

# Orbital and Millennial-scale variations in East Asian monsoon

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The region under the influence of Asian monsoon system covers a large area from the low latitude tropics to the high latitude Eurasian continent, and Asian monsoon is believed to exert significant influence on the global climate (An, 2000). Moreover, millennial-scale variations in Asian monsoon and its possible association with Dansgaard-Oeschger (D-O) Cycles have been demonstrated by previous studies (Porter and An, 1995; Tada et al., 1995, 1999; Irino and Tada, 2000; Wang et al., 2001). These studies demonstrate that Asian monsoon system plays a significant role on the millennial-scale abrupt climate changes. Thus, it is critical to reconstruct spatial patterns of the millennial-scale variation in the Asian monsoon in order to understand the role of atmospheric circulation on propagation of D-O Cycles.

In the Japan Sea, continuous eolian dust accumulation during the last 200 kyr is revealed by Q-mode factor analysis and multiple-regression analysis of chemical and mineral compositions of the Japan Sea sediment (Irino and Tada, 2000, 2002). Since grain size of eolian dust is considered to record the information about the intensity of dust transport wind and distance from the source area whereas the flux of eolian dust is considered to record the extent of dust source area, sedimentary record of the Japan Sea provides the opportunity to explore temporal and spatial variations of Asian monsoon.

In this study, we first examine the provenance of detrital quartz in the sediment cores recovered from northern (KT94-15-PC-5; 150 km west of Akita) and southern (MD01-2407; 200 km north of Tottori) sites in the Japan Sea based on crystallinity and ESR (Electron Spin Resonance) measurements of quartz. From the results, the method to extract the information on eolian dust from the sediment is developed, and Taklimakan Desert to Loess Plateau area and Siberia to Northeast China area are identified as the provenance of eolian dust in the Japan Sea sediment. Then, temporal changes in the grain size and flux of eolian dust in the Japan Sea sediment and their latitudinal changes are obtained from the northern and southern sites in the Japan Sea.

The temporal and spatial variations in provenance, grain size, and flux of eolian dust in the Japan Sea indicate orbital to millennial-scale variations. Namely, the grain size and flux of eolian dust is large with larger value at northern site than southern site, and Siberia to Northeast China area is the dominant source of eolian dust during the periods of small insolation in June at 30N and stadials of D-O Cycles. Whereas the grain size and flux of eolian dust is small with smaller value at northern site than southern site, and Taklimakan Desert to Loess Plateau area is the dominant source of eolian dust during the periods of large insolation in June at 30N and interstadials of D-O Cycles. These orbital to millennial-scale variations reflect the changes of aridity and wind intensity around Taklimakan Desert to Loess Plateau area and Siberia to Northeast China area, and those changes may indicate orbital to millennial-scale migrations of westerly jet and Asian summer monsoon limit and/or variations in Asian winter monsoon intensity.