The effect of southward shift of the Antarctic Circumpolar Current frontal system during Termination II

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The Southern Ocean plays a very important role in the global climate system on the present and geologic past. The Southern Ocean has also become a region of paleoceanographic focus because of its key 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 utilization of preformed nutrients in surface waters was more efficient in the glacial Southern Ocean than today, effectively lowering the glacial atmospheric CO2 concentration. To resolve the causes and processes of atmospheric CO2 change, it is important to understand mechanisms and processes of sub-systems in the Antarctic Cryosphere such as a change of biological productivity, sea surface temperature, surface water frontal system, sea-ice distribution, and East Antarctic ice sheet during the glacial-interglacial climate cycle.

We used a sediment cores collected at the Southeast Indian Ridge (SIR1PC, 54.7 deg. S, 140.0 deg. E, 3358m) to reconstruct the past variations of several paleoceanographic phenomena. We analyzed for these sediments by oxygen and carbon isotopes, ice-rafted debris (IRD) counts, elemental analyses, and organic geochemical proxies.

At the modern APF core SIR-1PC, carbonate % was increased in the interglacials and decreased in the glacials. Variation pattern of carbonate % shows a change of typical saw-tooth pattern, and extremely corresponds to the air temperature change in the Vostok ice core (e.g., Petit et al., 1999). These results indicate that the surface water frontal system and deep water chemistry in the Southern Ocean have closely interacted with climate changes on the Antarctica. Therefore, a saw-tooth variation of carbonate contents at SIR-1PC may be caused by the north-south oscillations of the APF and sea-ice coverage during the glacial to interglacial climate changes.