

## The inputs and outputs of the water and water quality in closed lake - A case study of Lake Shibire -

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Lake Shibire is a closed lake with no inflow or outflow rivers. There is believed to be an outflow by water leakage, but the location of the outflow is not clear. This research offers the example of the lake in an attempt to confirm the location of outflow water, by examining the changes in water quality between inflow and outflow. When there was a heavy rain, causing water level to rise quickly, and when there was no rain, the water level fell. And the results of analyses suggest that in addition to the direct inflow of rainfall, water may flow into this depth area as well. The composition ratio of the rainfall differed from the ion composition ratio of the inflow water and lake water. The main ion composition of the lake changed during flow it over and though the soil or the rock inside.

Lake Shibire, located in a Yamanashi Prefecture nature park, is a closed lake with no inflow or outflow rivers, with a small watershed. Therefore, this lake is optimal for examining material inputs and outputs inn a watershed surrounding a lake. In addition, there is rainfall which is transmitted through the soil, and rainfall which flows directly into the lake. Furthermore, there is believed to be an outflow by water leakage, but the location of the outflow is not clear. This research offers the example of the lake in an attempt to confirm the location of outflow water, by examining the changes in water quality between inflow and outflow. As for the investigation method, water depth at the center of the lake was gathered every 1m, once a month starting from June, and a collection device for soil solution was installed to gather stemflow and throughflow in the broadleaf tree forest and conifer forest on the lake shore. Also, a rain collection device was installed to gather rain outside in forest. Collection of these samples in addition to nearby spring/river water was carried out on the same day once a month. A water level recording device, and a self-recording measure of precipitation device were also installed in the same place on the shore. Analysis of the main ions was done by capillary electrophoresis, an automatic titration device analyzed alkalinity and silicic acid was analyzed by a molybdenum blue method. From these results, we considered changes in water quality from rainfall to the lake. In addition due to snow/freezing during the winter season, data collection other than the self-recording devices was impossible.

Concerning the relationship between water level and precipitation, in September there was a heavy rain, causing water level to rise more than 1m in four days, and when there was not rain afterwards, the water level fell. It may be said that water level responses rapidly to changes in rainfall amount. In addition, according to the vertical distribution, silicic acid increases the 3m-depth zone. This result suggests that in addition to the direct inflow of rainfall, silicic acid of soil or rock origin may flow into this depth area as well. In addition, the conductivity and dissolved oxygen increase in this zone, strengthening the possibility that there is underground inflow. The concentration of silicic acid in the lake rose in October after a heavy rain fell, suggesting that the volume of underground inflow was high. Before October, concentration of silicic acid was low in the surface, and high in the bottom of a lake. In November and December, the concentration of silicic acid in the surface layer of the lake was abnormally high, where the concentration in the bottom of the lake was low.

The ion composition ratio of the rainfall differed from the ion composition ratio of the inflow water and lake water. When rain fell on the forest, calcium ions and carbonic acid ions increased. In addition, sodium ions and potassium ions increased in stemflow compared with the rain. In the lake water, the ion composition ratio is almost identical to inflow, but the concentration of each ion is different. The main ion composition of the lake changed during flow it over and through the soil or the rock inside, and the concentration is diluted by rainfall. The rain enters the soil, and calcium ions and magnesium ions washed out, after which enters the lake as underground inflow. In addition, the high concentration of sulfuric acid ions found in spring water which is believed to be outflow from the lake, is thought to be a result of absorption of sulfuric acid from the rock the outflow flows through.