Late Holocene environmental changes inferred by fossil diatom assemblages at three coastal lakes, Soya Coast, Antarctica

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The Antarctica Ice Sheet is the largest glacial system on Earth, and the Antarctic Ice Sheet occupies 90 % of the world’ s glaciers. The Antarctica, which is covered with enormous ice sheet, plays an important role in the climate systems on Earth and is a place where climatic change on Earth is remarkably reflected. Antarctic coastal lakes are invaluable archives of paleoclimate and paleoenvironment changes influenced by the retreat of Antarctic Ice Sheet after Last Glacial Maximum (LGM). In Soya Coast (Kaigan) of Lutzow-Holm Bay region, many coastal lakes are located in ice-free areas. Some costal lakes located below 20m ASL are marine relict lakes resulted from the recession of glaciers and subsequent isostatic uplift. This study discussed the environmental change inferred from microscopic observation of fossil diatom assemblages in a sediment cores from such coastal freshwater lakes, Lake Oyako-ike, Lake Maruwanminami-ike and Lake Maruwan-Oike, in Soya Coast along with radiocarbon dating, observation of sedimentary facies, elemental analysis, chlorophyll compounds and carotenoids and observation of microalgae and cyanobacteria.

Diatom is one of the most common phytoplankton (Class: Bacilllariophyceae), and is used as powerful and reliable environmental indicator which can be attributed to their high abundance and species diversity. Diatom is distributed among most aquatic environment and their cell wall made of silica (hydrated silicon dioxide) called as frustule, remained highly durable and well preserved in accumulated sediments as fossils.

In this study, we presumed to reconstruct environmental change inferred from fossil diatom assemblage changes from lake sediments core collected from coastal lakes on the Soya Coast, East Antarctica. In detail, we investigated of the changes of the lake water environment and clarified the mean uplift late in late Holocene period.

The results of the characteristics of the sedimentary facies, analysis of chlorophyll compounds and carotenoids, observation of algae and cyanobacteria, and diatom analysis showed that the times of transition from the coastal sea environment to freshwater lakes were 1000 cal yr BP in Lake Oyako-ike (Ok4C-01), 2330 cal yr BP inLake Maruwanminami-ike (MwS4C- 01) and 2700 cal yr BP in Lake Maruwan-Oike (Mw4C-01).

We found that diatom diversity decreased remarkably with processes from marine to freshwater lakes in common with 3 lakes. At the time of the coastal environment, diatoms were rich in planktonic, benthic and epiphytic, however planktonic diatoms did not observe at all in freshwater lakes, only epiphytic diatoms are observed. Such a decrease in diversity presumed that decrease of salinity and nutrient in water column of lakes due to isolation from the ocean.

Comparing the transition process of the three lakes and the results of the relative sea level change of the Soya coast of Takano et al. 2012, it is consistent with the average uplift rate of 3.2 mm / yr of the previous study (1.72 mm / yr in Lake Oyako-ike, 3.8 mm / yr in Lake Maruwan-Oike, Lake 3.5 mm / yr in Maruwanminami-ike). This result shows that the relative sea level change in Soya Coast was greater than

other ice free area in the East Antarctic region.

Keywords: Antarctica, Holocene, Lake Sediment, Diatom

