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Seasonal Change of Lake Sediments with Water Movements and Climatic Changes in the North Basin of Lake Biwa

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Seasonal change of sediments collected from the traps at the northern basin of Lake Biwa was considered. We carried out the sediment trap experiment from the early 2003, and studied monthly change of the physical properties of sediments and lake water. In this symposium, we report monthly trend of sediments, water movements in the lake and some climatic data.

Lake sediments are widely used to know past environmental changes with climatic change, crustal movements. Lake Biwa is the largest lake in Japan (surface area of 674km², average volume of 27.5km³). Maximum and mean depth in the lake is about 104m and 41m, respectively. Therefore, because of large freshwater body, water current of the lake is induced by complex climatic factors like wind, temperature, precipitation, or some geophysical effects, such as Coriolis force. To evaluate long-term environmental changes, it is important to know the sedimentation process and what factors affect on that process. Sedimentation processes in the lake are influenced directly by water movements, and indirectly by some climatic changes. In the study, our goal is to reveal present sedimentation process on the bottom surface in Lake Biwa, and to estimate the effects of some environmental factors contributing to modern sedimentation processes on the long-term lake sedimentation.

As the first step for clarifying the sedimentation processes in the lake, we are carrying out the sediment trap experiment at the northern basin of Lake Biwa (Fig.1) since the end of January 2003. In Lake Biwa, there is one thermal stratified and mixed season in a year (Fig.2). In the stratified season, density difference between epilimnion and hypolimnion gets large according to the differences of water temperature between them. Because of the density stability, vertical transport of the particles from epilimnion to hypolimnion may be restricted in a stratified season, and seasonal fluctuation of the sedimentation rate may be affected by its restriction.

When we focus on the vertical transport processes of the particles, it depends not only on a vertical water temperature profiles but also on a physical properties of the particles like particle size and density. Therefore, the size distribution of sediment particles may be changed according to the fluctuation of the vertical profile of water temperature. However, climatic change, such as wind, affects vertical profile of the water temperature due to vertical movement of the lake water, and consequently may also affect the vertical transport of the particles. Furthermore, strong wind may cause upward transport of the particles around the lake bottom due to the friction between water and lake bottom. From relatively short-term study on the southern slope of the north basin of Lake Biwa, re-suspension of the lake bottom due to strong wind was observed for several hours during the stratified season, and the enhancement of the upward transport of the sediments was suggested. Indeed, heavy rain may enhance the inflow of the particles into the lake through river and several pathways, and may affect the amount of particle transport around the lake. From the monthly study for four years, it was observed that the thickness of high turbid layer around lake bottom was increased after heavy rain. These results in the past studies suggest that relatively short-term climatic changes induce

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temporal changes in the lake bottom environment. For the relatively long-term changes around the lake bottom environment, the latter study deduced that organic matter such as phytoplankton produced near the lake surface might sustain the high turbid layer around the lake bottom during the stratified season through its settlement. However, the mechanisms and climatic factors affecting the seasonal changes in the lake sediments are still unclear.

In this symposium, we report these climatic effects on the sediments collected from the traps, and discuss the sedimentation processes for a monthly or relatively short time-scale with water movements and climatic changes.

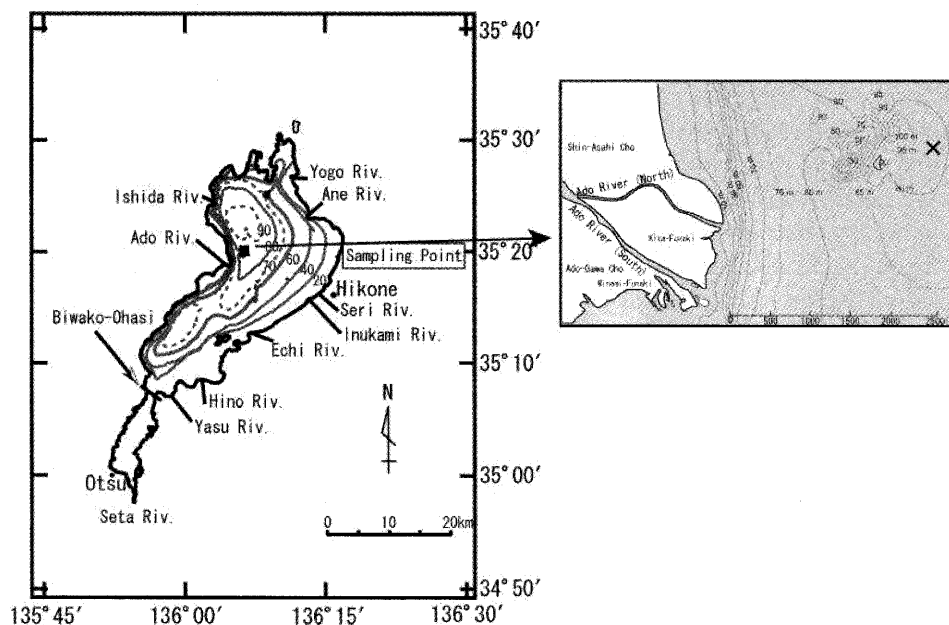


Figure 1 Study site of the sediment trap experiment in Lake Biwa

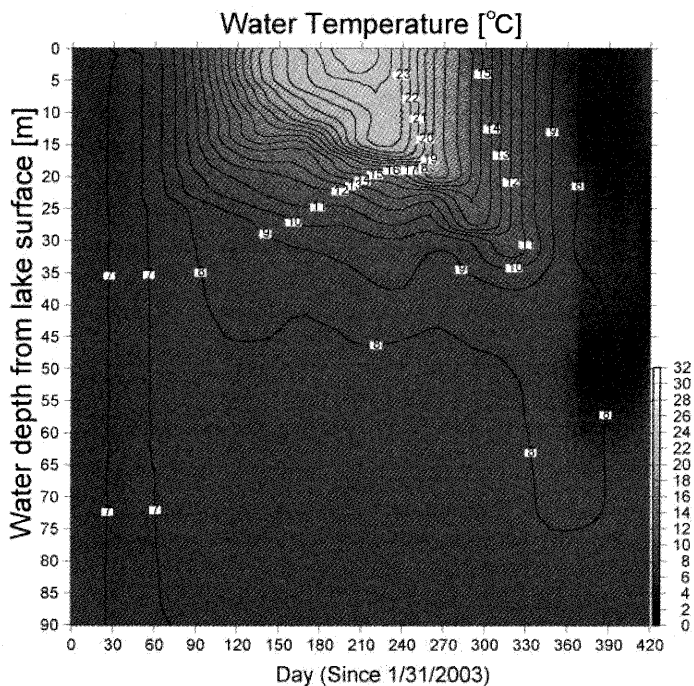


Figure 2 Water temperature at the study point (from Jan, 2003 to Mar, 2004)