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The Late Holocene paleoenvironment in the hypersaline Lake Suribati, East Antarctica

Hiromi Nakashima[1*], Koji Seto[2], Kota Katsuki[3], Ryo Kaneko[4], kazuyoshi yamada[5], Satoshi Imura[6]

[1]Geosci. Shimane Univ., [2]ReCCLE, Shimane Univ., [3]CAMC Research, Kochi Univ., [4]Ocean Research Institute, Tokyo Univ., [5]Naruto University of Education, [6]National Institute of Polar Research

The ice sheet of the Antarctica is affected by the climate change, and repeats progression and regression. Many of hypersaline lakes in the Antarctica were formed by the uplift of the continent with the regression of ice sheet. For this reason, the hypersaline lakes may record paleoenvironment after the regression of glaciers. It is considered that the Lake Suribati was a part of the sea, and isolated from seawater for glacioisostatic rebound. After that, it seems that isolated seawater has been concentrated by evaporation, and the hypersaline lake water formed. However, the environment change in the lake water after the isolation is not revealed enough. This study purpose is to clarify a paleoenvironmental history and the process of formation in the hypersaline Lake Suribati used by geochemical, sedimentological and paleontological methods.

Lake Suribati is located in the Skarvsnes, East Antarctica. This lake is the maximum depth of 34m and an area of about 0.41km^2. The water level of this lake is 33m below mean sea level, and lake separated from marine by the sill of 15m altitude. Salinity shows hypersaline for 40 - 200 psu, and the halocline observed at depth 7 - 12m. The environment of bottom water under halocline shows euxinic condition.

This study used to sediment core Sr4C-01 (length 63cm) in Lake Suribati by the 46th Japanese Antarctic Research Expedition, and is performed chemical analysis, grain size analysis and paleontological observation.

AMS radiocarbon age has been obtained from three horizon. The ages of core bottom (depth 63cm) was estimated to be 3500 cal yrs BP based on the sedimentation rate. Sr4C-01 core mainly composes of mud with lamination. The mean grain size of Sr4C-01 core was fluctuated between 6 and 7 phi. Mode was recognized in 3 - 4 phi and 6-8 phi, showing bimodal distribution. This suggests existence of at least two depositional systems. Total organic carbon (TOC) contents were about 1% below a depth of 10cm, and about 2 - 3% above this horizon. The fluctuation of TOC contents has the cyclic seven peaks of about 350 years interval. TOC/TN ratios were about 8.This is suggest that the organic matters were produced by phytoplankton in the lake. TOC/TS ratios were about 2 below a depth of 30cm, and increased upward above a depth of 30cm. For that reason, the bottom environment in situ shows the reduced condition below a depth of 30cm, and change to relatively oxidized condition above this horizon. The species of open sea of silicoflagellates and diatom were occurred in core bottom, but did not occur from core top. CaO and MgO contents in sediment core have anormally values between 9 and 30cm in depth. The mineral grain in the sediment sample of high CaO content was analyzed by XRD method, and was identified with aragonite. It is considered that aragonite precipitated on the surface sediment during the concentration process of isolated seawater with evaporation.

From these evidence, it is seem that Lake Suribati isolated from sea before the at least 2,200 cal yrs BP. The lake water in Lake Suribati has been concentrated by evaporation during 2,200 - 1,000 cal yrs BP, and the hypersaline lake water formed.

Keywords: Antarctica, hypersaline lake, sediment core, TOC, evaporite, diatom