平成28年度 環境科学院 修士論文内容の要旨

Boron content and XRD measurements of Lake Ogawara core sediments as an indicator of paleo-salinity change during the past several millennia
（小川原湖コア堆積物のホウ素含有量とXRD分析ー過去数千年間の古塩分濃度変動の指標として）

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Reconstruction of paleo-salinity variation from brackish lake deposition contributes to a better understanding of past sea level fluctuation which is considered as one of the significant environmental parameters in the past. Many studies (e.g. Harder et al., 1959) indicate that boron content in sediment can be used to evaluate the salinity of the water prevailing at the time the sediment were formed not only because of the constant relationship between salinity and boron contents but also because boron can be up-taken by clay minerals. To correct variations in boron content due to changes in composition and grain size of illites, several methods have already been tried by extracting clay-silt fraction (Brook et al., 1976) or determining potassium content (Walker et al., 1963). This study attempt on both boron content determination and semi-quantitative analyses of clay mineral composition by X-ray diffraction (XRD) in sediment core as an indicator of paleo-salinity.

In this research, 184 bulk samples are from a 20 m-long core taken in 2009 at the deepest site (26 m) of Lake Ogawara, a brackish lake on the Pacific coast, northwestern Japan. The lake is filled with partly a succession of finely laminated clay, which was deposited stably over the last 9000 years (Inagaki et al., 2002). The age for To-Cu tephra at 11.2 m depth of the core was estimated to be ca. 6000 calBP (calibrated years before present) (Machida and Arai, 2003). Boron contents were measured by alkali-fusion/ICP-AES and clay minerals were detected by XRD and analyzed by both Reference intensity ratio (RIR) method and integral intensity ratios between illite and standard corundum (I/Ic) in 30 samples to evaluate the salinity change in the lake water of Holocene age.

From the result of boron content measurement, the upper 0.7 m sediments deposited in present brackish water (45–55 ppm); in the range of 1–9 m were brackish/fresh-like layers (30–50 ppm); the 9–15 m sediments were marine (50–90 ppm); 15–20 m were fresh-like layers (25–45 ppm). The result of XRD analyses show that, clay minerals like illite that could uptake most boron content in 1–5 m layers (< 1 %) tends to be less than that in 5.5–9 m layers (> 3%), indicating that despite similar boron content, salinity depositional environment in 1–5 m appears to be lower than that in 5.5–9 m layer. The paleo-salinity change suggested by the vertical distribution of boron content and result of XRD analyses keeps congruent with a preliminary result of diatom analysis (Kashima, personal communication). Despite the relatively stable variation of illite, boron content increased rapidly from ca. 50 ppm (at ca. 11 m depth) to ca. 80 ppm (at 10.3 m depth), and subsequently decreased to ca. 45 ppm (at ca. 9 m depth). These layers might be also correlated with a hypsithermal climate (Holocene climatic optimum), when sea level changes are also relative drastic near Hokkaido, Japan (Yasuda, 1988), substantiating the validity of this method as well.