Paleoceanographic changes of the Japan Sea during the last 300 kys based on high resolution chemical analysis of MD01-2407 core

Yoshiki Kido[1], Toshitada Koshikawa[2], Ryuji Tada[3]

[1] Earth and Planetary Sci., Tokyo Univ, [2] Earth and Planetary Sci.,Tokyo Univ, [3] DEPS, Univ. Tokyo

Understanding of the millennial-scale, large and abrupt climate changes during the Late Quaternary will be greatly enhanced if high-resolution quantitative chemical analysis of wet sediment cores becomes possible. The X-ray analytical microscope (Horiba XGT-2700) is recently applied for non-destructive, rapid, high-resolution, quantitative chemical analysis of dry rock samples under non-vacuum condition (Koshikawa et al, 2002submitted).

In this study, we explored the possibility of applying XGT to wet sediment core analysis by evaluating the effect of interstitial water on XRF intensities. After correction for XRF absorption effect by interstitial water, high correlation (r2 more than 0.88) were obtained between the corrected XRF intensities measured by XGT and the major element concentration analyzed by conventional XRF method for K, Ca, Ti and Fe. Whereas correlations are moderate (r2 more than 0.67) for Si and Al. However, the relative standard deviation (RSD), which is defined as the percentage of the standard deviation divided by the average, is less than 1.2% for all the six elements. These results show that our XGT method for wet core samples have reasonably good capability for quantitative analysis of these 6 major elements.

High-resolution chemical analyses using XGT was conducted for the MD01-2407 sediment core from Oki-ridge, Japan Sea. The core consists of fine-grained siliciclastic sediments with distinct dark-light sedimentary cycles that are useful for correlation. The marine isotope stage (MIS) is defined by the delta 18O stratigraphy established by Minami (2003MS) using planktonic foraminifera (Minami, 2003MS).

The XGT analytical result suggests that the concentrations of six elements show several hundred to thousand years scale variations during the last 300ky. Especially, the pattern of CaO contents shows variability that closely match with Dansgaard-Oeschger cycles during the last glacial. The CaO generally shows clear positive peaks at the bottom of laminated dark layers and has negative correlation with L* during MIS2 (R2= 0.30), MIS3 (R2= 0.45) and MIS6 (R2= 0.33). Dark layers with high CaO are often characterized by abundant planctonic foraminifera and coincide with the intervals with high abundance of diatom (Koizumi, per.com.). Conversely, CaO shows positive correlation with L* during MIS5 (R2= 0.11) and MIS7 (R2= 0.09). In this interval, CaO is relatively low in the dark layers. The CaO in MIS1, 4, and 8 shows no correlation with L*.

Deposition of the dark layers during the MIS3 probably reflects the increase in the primary productivity caused by the increased influx of the nutrient-rich East China Sea current water (Tada et al., 1999). Contrarily, the high CaO contents in the light layers and low contents in the dark layers during the last interglacial may suggest the high primary productivity caused by upwelling which enhanced oxygen minimum zone and dissolution of the CaCO3.