

A Study on the Physicochemical Characteristics and their Formation Mechanism in Lake Waku-ike, Nagano Prefecture

Hideo Oyagi[1], Kazuhiro Itadera[2]

[1] Earth Information Mathematical Sci., Nihon Univ, [2] Hot Springs Res. Ins., Kanagawa Pref.

In spite of no direct connection with seawater, Lake Waku-ike has been attracted by its high concentration of hydrogen sulfide. In particular, stagnant characteristics of its deep water have been paid attention from the viewpoint of meromictic feature. Most of research on meromictic lakes has been done with respect to brackish lakes, such as Lakes Abashiri, Suigetsu, and Kai-ike in Japan, which are located in the coastal area. Both fresh water with low concentration as supplied into surface layer and seawater as intruded into bottom layer are greatly involved in the maintenance of partial circulation in brackish lakes. It can be said that density variation between fresh water and seawater is greatly concerned with the formation of stagnant layer in brackish lakes. In case of Lake Waku-ike, however, the lake basin is surrounded by mountainous district. From these geomorphological characteristics, it is pointed out that the influence of wind on the movement of lake water is comparatively small. There has been few research results on the physicochemical characteristics of Lake Waku-ike, as well as the occurrence mechanism of hydrogen sulfide in its deep layer. The purpose of the present study is to make clear the circulation mechanism of Lake Waku-ike as an inland lake. A research focus was concentrated to examine water temperature and water quality in order to clarify the formation process of stagnant layer as a tracer.

Lake Waku-ike is located in the Sai River catchments area, situating in 15km distance from southwestern side of Nagano City. Lake Waku-ike is a small-scale dammed lake with an area of 0.02km² and the maximum depth of 10.8m. It was recognized from the periodical observation that the depth of thermocline is located 3~6m depths, and strong thermal stratification is formed. The maximum value of vertical gradient of water temperature is 8.6 °C/m. It is considered that the circulation of lake water is rather inactive due to the influence of small wind effect on the lake. It is also pointed out that the formation of thermal stratification is a good indicator for circulation of lake water. The ratio oxygen and hydrogen stable isotope indicates the distinct difference of surface water ($\delta^{18}\text{O}$: -7.67 per mil, δD : -60.8 per mil) from deep ($\delta^{18}\text{O}$: -9.26 per mil, δD : -73.1 per mil). The vertical difference in the water body is recognized stagnant layer especially in summer season.

From the fact as mentioned above, a clear stagnant layer is formed in the deep water. It is concluded that the physical characteristics of imperfect circulation in Lake Waku-ike.