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Appearance of Foraminifera and Its Paleoenvironmental Interpretation from Bottom Sediments in Central Lake Hovsgol, Mongolia

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1. Introduction

At present, many scientists are studying climatic changes to find new evidences from many continental records such as ice-cores and ocean bottom sediments. Many paleoclimatic works have been done in continental environments such as Lake Baikal and Lake Hovsgol. On this study, we try to interpret paleoenvironments of northern Mongolia and changes of East Asia Monsoon in Holocene using bottom sediments of Lake Hovsgol.

Lake Hosvgol is located in North Mongolia (Fig. 1). The lake occupies a southern part of the Baikal Rift Zone, which formed about 2.5-4 Ma(Karabanov *et al.,* 2004). It is the second largest and deepest in the East Asia following Lake Baikal - 136㎞ long and average 20㎞ wide with a maximum depth of 262m and average depth of 139m. The lake stores 383km^3 of water of very low salinity of 180-200mg/l. The area of the lake is 2700km^2 and at present an outlet from the lake is the Egerin river running from its southernmost bay. Around Lake Hovsgol area, mean precipitation is 10-50mm in winter, and is 300mm in summer(Nara *et al.,* 2005,

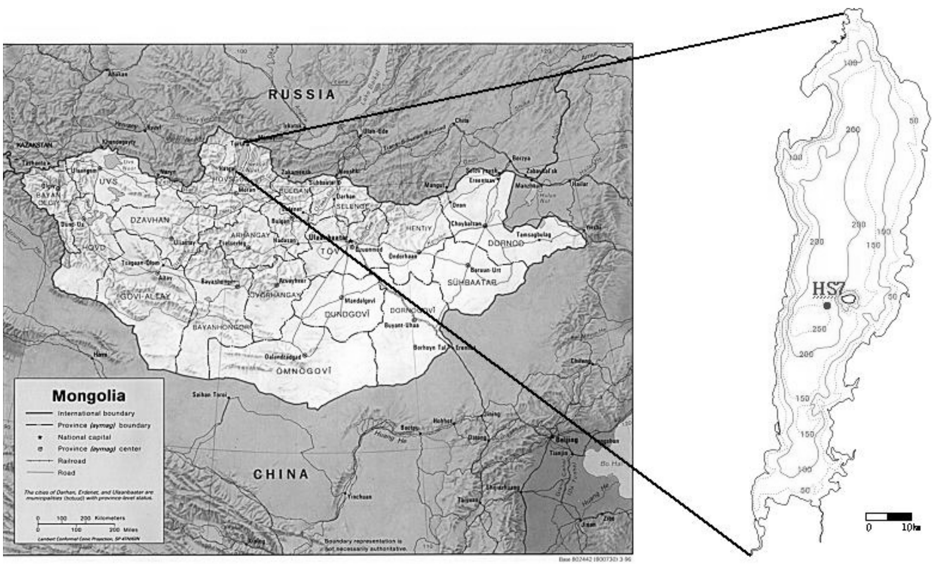

Fig. 1. Bathymetric map of Lake Hovsgol showing coring site.

Fedotov *et al*., 2004,). The majority of this moisture is probably delivered from the North Atlantic via Kazakhstan and Middle Asia(Kuznetsova, 1978).

2. Results and discussion

We collected fourteen sediment cores taken by a gravity corer in July, 2004. The cores in plastic tubes were transported to Korean laboratory using a cool box from Mongolia and are stored in a cold storage without freezing (keeping 2-3℃). Among these cores, this study has been carried out with HS7 taken in the deepest central part(250m deep) of Lake Hovsgol. The core length is 128㎝. The core was splitted into two halves in a laboratory. One half core sample is still stored for future use, and the other half sample was analyzed.

First of all, we described the sediment texture and color. Sediment samples taken at 2㎝ intervals are used for analysis of grain size and water content. Water contents were determined from weight difference between wet sediment and the residue after drying at 60℃ for two days. Grain sizes are analysed with a sieve(63㎛). Sediment samples are divided into mud and sand contents through this work. Also, foraminifera and ostrocoda are classified at 1-㎝ interval using a sieve(63㎛), because they can indicate water condition and paleoenvironment of the lake.

Three different sedimentary units are divided on the basis of water contents, sediments texture, sediment color and observation of fossils(Fig. 2). Unit 1 of core HS7 spans the interval from 0 to 10㎝ and is laminated and olive gray. Water contents are on the range of 70-80%. Some egg shell fragments appear in this unit. Mud contents are on the order of 90-95% compared to low sand contents. But, at the point of 10㎝ depth, mud content decreases suddenly compared with an upper part.

Unit 2 (10-27㎝) is dark greenish gray in upper part(about 2㎝), and in lower part is alternated with dark greenish gray and light brownish gray. This unit starts with dropping water contents, i.e., upper part is 75% and lower part is 40%. Also, similar to Unit 1, the mud contents drop from 92% to 76% at the boundary with Unit 3. Lamination is well developed. Carbonated fossils such as foraminifera and ostracoda appear in this unit. At the interval from 17 to 18㎝, planktonic foraminifera(*Neogloboquadrina pachyderma(s),* Fig. 3) were discovered, which appear in the East Sea as benthic foraminifera. Particularly, in the interval from 19 to 20㎝, foraminifera including particles of foraminifera are better-preserved than in other intervals. At the interval from 26 to 27㎝ the foraminifera appears again. Only the interval from 55 to 56㎝ of Unit 3 contains particles of foraminifera.

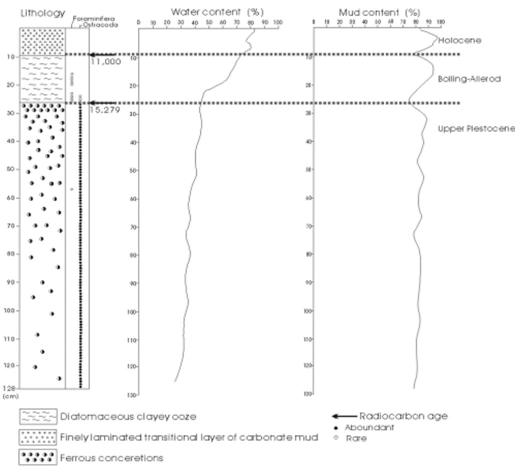

Fig. 2. Lithologic composition, water content(%) and mud content(%) from Lake Hovsgol gravity core (HS7, water depth :250m, core length : 128cm, *Prokopenko et al*., 2005)

In the Unit 3(27~134.5㎝), water contents are from 25 to 40%. Mud contents increase at the average 85%. Lamination is not well developed compared with Unit 1 and Unit 2. It is generally massive and is crudely stratified. The color is dusky blue green. Over the all interval, ostracoda are well preserved(Fig. 4).

In order to get correct ages for the boundaries of the sedimentary facies, AMS radiocarbon dating was tried for the sediments. But this analysis was failed because sufficient terrestrial macrofossils were not present possibly owing to fine sediment texture obtained from the center of lake. The age was decided by referring to water content, sediments texture, sediment color and observation of fossils comparing to the previous data(Prokopenko *et al.,* 2005). As a result, the boundary of Unit 1 and Unit 2 is about 11ky B.P, i.e. a start of the Holocene, and the boundary of Unit 2 and Unit 3 is 15ky B.P. In the Unit 2, appearance of foraminifera, alternating dark greenish gray with light brownish gray, and increasing water contents and mud contents imply a transitional time. Rising water content indicates the increase in precipitation.

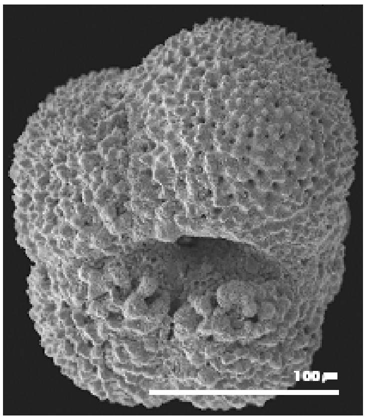

Fig.3. Foraminifera from Lake Hovsgol (*Neogloboquadrina pachyderma(s)*)

The increase in precipitation was apparently caused by an abrupt change in the pattern of global atmosphere circulation, induced by a change in the circulation of waters in the North Atlantic. This climate change affected Lake Hovsgol, and the water level were rising and its fauna and flora were changed. Moreover sediment input were changed. It suggests that Unit 1 is for Holocene, Unit 2 is for a transitional time, so call Bolling-Allerod warming. Unit 3 is for upper Pleistocene.

Foraminifera has been rarely reported to appear in continental environments. This occurrence of the foraminifera is assumed that the lake salinity was high unlike normal lake water condition at that time. And the frequent appearance of the foraminifera is interpreted that Lake Hovsgol underwent frequent paleoclimatic changes during the late Pleistocene and Holocene. The detailed information can be obtained through ostracoda study. We are doing ostracoda classification. In the future, we will recognize the paleowater condition such as salinity through the identification of ostracoda and foraminifera.

Furthermore, we will take other analyses such as geochemical analysis of sediments, mineral component analysis of sediments, stable isotope from the ostracoda and diatoms, diatom contents. These data will provide more detailed information about the paleoclimatic change in Lake Hovsgol.

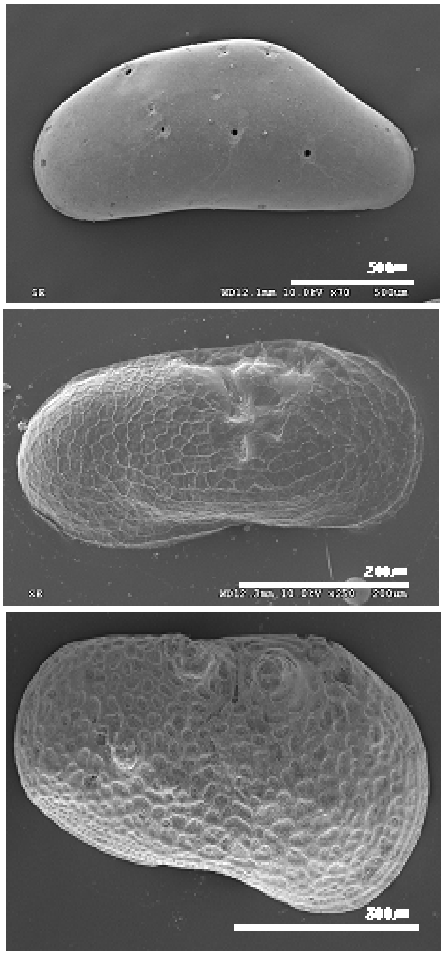

Fig.4 Ostracoda from Lake Hovsgol(Ostracoda presents three species)

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