

Formative Process of varve sediments and recent cyclic change in the Lake Hiruga, Fukusima Prefecture, central Japan

*Koji Seto¹, Junko Kitagawa², Sena Irisawa³, Kota Katsuki¹, Kazuyoshi Yamada⁴

1. Research Center for Coastal Lagoon Environments, Shimane University, 2. Fukui Prefectural Satoyama-Satoumi Research Institute, 3. Sci, Shimane University, 4. Museum of Natural and Environmental history, Shizuoka

Lake Hiruga, is one of the Five Lakes of Mikata, is a small lake of less than 1 km², which is located in the Japan Sea side of central Japan. This lake is in contact with the Japan Sea by Hiruga channel, and with Lake Suigetsu by artificial Saga Tunnel. Although the salinity of lake water is close to the seawater, the bottom water shows the low water temperature (about 10°C) in the summer season, and shows the constantly anoxic environments, because the water depth of lake basin is deep (about 38m).

In order to clarify the history of paleoenvironmental change at the Lake Hiruga, the coring was carried out around the center of lake. In this time, we discuss about the formative process of distinct lamina in core top of 50cm, and report to cyclic change.

15HG-2C and 3C cores consist of mud sediments with the lamination at the integrated core length of 251cm. AMS¹⁴C dating is carried out in 11 horizons. Based on the results, the age of core bottom is about 3300 years ago. Lake Hiruga was a freshwater lake until AD150, and changed to oligohaline lake from that time. Around the 10th century, the bottom water of this lake became to mixoeuhaline water. Judging from the bottom water exhibits a euxinic environment, it might have had a distinct stratified structure in water column. From the 19th century, the lake basin shows high sedimentation rate, and distinct lamina sediments are formed. It is considered that this is caused by the construction of the Saga tunnel.

In distinct lamina sediments, a lamina with high soft X-ray absorption intensity shows gray color. This suggests that it is a lamina with high precipitation. According to the precipitation pattern in the Wakasa district, the peaks of precipitation are shown snowfall season in winter, and rainy and typhoon seasons in summer. In snowfall season (Dec. to Jan.), the precipitation is the highest. Although the drainage to the lake is large, the current velocity seems to be low, because it accumulates in the catchment area as a snowfield. It is considered that this period contributes to the supply of fine sediments, and forms a lamina with low soft X-ray absorption intensity. In rainy season (Jun. to Jul.) and typhoon season (Aug. to Sep.), heavy rainfall is likely to occur, and the current velocity in lake seems to be high. It is considered that these period contributes to the supply of coarse sediments, and forms a lamina with high soft X-ray absorption intensity. When both events occurred, a lamina with high intensity shows double layer. In this reason, a lamina set with high and low intensity seems to be interpreted as varve.

During the last 200 years, the fluctuation of 5 cycles in total organic carbon (TOC) contents, and the fluctuation of 10 cycles (about 20 years cycle) in total sulfur (TS) contents were recognized. It is considered that the cyclic fluctuation of TS contents is caused by different level of reduced environment due to differences in inflow of seawater with cyclic sea-level change. This cyclic fluctuation seems to be related to the Pacific Decadal Oscillation (PDO). We recognized about 35 years cycle in the TOC contents, and 75 years cycle in the sediment flux.

Keywords: Lake Hiruga, varve, Total sulfur contents, cyclic fluctuation, PDO