Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MIS21-11 Room:301A Time:May 28 09:00-09:15

Glacial-interglacial variations in nutrient cycle and biological productivity in the Southern Ocean

IKEHARA, Minoru[1*] ; KUHN, Gerhard[2] ; ESPER, Oliver[2]

[1]Center for Advanced Marine Core Research, Kochi University, [2]Alfred-Wegener-Institut Helmholtz-Zentrum fur Polar-und Meeresforschung

The Southern Ocean has played a significant role in the global climate system during the geologic past, even in the present-day. The Southern Ocean also became an important investigated region of paleoceanographic focus because of its unique role in global deep-water circulation and its potential significance for the global carbon. For example, it has been proposed that primary production was higher and nutrient utilization in surface waters was more efficient in the glacial Subantarctic Southern Ocean than today, effectively lowering the glacial atmospheric CO2 concentration. However, it was reported that biological production was much lowered during the glacials in the Antarctic zone, which is south of the Antarctic polar front.

We evaluated nutrient supply and biological production in the Antarctic zone of the Southern Ocean using a piston core PS2603-3 from the Enderby Abyssal Plain. Biogenic opal concentrations were significantly increased for the last two peak interglacials Holocene and Marine Isotope Stage (MIS) 5e. δ15N of bulk sediments were lowered during the interglacials (Holocene and MIS 5), whereas they were increased during the glacials (LGM and MIS 6). Lower primary production and nutrient utilization for the full glacials was mainly caused by weak upwelling of Circumpolar Deep Water (CDW) in the polar region due to surface water stratification by sea-ice coverage and its melting water input. Low values of δ15N at MIS 5e suggest that the nutrient utilization was much higher than Holocene due to warmer surface condition in the Indian sector of the Southern Ocean. These results indicate that the surface water stratification was significantly broken at the last interglacial owing to an extreme retreat of sea ice distribution and southward shift of polar front with warmer Southern Ocean.

Keywords: Southern Ocean, productivity, nutrient, stratification