# Reconstruction of the sedimentary environment in the northern Japan Sea based on the sand content and mud mineral composition of the sediments at IODP Site U1422

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The sediments of the Japan Sea show large variability in appearance and grain composition depending on the depositional environment. Especially, changes in depth and intensity of vertical circulation in the Japan Sea significantly affect the sedimentary environment. Vertical circulation promotes ventilation of the basin, where oxygen-rich seawater brought into the deep sea decomposes organic matter and forms light-colored sediments. On the other hand, stratification of the Japan Sea surface due to precipitation or reduced inflow of high-salinity seawater from the Tsushima Strait prevents ventilation as well as supply of organic matter due to active primary production enhances the preservation of organic matter and forms dark-colored sediments. In the case of Japan Sea, it has been well known that the alternation of light and dark layers were formed in response to the intensity of east Asian summer monsoon (EASM) although the influence of EASM on the stratification of the Japan Sea became insignificant during periods of very low sea level. East Asian winter monsoon (EAWM) is also thought to affect the depositional environment through severe cooling of the Japan Sea surface water followed by the production of sea ice, which promotes formation of high-density seawater and ventilation. However, there have been few studies on EAWM intensity and its impact on the deep water environment of Japan Sea. Here, we aim to evaluate the impact of EAWM using sea ice rafted debris (IRD) as well as detrital provenance changes using mineral composition on the deep-sea environment of the Japan Sea.
In this study, we used sediments from IODP Site U1422 in the northern Japan Sea. The sediment was separated into sand / gravel particles and mud particles using a 63 $\mu$m sieve. The amount of IRD in the sand and gravel particles was determined through stereomicroscopic observation. The mineral composition of the mud particles was determined using XRD. Based on these data and physical properties of sediments measured onboard, we examined the paleoenvironmental changes around the Japan Sea and its sedimentary environment over the past 680,000 years.
The abundance of clastic minerals such as clay minerals, quartz and feldspars showed cyclic variation and diluted by sulfides, carbonates, and amorphous materials consisting mainly of biogenic opal. Sulfide and carbonate minerals were abundant before 400 ka and decreased after. The sand-size IRD fluctuated in harmony with glacial cycles and higher during glacial periods and lower during interglacial periods. Amplitude of IRD fluctuation increased at 400 ka. On the other hand, the amplitude of fluctuation of clastic minerals and amorphous materials in mud fraction did not change throughout the sequence.
In order to eliminate dilution effect on detrital minerals by diagenetic and biogenic components in mud fraction and examine their origin, we calculated the ratio between each lithogenic minerals and quartz. As a result, lithogenic minerals were classified into; 1) (Chlorite + kaolinite)/quartz and illite/quartz varying in anti-phase with sea-level change, 2) Smectite/quartz and anorthosite/quartz varying in phase with sea-level change, and 3) K-feldspar/quartz and albite/quartz showing similar but no regular fluctuation pattern. The IRD/quartz variation does not exactly coincide with the sea-level change, but tends to be larger during the low sea level period. In order to explain these observation, possible causes such as 1) strong EAWMs during glacial periods increasing the supply of fine particles, 2) precipitation brought by EASMs during interglacial periods increasing the amount of clastic material discharged from the Japanese

 

rivers, and 3) change in dust availability due to drying and wetting of K-feldspar and albite rich sources which provide quartz as well.