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## Moss on the Matanuska Glacier, Alaska

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**ABSTRACT:** A species of moss (Musci) is observed on the Matanuska Glacier of Alaska in the middle of summer. The life cycle of the moss is perfectly observed. This is very rare and special because the environment is completely glacial and barren of plants. Matanuska is a gigantic glacier formed about 18,000 years ago in the Palmer region near Anchorage. It has a dimension of 27 miles in length and 4 miles in width. The glacier is located in the region between Anchorage and Mount McKinley. This huge glacier carved the Matanuska valley thousands of years ago. The mighty glacier also forms the Matanuska River. The summer weather is very changeable throughout the day: warm, cold, sunshiny, windy, cloudy, rainy, snowy, foggy, etc. The Arctic clouds move very quickly and create variable climates. So there are four seasons even in one day during the summer period of this region.

**Key words:** Alaska, Arctic climate, Bryopsida, Matanuska Glacier, Musci, Taiga

### INTRODUCTION

In Alaska, the daytime in summer and the nighttime in winter are very long. In other words, the daytime in winter and the nighttime in summer are very short. This has a very important meaning for the ecosystem and for the plants and animals, and even the lower biome. A lot of snow in winter makes glaciers. The average precipitation including the amount of snow in the whole Arctic zone is about 250 mm per year (Swaney 1999). The winter lasts about half of the year. On the other hand, spring and autumn are very short and summer is also comparatively short.

One of the characteristics of the Arctic climates of this area shows a cold temperature between  $-15^{\circ}\text{C}$  in winter and  $10^{\circ}\text{C}$  in summer. The coldest temperature is about  $-26^{\circ}\text{C}$  in winter. The water from the glacier in summer is very cold in contrast to the atmospheric temperature. The water is less transparent with a view to turbidity. When the sun reflects on the surface of the water, the water reveals a silver-white color.

The river water contains diverse elements and nutrients for the lower plants: phosphates, nitrates, nitrites, silicates, etc. There are various substances in the huge glacier: carbon dioxide, dust, soil, stones, seeds of plants, etc. The components are from the neighboring environments: mountains, forests (trees, flowers, microbes), rain, snow, atmospheric gases, etc.

On the Matanuska Glacier, there are various kinds of lower plants. In this note, a species of moss, *Polytrichum alpinum*, will be introduced. At the same time, there are certain species of lichens which are not studied in this note.

### MATERIALS AND METHODS

The Matanuska Glacier (Figs. 1~3) is situated at  $61^{\circ} 35'$  North Latitude and  $149^{\circ} 20'$  East Longitude. This survey of the Matanuska Glacier was carried out on July 27, 2003. Fortunately, a species of moss (Musci) was observed "*in situ*." This taxonomical research work is accomplished by the means of observation, identification and classification. The sampling of moss was not enough to understand the environmental factors and the life cycle. But the photos which were taken "*in situ*" aided this research work. The sampling of Musci (Bryopsida) (Figs. 4~6) provided an important meaning for the glacial lower plants. There are, of course, no flowering higher plants on the glacier.

The moss (Figs. 4 and 5) is identified and classified based on mainly its' morphology but the microscopic observations for the lamella and chromosomes were not carried out.

### RESULTS AND DISCUSSION

The spores of Bryophyta or the microalgae such as Musci, Cyanophyta and Cryoalgae can permeate the stones or the small amount of soil on the glacier. When the Bryopsida sprout and grow in the glacier, the barren stones and soils could become inhabitable, even though they are on the glacier.

The very strong Arctic winds had carried a small amount of small stones, soils, plants, seeds and spores of lower plants into the Matanuska glacier over long periods. Although these elements

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Fig. 1. Base point of Matanuska Glacier in summer.



Fig. 4. The moss with lichens grows in the rib of the stones on the glacier.



Fig. 2. The sunshine is melting the glacier. A lot of things in the glacier are shown.



Fig. 5. Sporophyte of the moss.



Fig. 3. The glacial water forms a little stream and turns into a river.



Fig. 6. Capsule, calyptra, seta and sporangium of the moss.

were mixed in the glacier in winters, summers come and a few of a certain spore sprout.

The ecological characteristics of the Musci on the glacier are almost the same as *Polytrichum alpinum* (Chae 1980, Bertrand et al. 2003). So it can be classified as the following:

Phylum : Bryophyta

Class : Bryopsida : Musci

Subclass : Bryidae

Order : Polytrichales

Family : Polytrichaceae

Genus : *Polytrichum* Hedw.

Species : *Polytrichum alpinum* (Hedw.) Rochl.

The sizes and forms of the sporophytes, capsules, calyptras, and setas of the moss were shown very clearly as we can see in the photos (Figs. 5~6). The moss has rhizoid. The length of the stem is about 5 cm while the leaf is about 6~10 mm. The sporangium is almost the same as the *Polytrichum alpinum*. And the moss is distributed all over the world. It is a widespread species, therefore it can live on the glacier.

The moss is morphologically not so much different from other individuals in the Korean habitat. The middle of summer in this region is in late July. That period is the best environment for the moss. This moss is growing under the small torn stones in the environment where a small bit of stone crumbles. The soil is made of the stones which are on the glacial grounds.

The life cycle of the moss is "in situ", and complete. It has sporangium and spores. It withstands the cold atmospheric temperatures and the cold winds. At night time, especially, the temperatures drop very quickly and the environment is almost like winter. The ecosystem in the region is unstable because the plants may lack self-sustaining ability.

Neighboring the glacier, the flowering plants such as fireweed and certain kinds of wild flowers form a few of the very small communities (White and Williams 1989). The surrounding areas of the glacier are covered with snow for more than half a year, and the melting snow reveals the soil where certain kinds of plants can grow. So the plants and animals of these regions are, of course, very sparse.

The Matanuska Glacier is situated near Mount McKinley and the middle of a great ring of northern forests of coniferous trees in North America. The mountains contain a number of glaciers (Washburn and Roberto 2000, Molnia 2001).

There are many forests composed of kinds of spruce (*Picea mariana*), birch (*Betula nana*), hemlock and fir. These are trackless conifer forests. This ecosystem is called the "taiga" in North America. The taiga is the transitional zone between the boreal forests of the subarctic and the tundra of the High Arctic (Swaney 1999).

The warm sunlight generally causes the temperature to rise on the surface of the earth and the glaciers. In addition, the daytime and the duration of sunshine is longer. The ice melts and forms small or large streams and ponds. This natural phenomenon offers appropriate water and humidity for plants and forests to survive and grow in summer.

A lot of moss generally grows in forests. Many species generally grow on the trunk of the trees. Anyway, mosses like to live in abundant humidity and a semi-sunshine environment, so it grows mainly under the trees and grasses, and around swamps or ponds. There are abundant humidity and water on the glacier. But its growing environments are not good: the temperature is very low; sometimes it is very cold; and the soil is especially very poor.

Anyway, the changes of air pressure and temperature of the surrounding environments make plant and animal survival very hard against the chilly weather. The climate is moderate but chilly in summer. The water of the glacier should contain many kinds of elements which could be good nutrients for growing moss or plants. But the summer duration is comparatively short for the growing of plants. Nevertheless, a species of moss can be seen on the glacier and it survives under inadequate conditions even in the summer period. *Polytrichum* survives here.

The Matanuska Glacier in its aestival period is partly melted by the moderate temperature of the surface and forms the Matanuska River. The average daytime temperature in summer is about 10°C ~ 15°C. The temperature actively melts the glacier and causes an abundant amount of water to flow fast down the slopes. Over a long period of time the transformation of nature, such as by landslides, turns the stones into soils which are layered on the surface of the glacier. The mass of the glacier increases in winter with the snowfall and decreases in volume on account of the high temperatures.

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