.5	2.242	2.236	33.219	26.526	1.3
17	80.4	81.1	2.291	2.287	33.173	26.486	1.8
18	59.6	60.1	2.671	2.667	33.162	26.446	2.7
19	49.4	49.8	2.289	2.287	33.085	26.416	3.4
20	39.3	39.6	2.749	2.746	33.077	26.372	5.1
21	29.2	29.4	5.371	5.369	33.009	26.055	10.4
22	19.6	19.7	6.243	6.241	33.008	25.948	12.6
23	9.3	9.4	6.328	6.327	33.005	25.935	7.4
24	3.8	3.8	6.402	6.402	33.001	25.923	5.1

Station: KNOT3

	Start	Bottom	End	
Date/Time:	00/06/06, 04:25	00/06/06, 05:49	00/06/06, 07:18	(GMT)
Lat.:	43°59.87'N	44°00.14'N	44°00.62'N	
Long.:	154°59.12'E	154°58.87'E	154°57.67'E	
Depth (m):	5295	5295	5309	

Remarks:	Cast for only CTD data
	Water samples for iron

CTD file #: KN3S04.DAT

Bottle #	CTD data					
	Depth	Pressure	Temp.	Pot-Temp	Salinity	Sigma-θ
	[m]	[db]	[°C]	[°C]	[psu]	[kg/m³]
1	5001.0	5102.1	1.522	1.074	34.694	27.763
2	3998.9	4070.2	1.453	1.128	34.689	27.764
3	2999.0	3045.3	1.510	1.289	34.671	27.745
4	1998.5	2024.6	1.829	1.693	34.613	27.675
5	1001.2	1011.8	2.629	2.563	34.443	27.473
6	801.4	809.6	2.937	2.884	34.381	27.397
7	700.3	707.2	3.126	3.079	34.338	27.345
8	599.3	605.1	3.135	3.096	34.257	27.280
9	505.1	509.8	3.184	3.151	34.183	27.216
10	400.2	403.8	3.329	3.303	34.076	27.117
11	350.2	353.4	3.361	3.338	34.011	27.062
12	300.4	303.1	3.272	3.253	33.929	27.005