Variation in Asian monsoon intensity during the last 150ka deduced from grain-size analysis of the Japan Sea sediments

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Existing paleo-climatic evidence suggests that the early part of the last interglacial (Eemian) was warmer than present. Paleoenvironmental reconstruction during Eemian is important with this respect because it could be an analog for the future environment resulted from the global warming. Climate in Japan is strongly influenced by Asian monsoon, so it is important to reconstruct its variability during Eemian. The Japan Sea sediments contain significant amount of eolian dust derived from inland Asia. Flux of Kosa transported to the sea is considered to be controlled by aridity of source area, whereas its grain size is controlled by velocity of westerly jet and/or winter monsoon (Matsui, 1999 MS., Irino et al., 2001 submitted). Naruse et al.(1997) estimated that there were several independent transport paths of Kosa from central Asia to Japan during the last glacial period depending on the latitude, and that Kosa blown to the northern and southern parts of Japan Sea was transported by winter monsoon and westerly jet, respectively. If this interpretation is true, Kosa grain size change may reflect not only wind intensity but also its transport path. To clarify the latitudinal dependence of transport paths and their temporal variations, the author examined grain size distribution of hemipelagic sediments obtained from the northern and southern parts of the Japan Sea and reconstructed temporal and spatial variation in modal grain size of Kosa, in order to examine the stability of east Asian atmospheric circulation during Eemian.

After extracted the detrital fraction, we measured its grain size distribution using a laser diffraction-scattering grain size analyzer. Obtained grain size distributions were resolved into two (silt size and clay size) log-normal distributions by Igor TM computer program. Silt distribution is well sorted with median diameter between 5-8.5 um, whereas clay distribution is poorly sorted with median diameter of approximately 3.5um. Based on chemical composition of clay and silt distributions, the silt distribution is attributed to Kosa and clay distribution is attributed to arc-derived detritus. After this treatment, we reconstructed grain-size distribution of Kosa during the last 140ka at two sites of Japan Sea.

The reconstructed variations in median diameter, standard deviation, and contents of Kosa show similar patterns of glacial-interglacil cycles at both sites. During glacial period, median diameter of Kosa is coarse (around 7-8.5 um), standard deviation is large (around 0.17-0.20), and content is high (around 70-80% at PC-5, around 65-75% at MD01-2407). During interglacial period, median diameter of Kosa is fine (around 5.5-6.5 um), standard deviation is small (around 0.13-0.15), and content is low (around 40-60% at PC-5, around 50-65% at MD01-2407). These parameters show millennial-scale variations during stage2-5.3 at both sites that are in association with Dansgaard-Oeshger (D-O) Cycles, which is recorded in Greenland ice core. But Kosa parameters-especially median diameter and content-during Holocene and a part of last interglacial period show smaller values at PC-5 core than at MD01-2407. As for Eemian, Kosa parameters for PC-5 core show abrupt and large changes during early part of Eemian (120-130ka), but Kosa parameters for MD01-2407 core do not show such changes.

The reconstructed millennial-scale variations in Kosa-parameters during stage 2-5.3 at both sites im the possibility that Kosa is transported by the same transport path to the ply close link between climate of East Asia and high latitude north Antarctic including Greenland, and the close similarity of Kosa-parameters between two sites during that time also imply northern and southern parts of the Japan Sea during glacial period. On the other hand, the difference between Kosa-parameter during interglacial period may imply the different transport paths to the northern and southern sites during interglacial periods.