MR99-K02 Cruise Summary

The main obsective of MR99-K02 cruise (from 8 May to 1 June, 1999) by R/V "MIRAI" was the study of material cycle under the "spring bloom" condition in the northwestern North Pacific. We visited three stations with emphasis on the observation at stn.KNOT, which is the Japanese time series station for the biogeochemical study. We visited stn.KNOT twice at the begining and late of cruise in order to observe the change in marine chemistry and biology during the "spring bloom" and conducted the comprehensive observations as follows:

1. Underway observation of pCO_2, TCO_2, nutrients, DO, fluorescence.
2. Hydrocasting for Sal., DO, nutrients, pH, pCO_2, TCO_2, TALK, carbon isotopes, chl-a, halocarbon, POC, and radionuclide.
3. Sea floor sediment sampling by multiple corer.
4. Drifting sediment trap experiment.
5. Primary productivity measurement by *in-situ* and *quasi in-situ* method (on deck incuvation).
6. Plankton sampling.
7. Recover and re-deployment of moored sediment trap system.

When we visited stn.KNOT, the "spring bloom" had not taken place yet. Stn.KNOT was located at the "sub-arctic boundary" and was unusually covered with the "Kuroshio" related water judging from high temperature (> 7 deg.C) and salinity (> 33 psu). Collected materials by the moored sediment traps which recovered at stn.KNOT also showed that the spring bloom has not taken place yet. although we investigated the "spring bloom" around stn.KNOT, we could not find the "spring bloom" event. We conducted the comprehensive observation under the above condition at stn.KNOT.

However, on the way to stn.50N, approximately 40 nautical miles northeastward from stn.KNOT, we met the water mass where sea-water pCO_2 was about 200ppm and concentration of fluorescene was 4 times higher than that at stn.KNOT and color of sea water was brown. We quickly changed our schedule and conducted the comprehensive observation at this position named "stn.HP1". It is noteworthy that the properties of water was changable and it was hard to say that we could conduct all observations in the same water mass perfectly.

Unfortunately, we did not meet the "spring bloom" at the second visit to stn.KNOT either. After we conducted the basic observation at stn.KNOT, we made a big effort to find the "spring bloom" around stn.HP1. However we did not find the "spring bloom" event which we met before. Instead of the "spring bloom" area, we conducted the observation in the area, named stn.HP2, where sea water pCO_2 was relatively lower (approximately 250ppm) and fluorescene was higher than stn.KNOT.

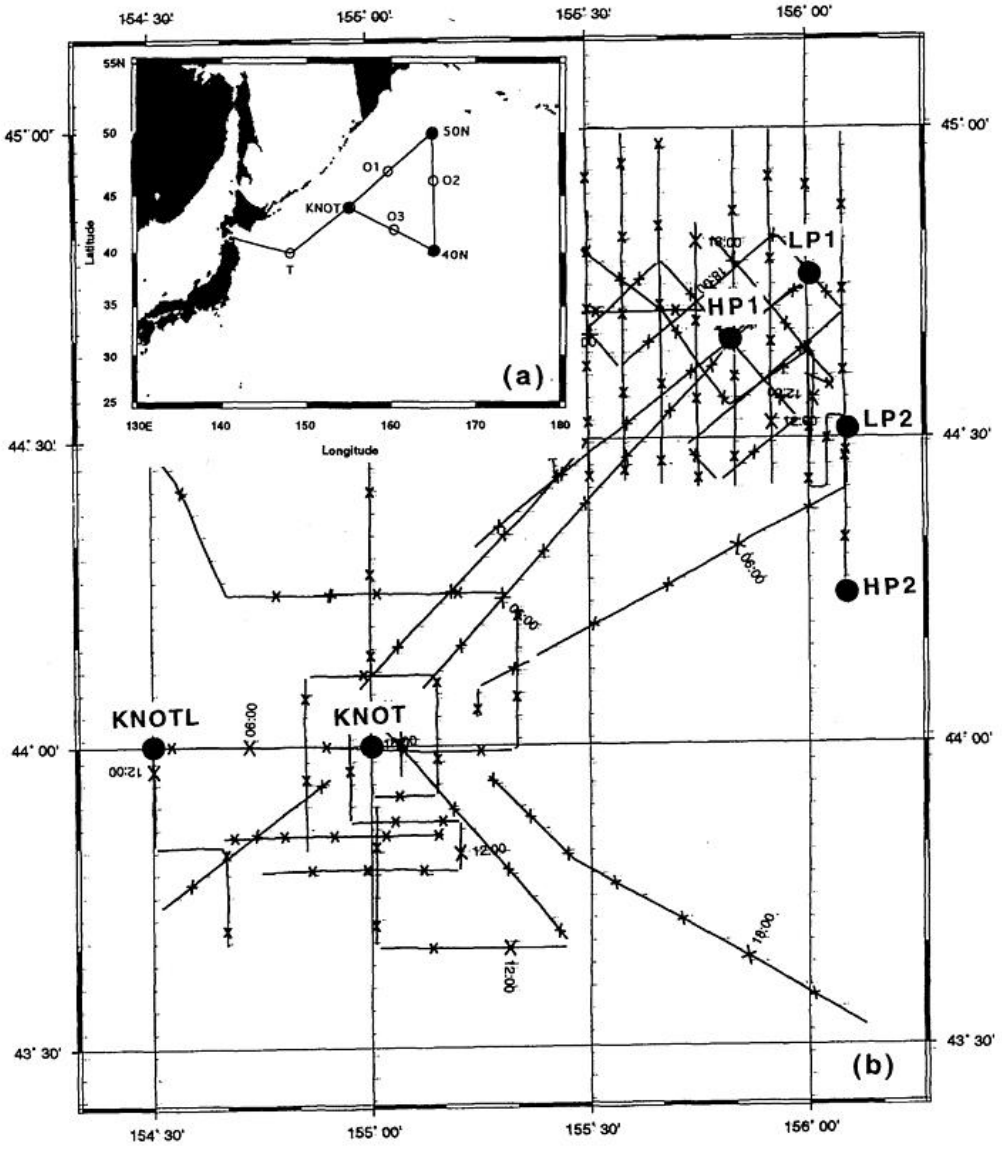
Most of results of the above observations should be waited until the analysis on land is completed. However the following interesting things has been reported on board:

1. Qualitatively speaking, settling particles collected by floating sediment trap were largely higher at stn.HP1 and HP2 than stn.KNOT and other stations.
2. Concentrations of halocarbon and DMS which suspected to be produced by phytoplankton was two times higher at stn.HP.
3. Nutrients were relatively consumed up.

Beside the above bloom study, we also carried out the observation at stn.50N and 40N. As same as

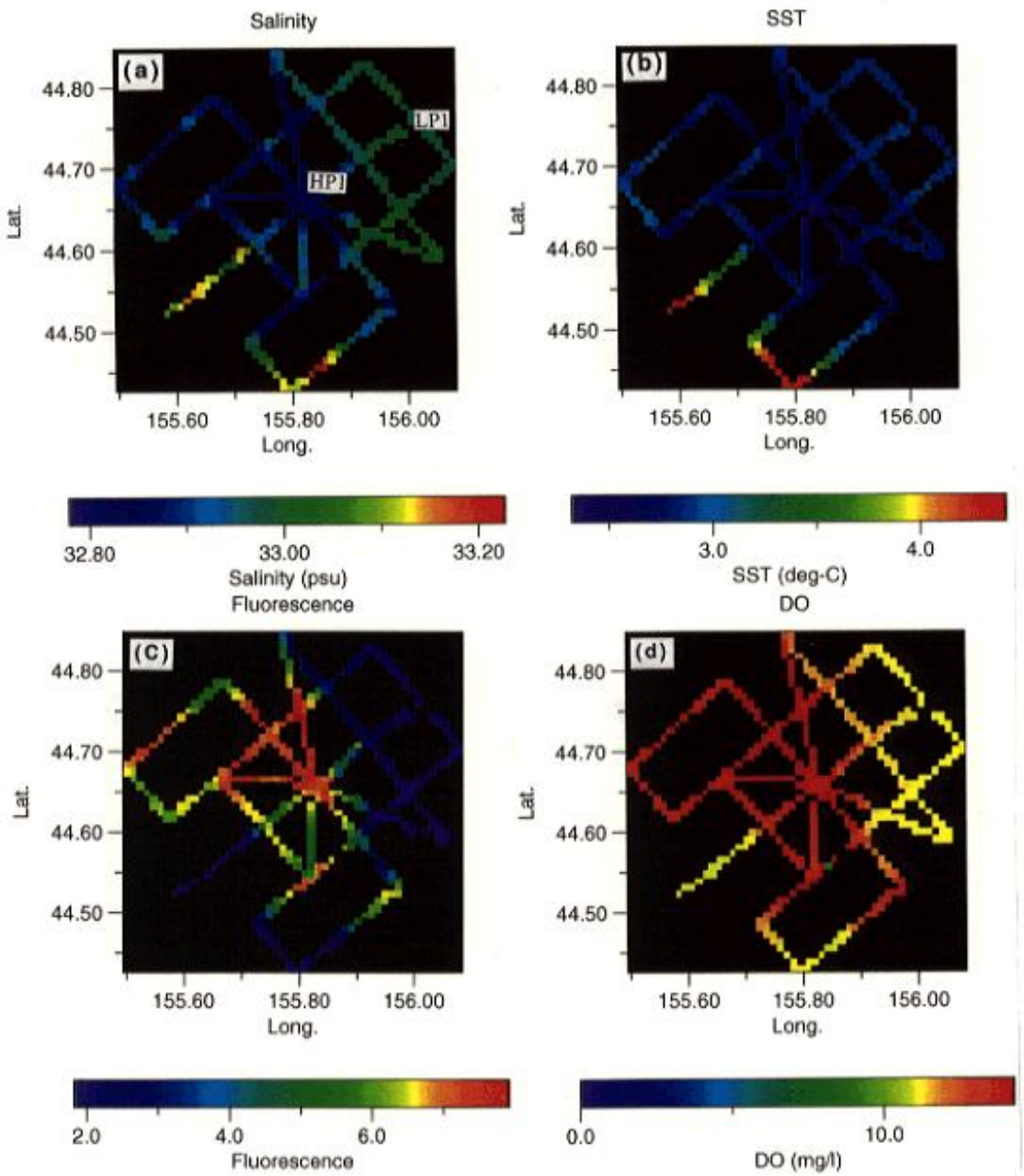
stn.KNOT, we did not observe any phenomena attributed to the ″spring bloom″. At both stations, moored sediment trap systems which deployed last July, 1998, were recovered successfully. High flux of settling particles could be seen in the middle of the last April, 1999, at stn.50N. However it was difficult to define this high flux as the ″spring bloom″ because sea water pCO_2 was still equal to or slightly higher than atmospheric pCO_2. It is likely that the real ″spring bloom″ which lower sea water pCO_2 is comming after our cruise.

Figures:



Cruise track during MR99-K02
(a) all cruise track
(b) cruise track around station KNOT. HP and LP indicate stations under spring bloom condition (high productivity ?) and nomal condition (low productivity ?), respectively

Cruise track during MR99-K02



Horizontal distributions for (a) salinity, (b) sea surface temperature, (c) fluorescence, and (d) dissolved oxygen along cruise track around HP1 (center position with low salinity, SST and with high fluorescence, DO) and LP1.

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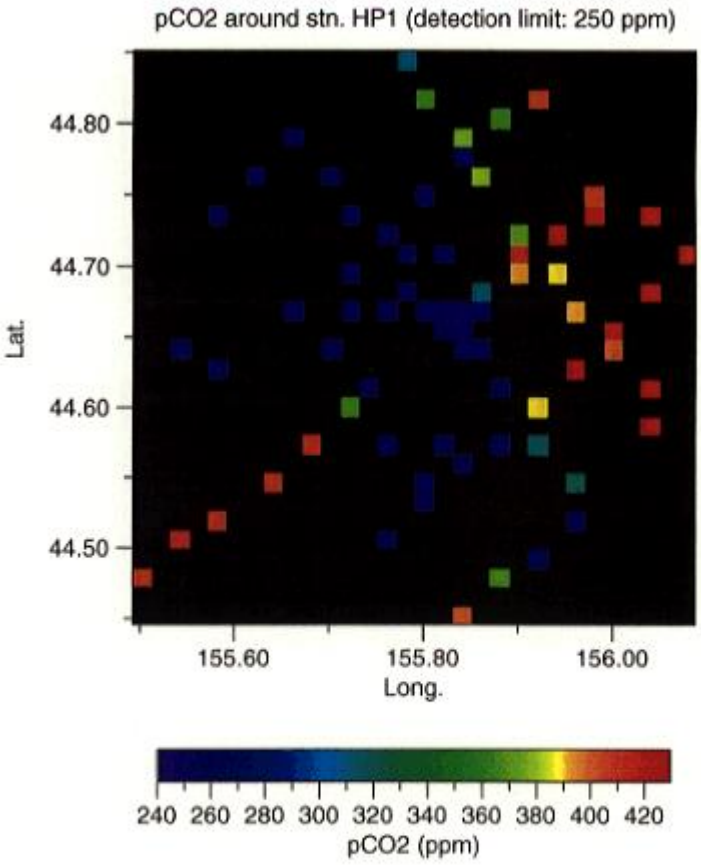
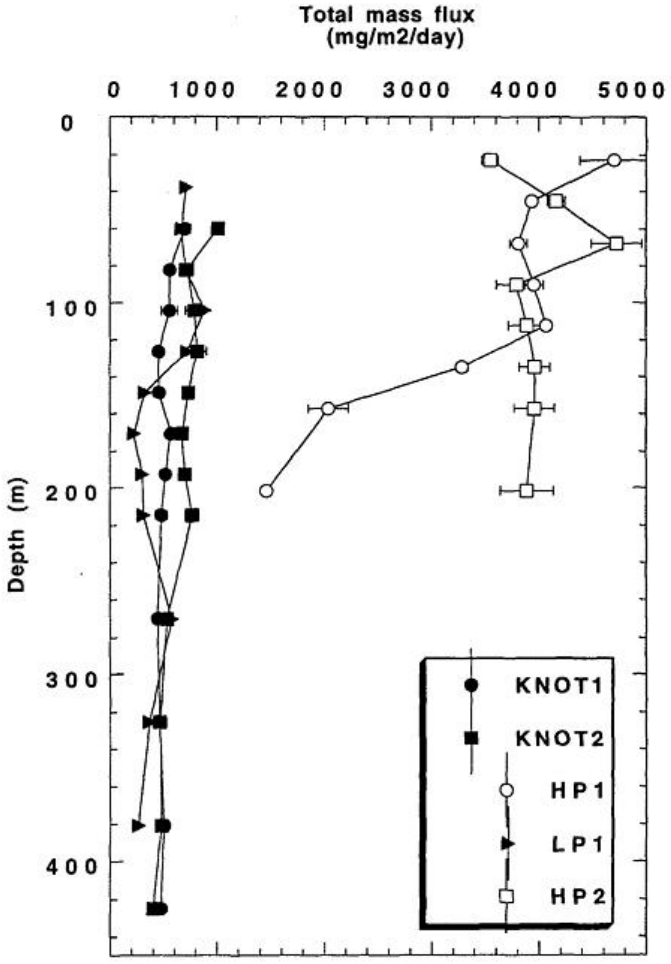


Horizontal distribution for pCO_2. Detection limit was 250 ppm and the real values were largely smaller than 250 ppm (*ca.* 180 ppm was observed by another pCO_2 sensor)

Horizontal distribution for pCO_2. Detection limit was 250ppm and the real were largely smaller than 250ppm and the real values were largely smaller than 250 ppm(ca, 180 rpm was observed by drifting sediment trap experiment.



Total mass fluxes of settling particles observed by drifting sediment trap experiment

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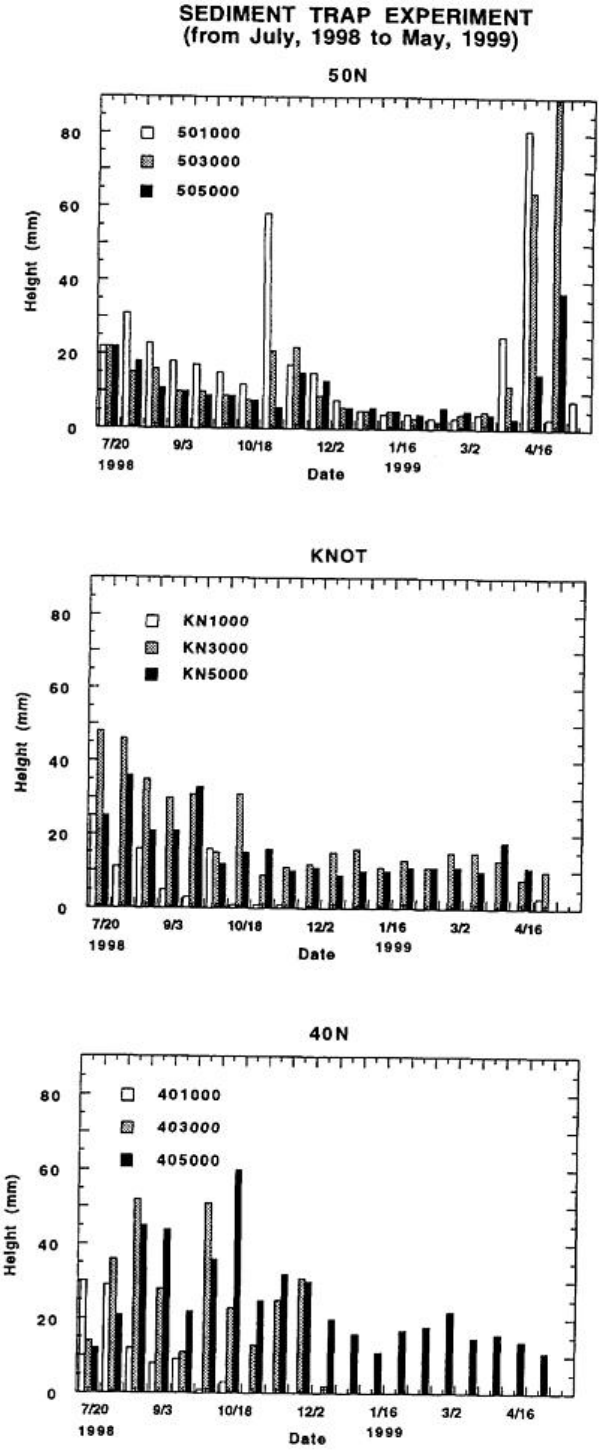
Station	Position	Date	Sal (psu)	Temp (deg-C)	DO (mg/l)	Fluorescence	pCO2 (ppm)
TEST	40-00N, 147-50E	9, May, 1999	33.12	5.4	12.9	2.3	250-260
KNOT1	44-00N, 155-00E	10-12	33.62	7.7	10.5	1.5	370
KNOTL	44-00N, 154-30E	12	32.97	4.5	11.4	1.8	390
HP1	44-39N, 155-49E	14-15	32.83	2.7	14.3	7.4	180-220
LP1	44-46N, 156-01E	14-15	32.98	3.0	11.3	1.9	390-400
O1	46-55N, 159-44E	16	33.01	2.1	11.4	1.5	410-420
50N	50-00N, 165-00E	17-18	33.08	2.6	11.2	1.3	430-440
O2	45-51N, 165-01E	19	33.09	4.2	11.0	1.6	370-380
40N	40-00N, 165-00E	20-21	34.32	13	9.3	1.1	330
O3	41-53N, 160-07E	22	33.41	7.1	10.4	1.7	360
KNOT2	44-00N, 155-00E	23-25	33.16	5.7	10.8	1.8	380
HP2	44-16N, 156-09E	27-28	32.87	2.9	12.1	2.4	240-260
LP2	44-31N, 156-12E	27	32.96	3.5	11.3	2.4	380

Stations summary



Seasonal variability in fluxes of settling particles at stn. 50N, KNOT, and 40N during July, 1998 and May, 1999. Fluxes are estimated by heights of samples in collecting

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