学 位 論 文 内 容 の 要 旨

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学 位 論 文 題 名

Reconstruction of temporal variation of Asian dust provenances in silt and clay fractions in Japan Sea sediments since 10 Ma based on a quantification of each source contribution using a statistical end-member decomposition of powder X-ray diffraction profiles
（日本海堆積物の粒度別粉末X線回折プロファイルの統計的端成分分解に基づくアジア起源風成塵供給源別定量とその時代変化の復元）

Japan sea sediments consist of various detrital materials of eolian and riverine origin. Understanding the provenance of eolian dust is vital for reconstructing the variability of wind patterns and monsoons in the past. A complete aeolian accumulation rates in silt and clay fractions from the Late Miocene to Pleistocene were reconstructed at the Integrated Ocean Drilling Program (IODP) Site U1425 in the Japan Sea. A total of 180 samples were collected from the Hole 1425D, which had 370 m in length and covered the last 9.69 m.y. Grain size separation was conducted to evaluate the mineral composition in silt (>4 μm) and clay (<4 μm) fractions by X-ray diffractometer (XRD). Mineral composition suggests the source variabilities in silt and clay fractions, which could be interpreted as provenance shifts occurring in 8 and 2.7 Ma.

Parallel factor analysis (PARAFAC) was applied to decompose X-ray diffractograms into individual subcomponents to identify the sources and quantify their contributions. Six-components PARAFAC model was established and 3 Asian dust sources (Taklimakan Desert, Gobi Desert and Ordos Plateau), a riverine source of Japan Island Arc, and 2 biogenic sources of diatomaceous and Opal-CT were identified.

In the late Miocene, high mass accumulation rate (MAR) of riverine input from Japan Islands reflected strong summer monsoon during 9.7-8 Ma. Provenance shift occurred between 8 and 7 Ma from Japan Islands source to aeolian source for a short period, which implied that Asian aridification was intensified at about 8 Ma coinciding with the late Miocene cooling. Aeolian flux increased dramatically in Pleistocene to the maximum of 3.1 g/cm2/kyr, where the Gobi Desert, Taklimakan Desert and Ordos Plateau were the 3 main contributors of the aeolian flux to the Japan Sea since then.

The contribution of Taklimakan source to Japan Sea ranged from 10 to 50% and the dust flux increased gradually in Pleistocene to the highest of 1.67 g/cm2/kyr at 0.29 Ma. Lower flux

occurred in the Late Miocene to Pliocene of <0.5 g/cm2/kyr. The MAR of Taklimakan aeolian in silt fraction was generally higher than clay fraction. The contribution of Gobi dust to Japan Sea ranged from 20 to 50% since 10 Ma. The highest MAR of 1.72 g/cm2/kyr occurred in 0.96 Ma and the lowest in Pliocene. The MAR of Gobi dust in clay fraction was higher than silt fraction from 9.24 to 0.73 Ma. The results show that Taklimakan dust is dominated by the silt fraction, while Gobi dust is dominated by the clay fraction, and they are controlled by the relative contributions of different pathways of dust transport, such as the westerly winds and East Asian winter monsoon (EAWM).

Clay-size dust from Gobi increased during three periods, late Miocene global cooling (LMGC), intensification of Northern Hemisphere Glaciation (iNHG), and mid-Pleistocene Transition (MPT), which reflected increased EAWM winds associated with global cooling and glaciation. Taklimakan became the major dust contributor to the Japan Sea sediments during the warmer climate periods in the latest Miocene to early Pliocene and the Late Pleistocene, where westerly wind activity dominated eolian transport. Dust from Ordos increased greatly 0.95-0.85 Ma due to enhanced Asian aridification since 2 Ma in Northeast China.