

## **Windholes and Permafrost**

Tokachi Shikaoi Geopark is home to some of the southernmost permafrost in the Northern Hemisphere. Permafrost is a permanently frozen layer on or under Earth's surface that remains at or below 0 degrees Celsius for at least 2 years. Windholes on the mountainsides around Lake Shikaribetsu preserve and generate permafrost and create microclimates that support cold-climate vegetation more commonly found in Arctic areas.

### *How windholes work*

Windholes are gaps between large rock fragments on talus slopes that vent cold air in summer and warm air in winter. They form a natural cooling system that regulates the climate of the slopes and sustains cold-climate environments year-round.

During autumn and winter, the air outside the windholes is colder than the air within. The temperature can be as low as -30 degrees Celsius outside yet as warm as 10 degrees inside the windholes. Because the cold air entering the windholes is denser than the warmer air, it sinks deep into the chambers between the rocks. At the same time, the warmer, less dense air rises and escapes through gaps between the rock fragments further up the slope. As the warm air escapes, more cold air is drawn into the spaces between the rocks lower down the slope.

In spring, the temperature rises and snow on the mountains begins to melt. Snowmelt seeps between the rocks, penetrating deep within the windhole chambers. During spring and summer, the air inside the chambers is colder than the air outside, and the snowmelt freezes, replenishing the ice stores within the windhole chambers. When the air outside is warmer than the air inside, the air circulation system within the windholes reverses. Cold air escapes from windholes lower down the slope, and warm air is pulled into the spaces between the rocks farther up the slope. As the warm air passes downwards between the rocks, it cools and is eventually vented lower down on the slope.

### *Ancient ice*

Because of the topography and cold climate of the Shikaribetsu part of the geopark, patches of permafrost remain at relatively low altitudes, where it is uncommon outside of the Arctic. Studies of the area have led to important discoveries, such as 4000-year-old ice. These have provided insights into the geology, climate, and ecosystems of the Tokachi Shikaoi area.