Holocene lake level fluctuations at inland saline lakes in the semi-arid regions, and their relationships to Holocene climatic changes

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Maintaining the quality of natural resources in semi-arid regions became an important environmental issue of the 1990s. Has the quality changed as a result of human activities or as a result of natural environmental changes, such as climatic change? What were the timing, rate, and extent of environmental change, and how can we infer these aspects? Inland lakes have been very important places for human beings since ancient days. However long-term monitoring of their environment usually do not extend back more than a few centuries, and for many regions the historical record is much shorter. The geological research project in Turkey and Syria, a multidisciplinary research program to investigate environmental history since Quaternary, has started in 1991 in conjunction with the archaeological excavation of Kaman-Kalehöyük by the Japanese Institute of Anatolian Archaeology, and the excavation of Tel Seker al-Aheimal by University of Tokyo. We focused the high resolution environmental reconstruction from central Turkey to north Syria to discuss relationships between environmental changes and archaeological epochs. We took field surveys at inland lakes and marshes surrounding archaeological sites at Konya basin, Lake Tuz, Lake Ak, Lake Seyfe, Kayseri and Kaman Kalehöyük in central Turkey, and Lake Khatouniyeh in north east Syria. Our drilling surveys presumed that there was a distinct local diversity of climatic change during the Holocene. A dry climate started about 11000 BC in corresponding to the global warming after the Younger Dryas. It was a wide climatic phenomenon because we observed it at all our survey points. The recover of humid environment during Neolithic occurred at first in Lake Khatouniyeh, north east Syria. The Holocene sedimentation of the lake began about 8500 BC, and it turned to be very humid environment at about 6700 BC. In contrast to it, dry environment continued in central Turkey during the Neolithic. The water levels increased again about 4500 BC when the global temperature turned to be stable in small lakes and marshes about 150-200 km east or north-east of Konya basin. However dry environment has continued in Konya basin and Lake Tuz in central or southern part of the Anatolian Plateau.

Key words: human impact, environmental change, Quaternary, Holocene, semi-arid regions

Long-term environmental changes in a lake-catchment system inferred from the high plateau lacustrine sediments of Lake Hovsgol, Mongolia

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Lake Baikal district is a highly sensitive region for changes in solar insolation, as suggested. Located in the middle latitudinal zone, this region is not only affected by westerly circulation, but also controlled by East Asian monsoon. They may be closely related to the existence of the Himalayas and the Tibetan Plateau. These lead to that direct solar insolation
is also crucial as well as global climatic changes, especially in the high plateaus in this region. Lake Hovsgol in Mongolia is located in the catchment of Lake Baikal. The elevation of the water surface (1650 m) is 1100 m higher than that of Lake Baikal. Areas for water surface and catchment are 2770 km² and 4920 km² respectively, indicating that lake-catchment ratio is very large. These mean that environmental conditions here are more sensitive to direct solar insolation and lake sediments are more directly influenced by surrounding catchments. Several short core samples (about 1 m) were obtained in the lake during the past several years, suggesting clear glacial-interglacial transition. In 2004, long core samples (81 m) named HDP'04 were obtained at the depth of 250 m in the central part of Lake Hovsgol (50°57'19"N, 100°21'32"E) by an international joint team (Japan, Russia, Korea & Mongolia). Samples were sliced every 3 cm for paleomagnetic measurement and 2 cm for physical and chemical analyses. They were distributed to four countries. We have been engaged in analyzing mainly physical properties of the samples (grain size, grain density, biSiO2, etc.). The number of samples for grain size parameter is 3687. Some results for the long core samples as well as short core samples will be given in the presentation.

**Key words:** environmental change, lacustrine sediments, Lake Hovsgol

Determining soil erosion history and processes using fallout radionuclides in semi-arid grassland, Mongolia

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Overgrazing is considered to be the cause of accelerated erosion and subsequent land degradation in semi-arid grassland, Mongolia. However, estimating soil erosion rate is difficult because few field data is currently available in Mongolia. In this study, two experimental watersheds with different grazing pressures were selected in the Kherlen river basin in north-eastern Mongolia. One site is Kherlen Bayan Ulaan (KBU; 6.9 ha), experienced high grazing pressure as wintering grounds for livestock. The other is Baganuur (BGN; 7.6 ha), where livestock numbers have been increasing after the introduction of market economy in 1991. Fifty soil cores were collected within the two experimental watersheds to determine the spatial distribution of $^{137}$Cs and $^{209}$Pb$_{\alpha}$ inventories. A high erosion rate was estimated in KBU watershed but low erosion rate was estimated in BGN watershed by diffusion and migration model using $^{137}$Cs inventories. Inventory ratios of $^{209}$Pb$_{\alpha}$ to $^{137}$Cs in soil collected at the reference site and eroded area with in the experimental watersheds were analyzed. The inventory ratios of eroded areas were higher in KBU watershed but lower in BGN watershed than the reference site. These data suggested deceleration of recent soil erosion in KBU watershed, where intensive soil erosion occurred in the past, whereas acceleration of soil erosion was indicated in BGN watershed, where the numbers of livestock had been increasing in the last decade. These data suggested temporal changes of soil erosion rate in two small watersheds with different grazing history.

**Key words:** soil erosion, radionuclides, overgrazing, semi-arid grassland, Mongolia