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Characteristics of periodicities exhibited in the major elements' variation of the late Pleistocene Japan Sea sediments

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Major element composition of marine sediment is generally controlled by the mineral composition that is also affected by sorting effect during their transport process. This feature can be used for the variability of provenance and transport pathway of detrital fraction in the sediments of the Japan Sea. Detrital fraction in the sediments collected from the abyssal part of the Yamato Basin in the Japan Sea has been regarded as the mixture of eolian dust and the detritus derived from the Japan Arc.

Eolian dust source for the Japan Sea sediments is desert and loess area of the inland China. Loess can be classified into two types based on their major element composition. One is distributed close to desert area and called typical loess. The other is peripheral soil (weathered loess) distributed surrounding typical loess and desert area. Weathered loess is distributed in the northeastern and southern China. We conducted spectral analysis for the temporal variations of winter and summer monsoon intensity deduced from contribution of typical and weathered loess, respectively, to the Japan Sea sediments. Typical loess contribution shows 100ky, 41ky, and 23ky periodicities widely known as the Milankovitch bands. On the other hand, Weathered loess contribution shows 41ky obliquity cycle as well as 293ky, 55ky, 32ky, and 27ky.

Detritus from typical loess is major part of eolian dust transported to the Japan Sea. In general, amount of dust transported to down wind is controlled by dust availability (aridity) of source area or length of dust season. Both require a southward migration of summer monsoon front which is nearly equal to the summer position of westerly jet suppressing the precipitation inland China and keeping a long lasting dust season (spring-like condition), which indicates weaker summer monsoon. Possible mechanisms to transport weathered loess to the Japan Sea are northwesterlies during winter or southward migration of westerlies main axis. Both phenomena require the stronger Siberian High during winter, which indicates stronger winter monsoon. Coherent 41 ky cycle seen in both typical and weathered loess suggests the latitudinal position of westerly is highly responsible for the East Asian monsoon. Trade-off relationship between winter and summer monsoon intensities is expressed only in this periodicity. Lack of common periodicities other than 41 ky suggests that winter monsoon behaves independently of summer monsoon in the East Asia.

Keywords: Japan Sea, Sediment, ODP Site 797, major element, periodicity