B-5 Study on the Carbon Cycle in the Ocean

Contact Person Yukihiro Nojiri
Senior Researcher
Global Warming Mechanism Research Team
Global Environmental Division
National Institute for Environmental Studies
Environment Agency
16-2 Onogawa, Tsukuba, Ibaraki 305, Japan
Phone +81-298-51-6111 (Ext. 353), Fax +81-298-51-4732

Total Budget for FY 1990-1992 113,511,000 Yen

Key Words ocean, biogeochemical carbon cycle, organic carbon, phytoplankton, sediment

(1) A large scale axenic culture tank was used in order to understand the causative relationship between the growth of phytoplankton and the variation of CO_2 concentration in atmosphere.

Variations of organic carbon and inorganic carbon in sea water and absorption of atmospheric CO_2 into sea water had been measured in the tank in detail.

About 17% of assimilated inorganic carbon was excreted from the cells as dissolved organic carbon (DOC), which is very important for the production of DOC in the surface layer of the ocean. It was found that the growth of *C. antiqua* was limited by available [$H_2CO_3^*$] instead of [HCO_3^-].

(2) Sediment trap experiment to measure the net carbon flux in the ocean was planned. The degradation of the settling particle in the deep sea, lateral transport of particulate having terrestrial origin were studied from the chemical analysis.

Samples collected by sediment traps moored in Japan Trench were analyzed. Adsorption of clay particle of terrestrial origin to larger biogenic particle and also scavenging of dissolved Mn and Cu with settling particle were observed.

An *in situ* dissolution experiment of calcareous tests was done. The dissolution of calcitic tests increased with depth, which is consistent with the thermodynamic stability.

From ^{14}C measurement of sediment, suspended particle and settling particle, the transportation model of organic matter from continental shelf to the pelagic ocean, which consists of degradation of organic matter and scavenging of suspended particulate, was described.

(3) It is important to analyze the mean concentration and characteristics of amino acids in interstitial waters in order to evaluate the importance of organic matter in interstitial water reservoir of the marine sediments.

We analyzed interstitial water from the Antarctic Ocean, equatorial upwelling area in the Pacific, the Indian Ocean, and hemipelagic regions.

The results suggest that the DCAA (dissolved combined amino acids) is strongly affected by sedimentary particles (e.g. siliceous plankton, carbonaceous plankton), that higher ratio of neutral to acidic amino acid fractions in the DFAA (dissolved free amino acids) than in the DCAA was attributed mainly to the reaction or adsorption with carbonates, and that biological and/or chemical reaction rates between the DCAA and the DFAA were much higher than the digestion and/or transformation rates of the THAAS (total hydrolyzable amino acids in the sediments).

The mean values of the total DFAA and total DCAA in the interstitial water from four areas of the Pacific, Indian and Atlantic Oceans are 4.95μM and 6.16μM, respectively.