

Provenance of detrital quartz in the Japan Sea sediments deduced from quartz crystallinity and ESR signal intensity

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Hemipelagic sediments of the Japan Sea contain significant amount of eolian dust derived from dry areas in inland Asia (Irinio and Tada, 2000, 2002). Since eolian dust in the Japan Sea sediments was transported from arid areas located windward direction from the Japan Sea, it is useful to explore the provenance of eolian dust to discuss the past wind system and aridity of land. Detrital materials in the Japan Sea are considered to be composed of eolian dust and suspended materials from the Japan Arc (Irinio and Tada, 2000, 2002). Then we try to distinguish the eolian dust component from detrital materials derived from the Japan Arc, and identify the provenance of the eolian dust.

In this study, we focus on ESR (Electron Spin Resonance) signal intensity and crystallinity of quartz, since quartz is a major component of eolian dust and is resistant to alteration during weathering, transport, and diagenesis. ESR is an analytical technique to estimate the amount of oxygen vacancy in quartz formed by natural radiation, whose amount shows positive correlation with the age of the host rock (Toyoda, 1992). Therefore the ESR signal intensity of quartz gives us information on the age of host rock (e.g., Naruse et al., 1997). On the other hand, the crystallinity of quartz has information on the physical condition of its formation (Murata and Norman, 1976). Therefore, these two parameters give us information on two different aspects of its host rock, one is the age and the other is the rock type, which help us identify the provenance of quartz.

In order to examine the provenance of detrital materials in the Japan Sea sediments and identify the eolian dust and its provenance, two hemipelagic sediment cores retrieved from the northern (KT94-15-PC5; 150 km west of Akita) and southern sites (MD01-2407; 200 km north of Tottori) in the Japan Sea were analyzed for ESR signal intensity and crystallinity of quartz. Moreover as a possible provenance of detrital materials in the Japan Sea, samples from Loess Plateau (Lingtai section) and sediment core retrieved from small terrace in the upper continental slope (KT94-15-PC9) were analyzed for ESR signal intensity and crystallinity of quartz. The PC-9 core is characterized by high sedimentation rate and considered to be predominance of detrital materials derived from the Japan Arc.

From the results of ESR signal intensity and crystallinity of quartz, the Japan Arc, Taklimakan Desert to Loess Plateau area, and Siberia to Northeast China area were identified as source of detrital quartz in the Japan Sea sediments. It is also demonstrated that the relative contribution of quartz from the two source areas of eolian quartz, which are Taklimakan Desert to Loess Plateau area and Siberia to Northeast China area, showed orbital to millennial-scale variations.