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Thermoluminescence color image and paleoenvironment change in sediments of Lake Hovsgol, Mongolia

Ayako Inagaki[1], Noriko Hasebe[2*]

[1]NaturalSci.&Tech., KanazawaU., [2]Nature&EnvironmentalTech., KanazawaU.

The seasonal climate differences in continental interior are very intense due to the heat balance. Lake Hovsgol in Bikal Rift Zone is located on high plateau of Mongolia and has a small water catchment, which make the lake sensitive to insolation. The sediments of Lake Hovsgol record paleoclimate change in good condition because it has only one outlet at its south end, Egiin river, without influence of human activity. East Eurasia continent including this area have unique geological formation, mainly which controls the climate and environment of here, so specific information of local climate change is needed for understanding the mechanism of climate change in the entirely supracrustal.

A lot of proxies in core samples (e.g. diatoms, mineral particle size, biogenic SiO2, pollens, trace elements) have been used for reconstructing paleoclimate. In this study, thermoluminescence color image (TLCI) analysis is applied to continuous lake sediments core (HDP-04) and the validity as a new proxy is investigated.

TLCIs are recorded by digital camera and the images are converted into numerical information by using developed application. The color pixels are plotted on CIE (Commission Internationale de lEclairoge) chromaticity diagram and counted within a color zone for statistical color analyses. The diagram makes us understand the characteristic of TLCI visually.

TLCI analytical results for Lake Hovsgol sediments are ;

1) The emission intensities of TLCIs were different from sample to sample, though TLCIs showed poor reproducibility based on the large standard deviations of emission intensities on the same samples.

2) The emission intensity of TLCI and the amount of HCl-soluble-material showed similar fluctuation and the color pixel points on CIE chromaticity diagram fell in the same region with those for calcium carbonate from Darkhad basin.

3) The emission intensities of coarse samples were higher than that of fine samples.

4) A small number of color pixel points were found on blue-purple region apart from main cluster of pixels in the CIE diagrams of fine samples, however, we couldn't find the concrete evidence of presence of eolian dust fractions due to few samples analyzed.

5) The emission intensity seemed to have no relation with glaciation or insolation cycles except for several events, in which the emission intensity and the rate of red emission were decreased.

6) By spectrum analysis, the emission intensity shows cycles in connection with insolation as was found in HCl-soluble-material and grain size fluctuation.

The emission intensity does not fluctuate irregularly and must reflect amount of HCl- soluble-material and something else. More investigations of the factor having an influence on the emission intensities of TLCIs are needed. In addition, we must consider the most suitable color threshold on CIE chromaticity diagram for sample characterization. It is suggested that TLCI analysis will be valuable as a proxy of climate change in the future.

Keywords: thermoluminescence, Lake Hovsgol, paleoenvironment, HCl-soluble-material