Changes of primary production in the Northwestern North Pacific off Sanriku, over the last 27 kyr

Kayo Minoshima[1]; hodaka kawahata[1]; Tomohisa Irino[2]; Ken Ikehara[3]; Masao Uchida[4]; Yasuyuki Shibata[5]

[1] AIST; [2] EES, Hokkaido Univ.; [3] MRE, AIST; [4] JAMSTEC; [5] Environ. Chem. Div., Natl Inst Environ Studies

The sea off Sanriku, the Northwestern Pacific, is characterized by a complex physical structure caused by the mixing of Oyashio, Kuroshio and Tsugaru waters, which is associated with many eddies. Primary production in this region is known as one of the most active areas around the Japanese islands. The biological pump in this region works as the efficient uptake of atmospheric CO2 and plays an important role in the global carbon cycle and global climate change. Here, we analyzed total organic carbon (TOC), C37 alkenone, biogenic opal and nitrogen stable isotope (d15N) in piston core PC-6 in order to understand changes in primary production over the last 27,000 years. The core was recovered from 2,215 m water depth on the continental margin off Sanriku (40N, 143E) during R/V Kairei KR02-15 cruise, 2002.

TOC/TN atomic ratios showed constant values (av. 8.18) throughout the core. It indicates that the organic matter is mainly of marine origin. TOC and C37 alkenone contents were relatively low (av. 1.04 % and av. 1.56 ug/g, respectively) during the glacials (27-18 ka) but gradually increased after 15 ka. After 6 ka, TOC contents still increased whereas C37 alkenone contents decreased slightly. Biogenic opal contents were low (av. 0.75 wt. %) from the glacials to deglaciation and increased in the Holocene. Especially the rapid increase was observed after (up to 31.2 wt.%). These observations indicate that primary production was much higher in the Holocene than during the glacials. Changes in C37 alkenone/TOC and biogenic opal/TOC ratios suggest that the export production is mainly controlled by diatom after 6 ka. Primary production is higher in the Holocene than during the glacials and that contributor to TOC may exchange Haptophyte for Diatom at a boundary of about 6 ka. Ice rafted debris (IRD) found between 27ka and 12ka indicates that this region had been influenced by sea ice, which might affect the timing of the phytoplankton bloom. In other words, the bloom might be shifted from June at the modern condition to mid-summer during the glacials, which resulted in the reduction of the duration time of bloom and the decrease in the primary production. d15N value (av. 6.61 per mil) at the surface sediment was comparable to that (~4.5-6 per mil) of the modern settling particles in the similar region (Nakatsuka et al., 1997). Therefore core PC6 should record the change in nutrient condition in the surface mixed layer. d15N values were high between 27 ka and 10 ka with a maximum around 15 ka, and decreased sharply from 10 ka to the present with a minimum around 1.4 ka. In spite of the low primary production, high d15N values during the glacials indicate that the efficiency of paleo-productivity is higher during the glacials than in the Holocene.