

Relationship between the climate of recent 112 years and TOC content of the sediment from Waku-ike in Nagano City, Japan

Naoko Kakuta[1]; Takaharu Tawara[2]; Fujio Kumon[3]

[1] Environmental Sci., Shinshu Univ; [2] Geosphere and Biosphere Sci., Shinshu Univ.; [3] Environmental Sci., Shinshu Univ.

Waku-ike is a small eutrophic pond located in Shinko-mati, Nagano City. The pond is 0.023 square kilometers in area, 10.8 m in maximum depth, and at 565 meter elevation. A large landslide caused by the Zenkoji earthquake on 8 May 1847 took place from Iwakura Mountain. The hollow of the landslide was filled with water, and it is called as Waku-ike.

91cm-long cored sediment was taken at the eastern part of Waku-ike on 17 April 2002. Apparent density was calculated from wet weight and dry weight. The landslide sediment forms the basal part below 80cm depth of the cored sediment, and stable lake condition might have started at the depth of 66cm, judging from density variation. Postulating that the depth of 66 cm corresponds to AD 1852, 5 years after the earthquake, the average sedimentation rate is calculated as 0.44 cm/year. Total organic carbon (TOC) and total nitrogen (TN) contents were measured at 1 cm interval by EA1112 CHNS analyzer. TOC content fluctuates a little with depth, and the depth can be converted to the age on the basis of sedimentation rate. Then the TOC content from AD 1889 to 2002 was examined in relation to climate factors such as temperature and precipitation observed at the Nagano Meteorological Office during the same period.

The result shows that TOC content has good correlation with winter temperature (average of January and February) ($r=0.21$, $n=112$, p less than 0.01) and annually-lowest temperature ($r=0.25$, $n=112$, p less than 0.01). Other climate factors have no relation with TOC content. Warm winter corresponds with the shortness of the coldest period of winter associated with a long autumn or spring. Whole water circulation in the lake, take place in both seasons in Japan. Deep water at lake bottom goes back to the surface with abundant nutrient such as phosphates and nitrogen, which cause high biological productivity. Long autumn and spring period of high bioproductivity may increase total annual biological products in the lake, resulting in high TOC content in sediment.

Therefore, it is concluded that TOC content can be used as a proxy of winter temperature when sedimentation rate is almost constant.