Correction for scan XRF intensity alteration caused by change in porosity of Lake Baikal sediment core, Russia

Nagayoshi Katsuta[1]; Masao Takano[2]; Takuma Murakami[3]; Takayoshi Kawai[4]

[1] Earth and Planetary Sci., Nagoya Univ.; [2] Dep. Earth and Planetary Sci., Nagoya Univ.; [3] Earth and Environmental Sci., Nagoya Univ; [4] Environment, Nagoya Univ.

The X-ray fluorescent (XRF) scanner provides bulk-elemental composition of sediment nondestructively at the sliced surface of core samples. This technique is extensively known as a useful tool for obtaining the elemental distribution data of sediment with high spatial resolution. However, there is a problem that the variation of XRF intensity is caused by changes in not only the content of element in the core samples but also the water content. In this study, we constructed the correction method for converting the XRF intensity of wet samples to that of dry samples which removed the interstitial water as well as the porosity. The VER99-G12 core used this study, collected from the Buguldeika saddle, Lake Baikal, has suffered a strong compaction which was caused by a gravity core sampler for the soft lake sediment.

The scanning X-ray analytical microscope (SXAM) is a computer-controllable X-ray scanner that can obtain XRF images and transmitted X-ray (TXR) images of the sliced samples, simultaneously. The analytical samples were embedded by epoxy-resin, which were continuously collected from the half-cut cores by using the Aluminum-sheet bended u-channels for sub-sampling. After the preparation of resin-embedded core samples uniform 3-5 cm thick, we predicted the epoxy-resin content of core samples from the TXR intensity.

Comparison of the SXAM measurements of dry-powder and resin-embedded core samples indicates that both lighter and heavier elements Si, Ca, and Fe are affected by the alteration of epoxy-resin content. The corrected SXAM profiles of resin-embedded core samples, which were converted to XRF intensity of dry-powder samples, depict the closely resemble variations for bulk-composition of elements quantitatively measured at several cm-intervals by the conventional XRF analyzer. Moreover, using the corrected SXAM profile of Ca content with about 0.5 mm-resolution, we succeed in detection of carbonate (dolomite) layers about 1.5-5.0cm thick caused by atmospheric moisture around the Lake Baikal area associated with the North Atlantic abrupt cooling on the millennial scales (Heinrich events). The corrected SXAM profiles enable to precisely decode the detail of the paleo-environmental variations.