

## Global Warming Thaws Himalayan Glaciers at Frightening Speed

Tomioka Shiho

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Tomioka Shiho and Sato Osafumi

Katmandu--In the Himalayas, global warming is making its presence felt in dramatic fashion.

Aerial photographs taken by The Asahi Shimbun aircraft Asuka, in cooperation with Nagoya University field researchers, show that glaciers there have become thinner while lakes that hold the water of melted glaciers have rapidly expanded in the 30 years since the last photos were taken by the university.



Aerial photograph of Mount Everest

If the Himalayan glaciers continue to thaw, the

banks of the expanded glacial lakes could burst, causing massive flooding in downstream areas. Communities in India and Bangladesh that depend on glaciers for their water sources could also suffer shortages as the glaciers melt.

Of more than 3,000 glaciers in Nepal, however, only less than 1 percent have been surveyed firsthand. The latest field research was conducted from October through December by a team led by Fujita Koji, 38, associate professor of glaciology at the Graduate School of Environmental Studies of Nagoya University.

The Asahi Shimbun and the university team started taking aerial photos on Nov. 23. The team flew to northeastern Nepal to see areas close to the 8,848-meter Mount Everest.

In one of the areas, the researchers found Khumbu Glacier, which is already known to have become thinner, meandering for about 17 kilometers with a width of about 500 m. As many parts of the glacier were covered with soil, it looked like a brown river.



A 2001 photograph of the Khumbu Glacier from Kala Pattar, 5,400 meters

The researchers also found that the lower part of nearby Chhukhung Glacier had melted and, as a result, the brown mountain surface had appeared.



Island peak from Chhukhung Glacier

Yutaka Ageta, 64, professor emeritus of glaciology at Nagoya University, who joined the aerial shooting in 1978, said, "Compared to about 30 years ago, the entire surface size of the glacier has decreased by about 30 percent. The amount of ice lost during the period is huge. It is a matter of time before the (brown) mountain surface appears even in the upper reaches of the glacier."

Meanwhile, Imja Tsho Glacial Lake, located at 5,030 m above sea level in the south of Mount Everest, has expanded to about 2 km in length and about 600 m in width. The upper part of the lake where the water hits the glacier has stretched by several hundred meters since 2002, when Nagoya University conducted a field survey.



Imja Tsho Glacial Lake

The bank at the lowest end of the glacial lake is a moraine, which is a mound of rocks, gravel and sand carried by a glacier. Such a bank is fragile though it dams up the lake water. "If the water pressure on the moraine grows as a result of the increase in the amount of the lake water or if moraine starts to flow out rapidly, the bank could burst," associate professor Fujita said.

Glaciers in Europe and South America grow when snow falls in the winter. In the Himalayas, however, they grow with snow that falls during the summertime monsoon seasons at

temperatures a little bit higher than zero.

If global warming proceeds, snow that falls in the Himalayas could change to rain. The rain will melt glaciers instead of expanding them. "The glaciers in the Himalayas are a sensitive sensor to measure global warming," Fujita said.

In addition to the aerial survey, university researchers walked in the Himalayas. In late October, some of them went to the Khumbu region in northeastern Nepal where they saw Chhukhung Glacier from a moraine, located at 5,100 m above sea level and about 10 km south of Mount Everest. Then, one of them said, "Compared to the time of the survey 12 years ago, the uppermost part of the glacier has thinned considerably."

The lower part of the glacier has many crevasses. Water melting from the glacier flows vigorously as a 3-m-wide runoff. "Year by year, the snow-white part of the mountains becomes smaller while whole mountains darken," said a 33-year-old Sherpa, a member of a Nepalese ethnic group from the mountainous region. He pointed at Island Peak, a 6,189-m-high mountain popular with Japanese alpinists, and said, "It looks like a totally different mountain compared to what it was 10 years ago."

According to Nagoya University's survey, the snout of Chhukhung Glacier, which set back at a

pace of about 5 m per year in the late 1970s, is shrinking about 20 m per year in and after the 1990s. Likewise, AX010 Glacier has shrunk at an accelerated rate--from 2.7 m per year in the 1980s to 12.5 m in and after the 1990s, losing more than 1 million tons of ice in 20 years through 1999.

Fujita said that Himalayan glaciers have shrunk due to three factors:

» Higher temperature thaws the glaciers.

» Global warming changes snow into rain that melts the glaciers.

» The amount of snowfall has decreased.

The average temperature in Nepal rose by more than 3 degrees between 1970 and 1994. In the Himalayas in the northern part of the country, the temperature rose about 2 degrees, according to a survey of the International Center for Integrated Mountain Development (ICIMOD), a Katmandu-based research institute set up by eight countries around the Himalayas.

In early November, the survey team visited Tsho Rolpa Glacial Lake, one of the world's largest lakes of that kind, in the Rolwaling region on the west side of the Khumbu region.



Tsho Rolpa Glacial Lake

The lake is one of the many glacial lakes in and around the Himalayan mountains, including those in China and Bhutan. In Nepal alone, there are as many as 2,323 such glacial lakes.

"When I was an infant, Tsho Rolpa Glacial Lake was a small pond, which I had never cared about," said a 52-year-old man who is observing the water level of the lake and rainfall in the region under a contract with the Nepalese Ministry of Environment, Science and Technology. He called himself Nawang C. Sherpa.

The huge lake, located at 4,580 m above sea level, was originally a pond created about 50 years ago from thawed water from surrounding glaciers. It has since grown to 3.5 km in length, 500 m in width and 132 m in depth. It is still continuing to expand, posing a risk of lake burst. With the support of the World Bank, the ministry in 1998 installed lake burst alarm devices at 19 points along the Rolwaling river, which flows from the

lake. In 2000, the ministry also put a flood gate at the lake and lowered the water level by 3 meters. However, many senior officials of the ministry still say those measures are not enough.



Gokyo Lake

Nawang's home is located in Beding village, about 10 km downstream from Tsho Rolpa Glacial Lake. The community has a population of about 370. However, many of the men have left the village to work as migrant workers in cities. Because of that, only women and children remain there, growing potatoes and pasturing yaks and goats.

The ministry estimates that, if the glacial lake bursts, floods will hit Beding in 15 minutes after the burst. Nawang's riverside home will not be able to escape the disaster. However, he said, "As I have neither money nor a job, I cannot leave my hometown. All I can do is to hope that the lake burst never happens."

The ministry, for its part, apparently has difficulties in dealing with possible disasters.

"Due to shortages of budget, human resources and technologies, we cannot take sufficient measures," an official of the ministry said. The ministry has yet to collect even basic data on

glacial lakes--including those near bursting.

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