The marine observational study on the seasonal and annual variability of the biogeochemical parameters at station (51°N,165°E)、(40°N,165°E) and (40°N,155°E) in the Western North Pacific

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How does global changes, represented by changes in natural climatic modalities and anthropogenic forcing, impact marine biogeochemical cycles? Increased release of CO_2 and other gases have direct impacts on the ocean's physics, chemistry and biology. The ocean absorbs around one-third of the anthropogenic CO_2 emissions. (Houghton et al., 2001) The oceans have taken up anthropogenic CO_2 of 2.0GtonC/yr in the 1990s. (MaNeil et al., 2003) High latitudinal oceans are especially important as a sink for the anthropogenic CO_2. And high latitudinal ocean are important for biogeochemical cycling (the 'biogeochemical pump') and are likely to be particularly sensitive to global change. The northwest Pacific has been considered an important region for biogeochemical and climate change studies. (Honjyo, 1997) It is said that the anthropogenic increase of CO_2 has led to enhanced accumulation of carbon in the upper and intermediate ocean. The increase of CO_2 in the atmosphere leads to an increase in total dissolved inorganic carbon concentration (Brewer, 1987; Winn et al., 1998) and to decrease in pH in seawater.

The long-term sustained marine observations will be very important to monitor the seasonal, annual and decadal variability, to monitor the regional uptake of excess CO_2 in the seawater (Brewer, 1978, Chen and Millero, 1979) and to forecast the precise future change by the modeling approach.

Using the hydrographic data collected in the R/V *'MIRAI'(JAMSTEC)* cruises (MR97-K02,MR98-K01,MR99-K02,MR00K-01,MR00-K03,MR01-K03,MR03-K01,MR04-04), I analyzed the physical and biogeochemical properties and changes at station (51°N,165°E)、(40°N,165°E) and (40°N,155°E) in the Western North Pacific.

1. **The vertical distributions of θ, salinity, DO, nutrients(P,N,Si), DIC, TA, pH, CFCs and chlorophyll-a have shown the two types of vertical profile pattern by the difference of the latitude. (51N-pattern and 41N-pattern)**
   The CFC-12 concentration was much higher than CFC-11 concentration in the atmosphere. But on the contrary in the sea water, the CFC-11 concentration was much higher than CFC-12 concentration. The reason is assumed that the CFC-11 dissolves easily into the sea water than the CFC-12.
2. **Potential temperature-salinity and potential temperature-silicate plots for station (51°N,165°E)、(40°N,165°E) and (40°N,155°E)** was drawn. I examined the changes among each observation year's curve. But I couldn't find the **difference between them.**
3. **As for nutrients, drawing phosphate-nitrate and phosphate/nitrate-depth plots, I** examined if the **phosphate-nitrate ratios corresponded to the Redfield ratios. Phosphate versus nitrate at 3 stations showed the linear relationships. Slopes in the linear relationships between phosphates and nitrates ranged from 13.1 to 15.3 in the all layers (>100-150db). As a result, P: N ratios did not deviate from the Redfield ratios. P: N ratios at 3 stations were considerably close to the Redfield ratios.**
4. **The increase in NDIC and the decrease in pH were found in the intermediate layer (26.4,27.0,26.8 σ_θ) at the station (51°N,165°E)、(40°N,165°E) and (40°N,155°E) respectively.**
5. **On the basis of Brewer, Chen and Millero' equation, I calculated the rate of increase of DIC due to the gas exchange of the stmospheric increase. In this calculation I have got the increase rate of DIC(air-sea) at 2.64 μmol/kg/yr at sation (40°N,165°E) on intermediate isopycnal layers(σ_θ 26.5,27.0,27.1,27.2,27.4).**