

APE031-22

Room:104

Time:May 26 09:45-10:00

Changes of precipitation and evaporation in Central Asia estimated from paleo-lake level changes in Balkhash Lake

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Environmental change in Arid areas of Central Asia are caused by changes in water balance, for example, rainfall, evapotranspiration, infiltration, storage, runoff and fluctuation of ice volume in mountain areas. These environmental changes have huge effects on the environment in Central to East Asia. Accordingly, it is important that we discuss changes in water balance in order to reveal environmental changes in the arid areas.

Balkhash Lake is the huge shallow closed lake in Kazakhstan, Central Asia. The bottom sediment is composed of clay and abundant microfossils. The sediment core sample of Balkhash Lake must preserve records of paleo environmental changes not only in regional Ili river basin but also in the wide Central Asia.

We obtained the 6m length core in the west part of the lake in 2007 and such analyses were carried out, as fossil diatom and ostracod, pollen, geochemistry and grain size. Age control of the core is based on Cs-137 for the uppermost part and radiocarbon ages of fossil ostracods from the core. Furthermore, the terrestrial reservoir effect in this area is estimated by modern dead ostracods in surface sediments of the lake.

Diatom analysis shows mainly two different types of assemblages. One is characterized by dominance of freshwater planktonic species, and another is dominated by saline planktonic, saline benthic and freshwater benthic species of diatom. The first one suggests higher lake level, and the second one suggests lower lake level, as same interpretation as Stoermer and Smol (1999). Moreover, these assemblages changes are consistent with the observatory records of lake level during the last 120 years. According to the occurrence of these assemblages, the core shows eleven high lake level stages being dominant in freshwater planktonic species and eleven low level stages (about 0-300AD, 330-360AD, 750-790AD, 880AD, 1060AD, 1140-1180AD, 1260AD, 1490AD, 1560-1600AD, 1840AD and 1970-1990AD) dominant in saline planktonic species, saline benthic species and freshwater benthic species in the last 2000 years. Moreover, high proportion of fossil ostracoda and high C/N ratio correspond to each low level phase during 2000-1060AD. Also, the correlation was recognized between fossil brackish ostracod number (n/g) and relative abundance of saline planktonic and benthic diatoms. However, these tendencies of ostracod and C/N ratio changed after 1060AD. Namely, high proportion of ostracod and high C/N ratio are recognized in high lake level stages. It is possible that Ili river mouth changed from central part to west part of the lake in 1060AD. In addition, those low level stages, including around 0-300AD are consistent with the lake level changes in Aral sea chiefly inferred from changes of fossil dinoflagellates assemblages and Ca ratio (Sorrel et al., 2006).

On the low lake level events around 0-300AD, some topographic evidences are observed along the shore of Balkhash lake, and gypsum crystal-rich horizon is found in Aral Sea core (Boroffka et al., 2009). In the lake level change during the last 100 years, diatom assemblages after 1970 are different from the assemblage before 1970. Particularly, *Tryblionella complexa* is observed in the last 30 years. It suggests the influence of human activities including land use (Kubota, 2005) and effects of construction of the Kapchagai dam.

Keywords: Balkhash lake, lake level change, diatom analysis, ostracod analysis, pollen analysis, C/N