Onset and evolution of millennial-scale abrupt climatic changes deduced from the Japan Sea sediments and its possible cause

Ryuji Tada[1]

[1] DEPS, Univ. Tokyo

Millennial-scale large and abrupt climatic changes best known as Dansgaard-Oeschger cycles [DOC] is at least a hemispheric phenomenon but of global significance. The origin and propagation mechanism of such millennial-scale abrupt climatic changes has been explored for more than a decade, but still they are not clarified. The knowledge on the onset timing and the evolution process of the millennial-scale abrupt climatic changes should provide critical constraint to explore its origin and propagation mechanism. However, knowledge on its evolution and propagation mechanism is limited because IRD records from North Atlantic cores are only information source but the records are not continuous.

Recently, close linkage between the DOC in Greenland-North Atlantic and Asian summer monsoon was demonstrated. I further demonstrated that variation in the intensity of East Asian summer monsoon has been faithfully recorded as alternations of the dark and light layers in the hemipelagic sediments of the Japan Sea. Consequently, it is possible to trace back the record of millennial-scale abrupt climatic changes using the Japan Sea sediments. I examined core photographs of ODP cores obtained during Leg 127 in the Japan Sea to explore the onset timing and evolution process of the deposition of alternations of the dark and light layers in the Japan Sea. The result suggests onset is approximately 1.9 Ma. However, occurrence of alternations of the dark and light layers are sporadic between 1.9 and 1.5 Ma, occurrence of alternations became continuous from approximately 1.5 Ma, and contrast between the dark and light layers became distinct between 1.5 and 1.3 Ma. These timing are not related to the timing of the increase in maximum volume of ice sheets during the glacial maxima and that of emergence of 100 ky cycles.

Increasing evidence suggests that the DOC and Asian monsoon connection seems very tight and seems to be linked through westerly jet behavior, and recent study by Nagashima et al. (2005 in prep.) suggests N-S oscillation in westerly jet axis in association with the DOC in East Asia. Since presence of Himalaya and Tibet creates bimodality of westerly jet circulation pattern and uplift of Himalaya and northern Tibet is relatively young (during the last a few Ma), it is possible that uplift of Himalaya and northern Tibet triggered the onset of millennial-scale abrupt climatic changes.